

FINAL TECHNICAL REPORT

Leafy vegetables germplasm, stimulating use

01/01/2007-31/12/2010

**COUNCIL REGULATION (EC) N° 870/2004 of 26 April 2004
 establishing a Community programme on the conservation, characterisation,
 collection and utilisation of genetic resources in agriculture**

AGRI GEN RES 001

Acronym: Leafy Veg

Action title: Leafy vegetables germplasm, stimulating use

FINAL TECHNICAL ACTIVITY REPORT Reporting period from 01/01/2007 to 31/12/2010

Action starting date:	01/01/2007
Action closure date:	31/12/2010
Action duration (in months)	48 months
Total budget	€ 1,118, 600
EC contribution:	€ 358,846
(%) of total costs	32,08%
(%) of eligible costs	34,06%

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1. EXECUTIVE SUMMARY

1. Action objectives

WP1:

- **Objective 1:** Development of crop databases for spinach, *Cichorium* and minor leafy vegetables and updating the existing International *Lactuca* database.
- **Objective 2:** Prioritize accessions for regeneration, characterization and evaluation. If necessary, special selections or core collections will be made for the evaluations of the different crops with the help of these databases.
- **Objective 3:** Link results of the characterization and evaluation activities of the project to the respective databases.
- **Objective 4:** Establish a functional system of safety duplication of the leafy vegetable crops in cooperation with the ECPGR Leafy Vegetables Working Group.
- **Objective 5:** Identify gaps in the collections also in cooperation with the ECPGR Leafy Vegetables Working Group, to broaden the collections.

WP2:

- **Objective 1:** To regenerate and characterise parts of partner's gene bank collections, for improving conservation and utilization.

WP3:

- **Objective 1:** To evaluate germplasm of the leafy vegetable crops for pest and disease resistance and abiotic characters for a much more effective utilization of the gene pools.

WP4:

- **Objective 1:** To evaluate material for utilization and marketing purposes resulting in specialized and regional products, increasing the diversity of products for the consumer. This includes the evaluation for organic farming systems, which will result in products to fulfil consumer demands in this area.

WP5:

- **Objective 1:** Effective management of the project.

• **Key results achieved and outputs**

WP1:

- **Result 1:** The International *Lactuca* Database (ILDB) was updated and new databases for spinach, chicory and minor leafy vegetables were developed. The passport data of 17,530 accessions from 129 collections were collected for the four databases combined.
- **Result 2:** Fifty-five data files generated within the frame of the project in workpackages 2 (Characterization), 3 (Evaluation) and 4 (Utilization) were linked to the databases in downloadable Excel format. The option was included in the on-line search tool of the databases to select only accessions with project data, and access to the Excel files was provided in the accession information screen of the search results.
- **Result 3:** An inventory of the status of safety duplication of leafy vegetables accessions was carried out among the project partners. Safety duplication arrangements were initiated by three project partners during the course of the project.
- **Result 4:** A gap analysis of each of the four leafy vegetables databases was carried out and priorities for acquisition were identified.

WP2:

- **Result 1:** In total 131% of all accessions involved in the project have been regenerated (111%) and/or characterized (152%) within the duration of the project.

WP3:

- **Result 1:** Both for pest/disease resistance evaluation and quality/abiotic evaluation, tests and evaluations realised by all the involved partners (P0, P1, P2, P4, P5, P7, P8, P9 and P10) permit to reach during the 2007-2010 period 117 % of the aim for lettuce (*i.e.* 110 accessions finally), 104 % for spinach (*i.e.* 332 accessions finally), 102 % for chicory (*i.e.* 271 accessions finally) and 114 % for minor crops (*i.e.* 57 accessions finally). Finally, 784 accessions for all these species have been evaluated *i.e.* 106 % of the initial aim.

WP4:

- **Result 1:** The target numbers for evaluation utilisation and marketing (WP4) were exceeded for all crops: for lettuce 44 accessions were evaluated (target 40), chicory and endive 136 accessions evaluated (target 125) minor crops 57 accessions evaluated (target15). Furthermore all NGO partners involved in WP4 identified genebank accessions that had potential for development for their local markets.

WP5:

- **Result 1:** The project was managed by one coordinator and four WP leaders. To ensure an efficient flow of information among all eleven partners five general and four workpackage leader meetings took place during the four year project time. Also a project website was developed which became functional early during the project. The website proved to be valuable as it functioned as a platform for the project partners. E-reports were also used to enhance the flow of information among the partners. The communication between the project partners and the EC commission took place via the project coordinator and this communication proved to be effective as it solved the minor problems that occurred during the project time quickly. The interaction of the project with the general audience took place via a considerable number of professional (in journals, newspapers and on the web), via the project website, via scientific publications, via oral presentations at symposia or via the national radio and via events initiated by the various project partners.

2. SUMMARY OF THE DETAILED RESULTS ACHIEVED

Work package number	WP 1	Start date 1-1-2007 End date: 31-12-2010	Month 1 Month 48
Work package title: Documentation			
No of lead partner	P0		
No of participating partner(s)	P2	P3	
Total person-months	21.8		
• Main objectives			
<ul style="list-style-type: none"> • Objective 1: Development of crop databases for spinach, <i>Cichorium</i> and minor leafy vegetables and updating the existing International <i>Lactuca</i> database. • Objective 2: Prioritize accessions for regeneration, characterization and evaluation. If necessary, special selections or core collections will be made for the evaluations of the different crops with the help of these databases. • Objective 3: Link results of the characterization and evaluation activities of the project to the respective databases. • Objective 4: Establish a functional system of safety duplication of the leafy vegetable crops in cooperation with the ECPGR Leafy Vegetables Working Group. • Objective 5: Identify gaps in the collections also in cooperation with the ECPGR Leafy Vegetables Working Group, to broaden the collections. <p>Deliverables & milestones involved: D01-05 and M01 –M13; for the status of individual D&Ms: see overview deliverables and milestones page 39-45.</p>			
• Task 1: Collecting of passport data			
			Start date: Month 1 End date: Month 48
No of participating partner(s)	P0	P2	P3
METHODOLOGY			
Data collection			
<p>To update the ILDB and to develop databases for spinach, chicory and minor leafy vegetables, it was aimed to include all European collections and the main collections located outside Europe. A request to provide accession information was directed to the members of the ECPGR working group on leafy vegetables (http://www.ecpgr.cgiar.org/Workgroups/Leafy_Vegetables/Leafy_Vegetables.htm), the holders of collections included in EURISCO (http://eurisco.ecpgr.org/home_page/home.php), the participants in the EU GENRES project "Leafy vegetables germplasm, stimulating use" (http://documents.plant.wur.nl/cgn/pg/leafyveg/) and the main non-European collection holders listed in the Bioversity Directory of Germplasm Collections (http://www2.bioversityinternational.org/Information_Sources/Germplasm_Databases/Germplasm_Collection_Directory/). Collection holders not covered by the aforementioned groups but who were included in the first version of the ILDB were also approached in the case of lettuce. Requests for data were accompanied by an Excel spreadsheet containing instructions for data submission and a format for information on 35 passport descriptors largely following the EURISCO descriptor list (http://eurisco.ecpgr.org/documents/eurisco_descriptors-update-feb2008.pdf). In the request for data it was emphasized to provide information only of accessions that in principle are available for distribution to users. Received data were corrected in case of obvious spelling and formatting errors, but otherwise remained untreated. No attempts were made to verify the actual availability of the accessions, neither was the validity of the supplied data about taxonomy and geographic origin verified. Furthermore, the data were not checked for the existence of potential duplicate accessions within or between collections. Requesting and processing of the data was carried out between 2007 and 2009. Requests for data were repeated in case no response was received. In a few cases where no data were received for European collections, the data from EURISCO were downloaded and included in the database. For lettuce, the data from Iran in the previous version of the ILDB were maintained because of missing updates.</p>			

RESULTS

Database development

The collected passport data of lettuce, spinach, chicory and minor leafy vegetables were included in four separate databases that largely followed the format, lay-out and functionalities of other ECPGR central crop databases. The four databases can be accessed on-line via the common entry page at <http://documents.plant.wur.nl/cgn/pgr/LVintro/> (Appendix 1). Each database contains an overview of the institutes that contributed to the databases, with links to the institutional websites and names and contact details of the curators involved. Also the databases present the full passport descriptor list and provide an overview of the species included in the databases with the number of accessions by which the species are represented. Each database also contains a download section where all passport data of all the included accessions can be downloaded in Excel format. In addition, an on-line search tool was incorporated in each database, enabling the selection of accessions based on various search criteria, such as species, subcrop type, accession name, accession number, origin country and holding institute. In the search results an overview of the most relevant passport data of the found accessions is presented, such as holding institute, accession number, species, accession name, sample status and country of origin. All passport data are presented when a specific accession is selected from the search results. In case internet addresses were provided by the holding institute, a link is provided with the accession information in the institutional database where more information may be found, such as morphological characteristics, trait data and pictures of the accession.

Database contents

In November 2010, close to the finalization of the project, the databases collectively contained the data of 17,586 accessions from 129 collections. In the following table the numbers for each of the four crop groups are presented. The group of minor leafy vegetables includes the data of artichoke, asparagus, lamb's lettuce, rhubarb and rocket salad.

Crop	Number of collections	Number of accessions
Lettuce	30	11699
Spinach	25	2017
Chicory	21	1716
Minor leafy vegetables	53	2154
Total	129	17586

CONCLUSIONS

Task 1 was successfully carried out according to planning. It is expected that in a few cases final updates of the passport data of accessions from project partners will be made at the time of finalizing the project. The set of four databases form a unique information resource because they provide an up to date overview of available leafy vegetables accessions that are conserved world-wide.

• Task 2: Selection of accessions

Start date: Month 6

End date: Month 12

No of participating partner(s)

P0

P2

P3

METHODOLOGY

At the start-up meeting, the prioritization of accessions for regeneration, characterization and evaluation was discussed by the project consortium. It was not considered necessary to make special selections or core collections for carrying out the work in the other workpackages. Instead, it was decided that the choice of material would be made by individual partners involved in the experiments in order to remove backlogs for regeneration, characterization, etc. in individual collections, or select the material for individual research purposes. In a few cases also material from partner collections was included.

RESULTS

Selection of material by individual partners depending on the purpose of the experiments carried out in workpackages 2 (Characterization), 3 (Evaluation) and 4 (Utilization).

CONCLUSIONS

Task 2 was carried out according to the consortium decision made at the start-up meeting.

• Task 3: Uptake of generated data

Start date: Month 25

End date: Month 48

No of participating partner(s)

P0

P2

P3

METHODOLOGY

Data collection

Standard files for the exchange of data from workpackage 2 (Characterization), 3 (Evaluation) and 4 (Utilization) were developed in Excel format. The files contain the most relevant experimental information, including the name of the responsible institute, the contact person, a brief outline of the used methodology and the scoring protocol. For identification purposes, the experimental data are accompanied by the most relevant passport data of the examined material, including institute code, accession number and accession name.

Data presentation

The project data were linked to the databases as downloadable Excel files. For this purpose the download section of the databases was extended with the headers 'characterization data', 'evaluation data' and 'utilization data' in addition to the header 'passport data', under which the available files were listed. An additional functionality that provides easy access to the project data was implemented in each of the four databases. In the on-line search tool the option was included to search only for accessions with project data. Moreover, in the accession information screen, a section was added at the end that indicates whether research data of the accession are available or not. If so, the data files are listed, and a simple 'click' will open the selected file. This functionality provides direct access from a selected accession to available project data.

RESULTS

Database contents

In November 2010, close to the finalization of the project, the databases collectively contained the data of 74 experiments carried out in the context of the project. In the following table the numbers of data files per crop group and per workpackage are presented.

Crop	Characterization (WP2)	Evaluation (WP3)	Utilization (WP4)	Total
Lettuce	21	9	2	32
Spinach	6	5		11
Chicory	10	6		16
Minor leafy vegetables	11	3	1	15
Total	48	23	3	74

CONCLUSIONS

Task 3 was successfully carried out according to planning. It is expected that additional data files will be included in the databases at the time of finalizing the project.

• **Task 4: Arrangement of safety duplicates**

Start date: Month 7
End date: Month 48

No of participating partner(s)	P0	P2	P3				
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METHODOLOGY

The back-up of collections at a remote distance from the place where a collection is stored is an important aspect of genebank management because of the avoidance of the potential loss of the collection due to catastrophic events. In general, a black box construction is used for safety duplicates. A workplan was developed by the project consortium to promote the organization of safety duplication of accessions. As a first step, an inventory among the project partners was made of the level of safety duplication of leafy vegetables accessions, the storage conditions used by each partner and the possibility to act as a host for safety duplicates. Furthermore, project partners were asked to indicate potential bottlenecks in organizing a safety duplication system for their accessions. Assuming that sufficient seed quantities are available of the material to be used in the project, it was agreed that safety duplication of at least this material would be realized by each partner holding the material.

RESULTS

Main bottleneck in the arrangement of safety duplicates appeared to be the lack of sufficient seed quantities and/or the workload involved, rather than the lack of suitable hosts or quarantine issues. Five project partners indicated to be available as host for safety duplicates. Three partners considered a formal arrangement of a safety duplication system irrelevant because no collections (ProSpecieRara), or only working collections (PU and UNIBO) are maintained. Five partners (CGN, WHRI, IPK, GEVES, NORDGEN) had existing safety duplication arrangements prior to the project, and for these partners backing up their accessions is part of their standard management procedures. Safety duplication was organized partly by one partner (KIS), although formal arrangements were lacking. For three partners (ARCHE NOAH, Garden Organic and INRA) a safety duplication system was lacking, but initiated during the course of the project. The level of safety duplication was monitored regularly during the project and the status overview updated accordingly. The following table presents the status overview in spring 2010, close to the finalization of the project.

Partner	Storage temp. (°C)	Possibility to act as host	Percentage of available accessions that are safety duplicated				Hosting institute
			Lettuce	Spinach	Chicory	Minor LVs	
P0 CGN	-20	Yes	100	100	-	100	WHRI
P1 WHRI	-20	Yes	84	92	84	96	CGN
P2 GEVES	-18	Very limited	0	-	45	0	SNES
P3 IPK	-15	Yes	31	36	30	33	SGSV, Svalbard
P4 PU	-20	No	-	-	-	-	
P5 NordGen	-18	Yes	90	100	100	0	SGSV Svalbard
P6 INRA	-18	No	-	-	-	-	WHRI
P7 ARCHE NOAH	-18	No	49	52	50	50	AGES Linz, Austria
P8 Garden Organic	+12	No	100	-	-	-	WHRI
P9 UNIBO	+15	No	-	-	-	-	
P10 KIS	-18	Yes					
P11 ProspecieRara	-	No	-	-	-	-	

(-) = no collection present

Partner	Remarks
P0 CGN	Also triplicated in SGSV
P1 WHRI	Possibility to host safety duplicates is unclear for the long run
P2 GEVES	-
P3 IPK	At Svalbard since 2008

P4 PU	PU holds a working collection, not covered by the Czech national program for conservation of plant genetic resources. Material used in the project was provided by genebank RICP In Olomouc
P5 NordGen	-
P6 INRA	Safety duplication of 83, 74 and 77 accessions realized in 2008, 2009 and 2010, respectively
P7 ARCHE NOAH	Safety duplication of the accessions used in the project carried out
P8 Garden Organic	-
P9 UNIBO	UNIBO maintains only working collections
P10 KIS	Some accessions that were acquired through joint collecting missions are duplicated at the Czech gene bank. No official arrangements for safety duplication have been made up till now.
P11 ProspecieRara	No collections are maintained

CONCLUSIONS

Task 4 was successfully carried out according to the agreed workplan. Because of the work involved following seed multiplication (drying, cleaning, germination testing, packing, etc.) it is expected that the number of safety duplicated accessions as shown in the presented table will continue to increase after the end of the project.

• Task 5: Identification of collection gaps							
						Start date: Month 30	
						End date: Month 48	
No of participating partner(s)	P0	P2	P3				
<p>METHODOLOGY</p> <p>In order to identify main collection gaps within the newly established databases an inventory was made of the crop related wild species and their distribution areas. The International Plant Names Index (IPNI; http://www.ipni.org/index.html) of September 2009 was used as the basis for the inventory. Species names were checked for synonymy and reassignment to other genera and reported distribution areas were collected using information provided by IPNI, GRIN Taxonomy for Plants (http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl), Flora Europea (http://rbg-web2.rbge.org.uk/FE/fe.html), Mansfeld's World Database of Agricultural and Horticultural Crops (http://mansfeld.ipk-gatersleben.de), Tropicos (http://www.tropicos.org/) and the Cichorieae Portal (http://wp6-cichorieae.e-taxonomy.eu/portal/). In addition, crop experts were consulted. For lettuce, the results of an earlier inventory carried out by partner PU within the context of the EU project GENE-MINE were included in the analyses. Species were classified according to the gene pool structure of Harlan and de Wet in case of available information about the level of inter-fertility with the cultivated species.</p> <p>To summarize geographical information, origin countries were grouped together according to the regional subdivision of the United Nations Statistics Division (http://unstats.un.org/unsd/methods/m49/m49regin.htm) with the exception that the Russian Federation was regarded to comprise Northern Asia instead of belonging to Eastern Europe and that Cyprus was considered to belong to Southern Europe instead of Western Asia.</p> <p>The general aim of genebanks is to develop collections that represent the genetic diversity of a crop gene pool as wide as possible with a minimum of redundancy. Since the total diversity of a crop gene pool can be considered the widest possible diversity, a collection gap could be defined as that part of the total diversity within a crop gene pool that is not represented in current genebank accessions. Obviously, conserving the total diversity of a crop gene pool is impossible. Moreover, since this diversity is generally not quantified it is also unclear how representative a collection is for the total genetic diversity of a crop gene pool. In the absence of adequate genetic data, a gap was defined as a species, or a part of its known distribution area, that is not, or only poorly, represented in a germplasm collection.</p> <p>RESULTS</p> <p>An overview of the species, distribution areas and structuring of the crop gene pool is presented for lettuce in appendices Xa and Xb, for spinach in appendix Xc and for chicory in appendix Xd. Because of the complexity of the minor leafy vegetables group, the large numbers of species involved and the limited information on gene pool structure and distribution areas, the analysis for this crop group was restricted to a summary of the species included in the minor leafy vegetables database (appendix Xe). Based on the overviews presented in appendices Xa-e the following priorities for acquisition were identified.</p>							

Lettuce

1. Wild species of the primary gene pool that are currently lacking or severely underrepresented in germplasm collections, i.e. *L. aculeata*, *L. altaica*, *L. azerbaijanica*, *L. dregeana*, *L. georgica* and *L. scariolooides*.
2. Enlargement of the number of accessions of *L. sativa* and *L. serriola* from North Africa.
3. Introduction of North African samples of *L. saligna* and *L. virosa* that constitute the secondary gene pool.
4. Introduction of tertiary gene pool species that are currently lacking in the ILDB.
5. Uptake of a few specimens of the remaining *Lactuca* species that are currently absent in collections.

Spinach

1. Enlargement of the number of samples from the wild species *S. tetrandra* and *S. turkestanica*, both belonging to the primary spinach gene pool.
2. More extensive sampling of cultivated spinach from Iran and North Africa.

Chicory

1. Wild species of the primary and secondary gene pool that are either lacking (*C. calvum* and *C. spinosum*) or underrepresented (*C. endivia* L. ssp. *pumilum*) in the ICDB.
2. Enlargement of the number of accessions of *C. endivia* from North Africa and from Western Asia.
3. Introduction in the ICDB of *C. botae*, the single species constituting the tertiary gene pool.

Minor leafy vegetables

No acquisition priorities could be identified for the minor leafy vegetables included in the study. For artichoke (*Cynara* sp.), asparagus (*Asparagus* sp.), lamb's lettuce (*Valerianella* sp.) and rhubarb (*Rheum* sp.) too few data on species relationships within each of the genera are available to structure the gene pool, and hence to present recommendations for acquisition. The cultivated species *Cynara cardunculus* L., *Asparagus officinalis* L., *Valerianella locusta* (L.) Laterr. and *Rheum rhabarbarum* L. with 131, 224, 59 and 162 accessions, respectively, were considered to be fairly well represented in collections. For rocket salad (*Diplotaxis* sp. and *Eruca* sp.) the cultivated species are represented with a total number of 568 accessions, while the secondary and tertiary gene pools mainly consist of various *Brassica* species that have ample representation in collections.

Publication of the results

A draft manuscript about the composition of the databases and the results of the gap analyses was prepared for publication. Reference: Van Treuren R, Coquin P, Lohwasser U (to be submitted) Genetic resources collections of leafy vegetables: composition and gaps.

CONCLUSIONS

Task 5 was successfully carried out according to the agreed workplan. It is expected that publication of the results will follow after the end of the project. The results of the gap analyses will be used as guidelines for future collection missions in order to improve the composition of genetic resources collections.

Work package number	WP 2	Start date 1-1-2007 End date: 31-12-2010	Month 01 Month 48
Work package title: Regeneration and Characterisation			
No of lead partner	P3		
No of participating partner(s)		P0	P1 P2 P4 P5 P6 P7 P9 P10 P11
Total person-months	104,4		

• **Main objectives**

Objective 1: To regenerate and characterise parts of partner's gene bank collections, for improving conservation and utilization.

Deliverables and milestones involved: D06-15 and M14-26; for the status of individual D&Ms: see overview deliverables and milestones pages 39-45.

• **Task 1: Developing minimum descriptors for the minor leafy vegetables**

Start date: Month 01
End date: Month 04

No of participating partner(s) | P3 P0 P1 P2 P5 P7 P11

METHODOLOGY

Developing minimum descriptors:

Based on established descriptors, like IPGRI and UPOV, minimum descriptors for leafy vegetables were developed during an ECP/GR meeting in Poland in 2003. All project partners accepted these minimum descriptors with 8 characters for cultivated lettuce, 7 for wild lettuce, 8 for spinach, 7 for leaf chicory, 7 for witloof, 9 for endive, and 7 for root chicory (Report of a Vegetables Network, IPGRI, ECP/GR, 2003). For rocket (6 traits) and corn salad (6 traits) new minimum descriptor lists were established during the first annual meeting in Angers 2007 (detailed descriptors see below). For the partners it is also possible to enter additional descriptors which were characterized independently.

RESULTS

See annex 6.

CONCLUSIONS: Task 1 was successfully completed according to planning.

• **Task 2: Selection of accessions**

Start date: Month 01
End date: Month 38

No of participating partner(s) | P3 P0 P1 P2 P4 P5 P6 P7 P9 P10 P11

METHODOLOGY

During the start-up meeting the project consortium discussed about accessions for regeneration and characterization of primary importance.

It was decided that the selection of material to be included in regeneration and characterization was made by individual partners involved in the experiments. The individual choice of material should be used to remove backlogs for regeneration and characterization, remove backlogs in individual collections or select the material for research purposes. In a few cases material was exchanged between the partner's collections in order to keep the agreed numbers for characterization and regeneration.

RESULTS

The material for regeneration and characterization was selected by individual partners each year depending on the purpose of experiments.

CONCLUSIONS: Task 2 was completed according to the agreement at the start-up meeting

- **Task 3:** Regeneration of material of some crops started pending the growing season

Start date: Month 01

End date: Month 40

No of participating partner(s)

P0 P1 P2 P3 P4 P5 P6 P7 P9 P10 P11

METHODOLOGY

Selection of material for regeneration was made by individual partners depending on the purpose of experiments. Regeneration of accessions starts with sowing of seeds each year. Depending on the crop sowing is carried out in spring or autumn. A successful multiplication depends on many factors like appropriate method of cultivation, weather, germination rate, pest infestation etc. Due to the different cultivation methods of the crops the following regeneration protocols were compiled.

Multiplication of lettuce (*Lactuca sativa* L.)

- Isolation
 - All self-pollinating species, e.g. *Lactuca sativa* L. are multiplied in field or in greenhouse.
 - Only for wild cross-pollinating species like *Lactuca perennis*, *Lactuca tatarica*, *Lactuca sibirica* and some *Lactuca viminea* accessions isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging and hand pollination.
 - Other wild species and accessions are multiplied separately in greenhouses.
- Sowing
 - Usually sowing is performed in spring every year. Seeds are sown into pots in the greenhouse and later transferred to trays. Plants that lag considerably behind in growth may be left out because their poor performance could mean that these plants eventually do not contribute to seed multiplication of the accession.
 - Two month after sowing plants are transferred to field or to plots in the greenhouse.
- Cultivation
 - If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Weed control is necessary to limit competition and reduce weed-borne pathogens and insects. Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times. These practises are used in both the field and the greenhouse to decrease pesticide use.
- Pollination
 - Cross-pollinating species like *Lactuca perennis*, *Lactuca tatarica*, *Lactuca sibirica* and some *Lactuca viminea* accessions are pollinated by insects (depending on isolation method).
- Harvest
 - Plants are harvested when harvest maturity is achieved, mostly in late autumn.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

Multiplication of spinach (*Spinacia oleracea* L.)

- Isolation
 - Spinach is a cross-pollinating species, consequently isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging and hand pollination.

- Sowing
 - Usually sowing is performed directly onto field in spring in Europe every year.

- Cultivation
 - If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Weed control is necessary to limit competition and reduce weed-borne pathogens and insects. Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times.
 - After commercial maturity spinach accessions need a bird protection.

- Pollination
 - During flowering time plants are pollinated by wind or insects (depending on isolation method).

- Harvest
 - Plants are harvested when harvest maturity is achieved.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

Multiplication of Leaf chicory (*Cichorium intybus* L.)

- Isolation
 - Leaf chicory is a cross-pollinating species, consequently isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging and hand pollination.

- Sowing
 - Usually sowing is performed in autumn in Europe every year. Seeds are sown into pots in the greenhouse. Plants that lag considerably behind in growth may be left out because their poor performance could mean that these plants eventually do not contribute to seed multiplication of the accession.
 - All accessions overwinter in pots in the greenhouse.

- Cultivation
 - In next spring plants of each accession are isolated.
 - If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times.

- Pollination
 - During flowering time plants are pollinated by bees or butterflies (depending on isolation method) in order to ensure cross pollination and maintain the initial heterogeneity of parental seeds in final produced seeds.

- Harvest
 - Plants are harvested when harvest maturity is achieved.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

Multiplication of Endive (*Cichorium endivia* L.)

- Isolation
 - Endive is a cross-pollinating species, consequently isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging

and hand pollination.

- Sowing
 - Usually sowing is performed in spring in Europe every year. Seeds are sown into pots in the greenhouse and later transferred to trays. Plants that lag considerably behind in growth may be left out because their poor performance could mean that these plants eventually do not contribute to seed multiplication of the accession.
- Cultivation
 - Later in spring plants of each accession are transferred to field. If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times.
- Pollination
 - During flowering time plants are pollinated by insects (depending on isolation method).
- Harvest
 - Plants are harvested when harvest maturity is achieved.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

Multiplication of Rocket (*Eruca* spp.)

- Isolation
 - Rucola is a cross-pollinating species, consequently isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging and hand pollination.
- Sowing
 - Usually sowing is performed directly onto field in spring in Europe every year.
- Cultivation
 - If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Weed control is necessary to limit competition and reduce weed-borne pathogens and insects. Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times.
- Pollination
 - Flowering time starts two month after sowing and plants are pollinated by insects (depending on isolation method).
- Harvest
 - Plants are harvested when harvest maturity is achieved.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

Multiplication of Corn salad (*Valerianella* spp.)

- Isolation
 - Corn salad is both a self-pollinating and cross-pollinating species, consequently isolation is necessary. Different methods for isolating plants are possible, for example distance isolation, time isolation, caging, bagging and hand pollination.
- Sowing

- Usually sowing is performed directly onto field in early autumn in Europe every year.
- Cultivation
 - If necessary plants are irrigated and treated with fertiliser for optimal growth.
 - At commercial maturity accessions are characterized on the basis of descriptor lists (see Task 5).
 - Weed control is necessary to limit competition and reduce weed-borne pathogens and insects. Phytosanitary methods are practices like monitoring insect populations, applying biological controls, using clean cultural practices and applying pesticides at appropriate times.
 - Plants overwinter in field with a layer of fir branches.
 - In the next spring plants start bolting and later flowering.
- Pollination
 - Corn Salad is a self-pollinator but insects often visit the flowers, therefore an isolation of accessions is compulsory (depending on isolation method).
- Harvest
 - Plants are harvested when harvest maturity is achieved.
 - All plants of each accession are cut and put into bags. After drying in a drying chamber, threshing and sieving all accessions are cleaned by hand.

RESULTS

Depending on the conditions during vegetation period material could be regenerated as planned. Within the project period we had some harvest losses caused by rainfall and pest infestations (damages by rabbits and wireworms). In a repeated cultivation the planned material could be regenerated.

CONCLUSIONS: Task 3 is completed within project period.

• **Task 4: Regeneration and Characterisation for all crops started**

Start date: Month 01
End date: Month 46

No of participating partner(s) P0 P1 P2 P3 P4 P5 P6 P7 P9 P10 P11

METHODOLOGY

At the start-up meeting the following objectives for regeneration and characterization were agreed:

	Lettuce	Spinach	Chicory	Valerianella	Rucola	Total
Regeneration	931	49	201	40	33	1254
Characterization	797	112	182	46	146	1283

In the following tables the numbers of accessions which had to be regenerated and characterized per partner are presented.

Regeneration

Partner		Lettuce	Spinach	Chicory	Valerianella	Rucola
P0	CGN	60	15	-	-	5
P1	HRI	60	15	18	-	4
P2	GEVES	8	-	60	8	-
P3	IPK	320	-	100	15	24
P4	Palacky	-	-	-	-	-
P5	NGB	6	7	-	-	-
P6	INRA	300	-	-	-	-
P7	Arche Noah	60	12	16	8	-
P8	HDRA	17	-	-	-	-
P9	UNIBO	-	-	-	-	-
P10	KIS	100	-	7	9	-
P11	ProspecieRara	-	-	-	-	-

Characterization

Partner		Lettuce	Spinach	Chicory	Valerianella	Rucola
P0	CGN	60	-	-	-	5
P1	HRI	30	30	-	-	-
P2	GEVES	-	-	75	-	-
P3	IPK	500	-	-	37	141
P4	Palacky	30	-	-	-	-
P5	NGB	-	70	-	-	-
P6	INRA	-	-	-	-	-
P7	Arche Noah	60	12	-	-	-
P8	HDRA	17	-	-	-	-
P9	UNIBO	-	-	-	-	-
P10	KIS	100	-	7	9	-
P11	ProspecieRara	-	-	100	-	-

RESULTS

In the table the results per crop and in total are presented.

	Lettuce	Spinach	Chicory	Valerianella	Rucola	Total
Regeneration	1006	68	231	38	43	1386
Characterisation	1416	112	212	42	168	1950

From all partners involved in regeneration and characterization the following results were achieved:

Regeneration 2007 - 2010

		Lettuce	Spinach	Chicory	Valerianella	Rucola
Partner						
P0	CGN	70	29	-	-	11
P1	HRI	105	15	18	-	4
P2	GEVES	8	-	91	6	-
P3	IPK	327	-	101	16	28
P4	Palacky	-	-	-	-	-
P5	NGB	6	12	-	1	-
P6	INRA	300	-	-	-	-
P7	Arche Noah	61	12	16	8	-
P8	HDRA	17	-	-	-	-
P9	UNIBO	-	-	-	-	-
P10	KIS	112	-	5	7	-
P11	ProspecieRara	-	-	-	-	-

Characterization 2007 - 2010

		Lettuce	Spinach	Chicory	Valerianella	Rucola
Partner						
P0	CGN	634	-	-	-	17
P	HRI	51	30	-	-	-
P2	GEVES	-	-	97	-	-
P3	IPK	511	-	-	35	151
P4	Palacky	30	-	-	-	-
P5	NGB	-	70	-	19 ATRI	-
P6	INRA	-	-	-	-	-
P7	Arche Noah	61	12	-	-	-
P8	HDRA	17	-	-	-	-
P9	UNIBO	-	-	-	-	-
P10	KIS	112	-	6	7	-
P11	ProspecieRara	-	-	109	-	-

At the end of the project in total 131% of all accessions involved in the project have been regenerated (111%) and /or characterized (152%).

	achieved	target	achieved %	total %
Regeneration	1386	1254	110,53	131,26
Characterization	1950	1283	151,99	

Consequently the objective to regenerate and characterise parts of partner's gene bank collections, for improving conservation and utilization, was successfully completed.

Some bottlenecks within regeneration and characterization of material appeared in the last period of project time. The agreed number of regenerating and characterizing accessions of chicory and lamb's lettuce could not be achieved because of to less available accessions. As an acceptable alternative partners interchange within numbers of regeneration and characterization. Thus the agreed number of chicory could be achieved and even considerably more than 100%. The agreed number of lamb's lettuce could be compensated by a higher number of rucola accessions because both belong to minor leafy vegetables.

CONCLUSIONS: Task 4 is successfully completed.

• **Task 5: Collecting characterization data of all partners**

Start date: Month 01
End date: Month 48

No of participating partner(s)	P0	P1	P3	P4	P5	P7		
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METHODOLOGY

Collecting characterization data:

During commercial maturity the partners characterize/describe the material on the basis of the descriptor lists (see Task 1). They go on field or in the greenhouse and write down their observations in specific lists. After characterization is finished the documented data are entered in an excel sheet with the agreed format. Each crop has a special format available on the leafy vegetables web site. All partners send their duly completed characterization data to the work package leader of WP2 who is responsible for visual checking partner's data of accuracy and completeness. If necessary the respective partners will be consulted. All checked characterization data are sent to the leader of WP1 who is responsible for transferring the characterization data into the database via electronic data capture.

RESULTS

All collected characterization data of lettuce, chicory, spinach and minor leafy vegetables were entered into the agreed format and included in the four separate databases.

In the following table the numbers of characterization data per crop group and per year are presented.

	lettuce	chicory	spinach	minor leafy vegetables
2007	6	2	2	2
2008	8	4	2	2
2009	3	4	2	5
2010	4	0	0	2
total	21	10	6	11

CONCLUSIONS: Task 5 was successfully carried out according to planning. It is expected that additional data files will be included in the databases after time of finalizing the project.

Work package number	WP 3		Start date 1-1-2007 End date: 31-12-2010				Month 1 Month 48		
Work package title: Evaluation									
No of lead partner	P2								
No of participating partner(s)	P0	P1	P2	P4	P5	P7	P8	P9	P10
Total person-months	60,6								
• Main objectives									
<ul style="list-style-type: none"> • Objective 1: To evaluate germplasm of the leafy vegetable crops for pest and disease resistance and abiotic characters for a much more effective utilization of the gene pools. <p>Deliverables & milestones involved: D16-21 and M27-32; for the status of individual D&Ms: see overview deliverables and milestones pages 39-45.</p>									
• Task 1: Selection of collection material for evaluation of pest, disease resistance and abiotic traits									
							Start date: Month 6 End date: Month 12		
No of participating partner(s)	P0	P1	P2	P4	P5	P7	P8	P9 P10	
METHODOLOGY									
<ul style="list-style-type: none"> • Material for evaluation of pest and disease resistance and abiotic traits were selected during the first year and second year. The selection of material was based upon a decision made at the start-up meeting that each partner decides for its own material which accessions will be used for evaluation. Partners that depend on the distribution of seeds by other partners discussed with the other partners about the characters to be evaluated, the seed quantities required and the most appropriate selection of accessions. In few cases, material from partner collections was included (P9 and P10). • The parameters used by the partners to build up individual core collections to be analysed were: size of the crop collection of a partner, number of old varieties and wild material, spreading and number of diseases / races, intensity of breeding targeting growers and consumers' demands, already conducted evaluations. 									
RESULTS									
<ul style="list-style-type: none"> • Based on these parameters, the consortium decided to evaluate minimum numbers of accessions per aim and per species or group of species. <p><u>For pest and diseases resistance evaluations:</u></p> <ul style="list-style-type: none"> - Lettuce: 57 accessions scheduled <ul style="list-style-type: none"> • Downy mildew (<i>Bremia lactucae</i>): <ul style="list-style-type: none"> - 30 accessions with 20 races/isolates by seedlings tests to be tested by P4 - 17 accessions for field resistance to be tested by P8 • Root-knot nematodes (<i>Meloidogyne sp.</i>): 10 accessions to be tested by P10 - Spinach: 250 accessions scheduled to be tested on 3-5 races of downy mildew (<i>Perenospora farinosa</i>) - Chicory: 165 accessions scheduled <ul style="list-style-type: none"> • <i>Alternaria cichorii</i>: 60 accessions for field resistance to be tested by P2 • <i>Sclerotinia sclerotiorum</i>: 30 accessions for forcing chamber resistance to be tested by P2 • <i>Thielaviopsis basicola</i>: 75 accessions by seedlings tests to be tested by P2 after developing the test protocol within this program 									

For quality and abiotic characters evaluations:

- **Lettuce:** 55 accessions scheduled
 - Post harvest discoloration: 24 accessions scheduled to be tested by P2
 - Winter hardiness: 15 accessions scheduled to be tested by P7
 - Taste: 16 accessions scheduled to be tested by P8 (finally transferred to WP4)
- **Spinach:** 70 accessions scheduled to be tested for their chemical content (nitrate, oxalic acid and dry matter) by P5
-
- **Chicory:** 100 accessions scheduled to be tested for their sesquiterpenes content by P9
-
- **Rucola:** 50 accessions scheduled of which :
 - 20 accessions for their chemical content (nitrate, oxalic acid and dry matter) by P5,
 - 20-40 accessions for their glucosinolates content by P9

CONCLUSIONS: Task 1 was successfully carried out in 2007. Some changes in the number accessions for some of the evaluations occurred during the 2008-2010 evaluation period due to the low germination of these accessions or newly selected accessions in addition to these. The final number of accessions evaluated is indicated in Task 2.

• **Task 2:** Evaluation of the leafy vegetable material selected

Start date: Month 6
End date: Month 46

No of participating partner(s)	P0	P1	P2	P4	P5	P7	P8	P9	P10
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I. PEST AND DISEASES RESISTANCE EVALUATIONS

I.1) LETTUCE

I.1.1) Downy mildew (*Bremia lactucae*)

I.1.1.a) Seedling test

P4 evaluated a total number of 30 lettuce accessions for their resistance against 19 *Bremia lactucae* races (BL 1, BL 14, BL 16, BL 17, BL 18, BL 20, BL 21, BL 22, BL 23, BL 24, BL 25, BL 26, NL 3, NL 5, NL 6, NL 7, NL 10, NL 12, NL 15) and 2 B.I. isolates (DEG 2 and 70/08). Isolate DEG 2 - highly virulent, originated from Germany, not yet included to official set of isolates; more info - Lebeda and Zinkernagel (2003). Isolate 70/08 - highly virulent, originated from the Czech Republic (Lebeda, unpublished). The total number (30 accessions per 21 *B.I.* races or isolates) is above the scheduled number: 105 % of the aim.

METHODOLOGY

Tests have been conducted in 2008 (against 3 *B.I.* races), in 2009 (against 11 *B.I.* races and 1 *B.I.* isolates) and in 2010 (against 5 *B.I.* races and 1 *B.I.* isolates). They were arranged in 2 replications; in each replication 25 seedlings per accession were tested. Tests were carried out at the stage of fully expanded cotyledon leaves (inoculation sixth day after sowing). Lettuce cultivars British Hilde and Cobham Green were used as susceptible controls. The concentration of the inoculum was approx. 105 spores per ml. Seedlings were inoculated and incubated according to the methods described by Petrželová and Lebeda (2004). The degree of infection was assessed semiquantitatively 14th day after inoculation using 0-3 scale described by Dickinson and Crute (1974). The final value of sporulation intensity was expressed as a percentage of the maximum scores according to Townsend and Heuberger (1943).

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/ildb/download.htm> (i.e. *Bremia* cultivated lettuce 2008, 2009, 2010 CZE122).

I.1.1.a) Field resistance tests

P8 evaluated in 2008 16 accessions for field resistance against *Bremia lactucae* (94 % of the initial aim, due to germination problems of one accession). This test was used also for utilization characteristics (see WP4).

METHODOLOGY

The seeds were sown in 3 x 85 cell module trays in Bulrush organic module compost in a cold greenhouse in July 8 2008. Minor germination problems were observed as the germination percentage of accessions ranged from 20-85%. Seedlings were planted August 11 (this was late, due to wet conditions preventing bed preparation). Three replicates, but some accessions only 1 or 2 reps possible due to lack of plants. Plots 4.4m x 50cm paths. 14 plants in 4 rows. 30cm x 30cm spacing. August rainfall 152% of the 1961-1990 average. September rainfall 135% of the 1961-1990 average. Harvest took place between 23/10 - 29/10/08. Taste panel evaluations took place on October 31 with a panel of 13 people from Garden Organic (HDRA).

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/ildb/download.htm> in the EXCEL file named "GBR017 2008 Evaluation & Utilization data lettuce.xls"

I.1.b) Root-knot nematodes (Meloidogyne sp.) :

P10 evaluated 7 accessions for resistance against *Meloidogyne ethiopica* in 2008 and 23 accessions for resistance against *Meloidogyne hapla* in 2010. This total number is largely above (150%) the initial program.

METHODOLOGY

Tests were performed in pots in a growth chamber with specific parameters (illumination: 11 hours light, 13 hours dark; temperature: 25°C at light, 20°C at dark, air humidity 60%). Nematodes were maintained and multiplied on the roots of tomato *Lycopersicon esculentum* in isolated pots. Extracted egg and second stage juveniles (Pi = 3000 per plant) were used to inoculate seedlings of the lettuce test plants. After 45 day post inoculations the roots of lettuce test plants were carefully removed from the pot, washed and examined for the extent of nematode multiplication. Extraction of eggs and second stage juveniles were carried out using a dissecting microscope to estimate the reproduction of root-knot nematodes (Pf). A Reproduction factor (Rf) was calculated as $Rf = Pf / Pi$. Borders were set as: Resistant/tolerant ($Rf < 1$) vs Susceptible ($Rf > 1$)

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/ildb/download.htm> in the EXCEL file named: "nematodes Lactuca spp 2007-2010 SVN019"

I.2) SPINACH

P0 evaluated a total of 263 accessions resistance against a total of 7 *Perenospora farinosa* races: 2 races in 2008 (*Pfs* 5 and *Pfs* 7), 2 races in 2009 (*Pfs* 1 and *Pfs* 4) and 3 races in 2010 (*Pfs* 3, *Pfs* 6 and *Pfs* 10). The total number of evaluated accessions is above (105%) the scheduled number.

METHODOLOGY

In the greenhouse, 30 seedlings per accession were inoculated two times (at cotyledon stage and when 70-80% of the accessions had one well developed leaf). The protocol of Corell (2003) was used for scoring. In general, 30-48 plants were scored per test. All tests were carried out in duplo. Scores of the duplos were averaged, unless the difference in resistance scoring was more than five classes.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/spinach/download.htm> in three EXCEL files named "Spinach-Peronospora-2008-NLD037.xls", "Spinach-Peronospora-2009-NLD037.xls" and "Spinach-Peronospora-2010-NLD037.xls".

I.3) CHICORY

I.3.1) Resistance against *Alternaria cichorii*

P2 evaluated a total number of 68 accessions: 22 accessions in 2008 and 23 accessions in 2009 and in 2010. This total number is above the scheduled number (60 accessions) at 113 % of the aim.

METHODOLOGY

After the seedlings had grown up in the greenhouse, plants were cultivated in the field. These plants were inoculated two times by an *Alternaria cichorii* spore suspension (one just after the plantation, the second three weeks after). A susceptible accession has been planted too. Observations were conducted two weeks after a second inoculation and based on a scale of notation from 0 to 9. For the detailed methodology per year, see three excel files at <http://documents.plant.wur.nl/cgn/pgr/chicory/download.htm> named "Chicory-Alternaria-2008-FRA215.xls", "Chicory-Alternaria-2009-FRA215.xls" and "Chicory-Alternaria-2010-FRA215.xls"

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/chicory/download.htm> in three EXCEL files named "Chicory-Alternaria-2008-FRA215.xls", "Chicory-Alternaria-2009-FRA215.xls" and "Chicory-Alternaria-2010-FRA215.xls"

I.3.2) Resistance against *Sclerotinia sclerotiorum*

P2 evaluated a total number of 31 accessions : 14 accessions in 2008 and 17 accessions in 2009. Each of these evaluations was conducted on 2 years: growth of the plants and of the roots in year 1 and evaluation of root resistance in forcing chamber at the beginning of year 2. The total number evaluated (31 accessions) is slightly above the scheduled number: 103 % of the aim.

METHODOLOGY

Plants were sown in the field by the P2 partner (FNPE newly named APEF: French Federation of Witloof Producers) during springtime. Roots have been uprooted in November and then forced in a growth chamber (20°C and 80% of humidity during 21 days) For the first 14 accessions evaluated, the inoculation was done with an infected piece with *Sclerotinia sclerotiorum* inoculum during the forcing period in this growth chamber. For the second wave of 17 accessions evaluated, the inoculation was done in a less aggressive way: 3 roots of Bea variety previously inoculated with an infected piece with *Sclerotinia sclerotiorum* have been placed, per each accession evaluated, among the evaluated accession roots. A 0-5 scale of notation has been used and a disease index was calculated for each accession.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/chicory/download.htm> in two EXCEL files named "Chicory-Sclerotinia-2008-FRA215.xls" and "Chicory-Sclerotinia-2009-FRA215.xls"

I.3.2) Resistance against *Thielaviopsis basicola*

P2 evaluated a total number of 79 accessions on two years, namely 43 accessions in 2009 and 36 accessions in 2010. The total number evaluated is slightly above the scheduled number: 105 % of the aim.

METHODOLOGY

Thirty plants per accession were evaluated for black root rot and 10 plants per accession were used as a control. Accessions were sown in pots and artificial contamination of the soil by *Thielaviopsis basicola*

was conducted two days afterwards. A scale of 0 (no symptom) to 4 (decrease of the leaf growth & roots totally necrotic or dead plant) was used. A Necrotic Resistance Index was also calculated.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/chicory/download.htm> in two EXCEL files named : "Chicory-Thielaviopsis-2009-FRA215.xls" and "Chicory-Thielaviopsis-2010-FRA215.xls"

II. QUALITY AND ABIOTIC CHARACTERS EVALUATION

II.1) LETTUCE

II.1.1) Post harvest discoloration

P2 evaluated a total number of 28 accessions in 2008. This total number is above the scheduled number: 117 % of the aim.

METHODOLOGY

The trial was conducted during the 2007 growing season on the experimental site Sheep Pens (west) at Warwick HRI, UK (Latitude: 52.183. Longitude: 1.583). The trial was designed in 3 blocks, each block containing a single plot of 28 lines randomised in an alpha design. The trial was planted on 1st May 2007, with lettuce transplants raised under glasshouse conditions. Each plot contained 12 plants (4 x 3) of the same accession with 35 cm between each plant (central plants were therefore self-guarded to avoid 'edge' effects). Fencing and flappers surrounded the land to provide protection from the local fauna, and plants treated with protective sprays as information was released on the UK HDC Pest Bulletin (www2.warwick.ac.uk/fac/sci/whri/hdcpestbulletin/) according to good agricultural practice. Plants were irrigated through an oscillating line as required for establishment (although no soil moisture deficit was recorded; the land was irrigated to bring it near field capacity prior to transplanting), and irrigation stopped 7 days before harvest. The trial was harvested 30th May, 5th June, 12th June and 19th June 2007 depending on maturity for individual accessions with all replicates of an accession assessed on the same date. On harvest day the central two replicated heads per plot were cut at soil level and the untrimmed weight recorded. Excess material from each head was trimmed by removing the outermost exposed wrapper leaves and the trimmed weight recorded. Heads were processed by halving the head, removing the core, cutting lengthwise from butt to crown and again transversely then cutting into ~4 cm² pieces. Processed material from each head was mixed thoroughly. Approximately 75g of unwashed processed material were sealed (removing any excessive air and ensuring the seal was not compromised by material) in a non-selective permeability film bag (P-PLUS 35PA240; 200 x 250mm; Amcor Flexibles P-Plus, UK) with material from one head filling two bags. The use of non-selective film ensured that the atmosphere within the pack did not reduce the natural intrinsic rate of discolouration in each product. Bags were either hung or stored vertically on a racking system at 3. On each assessment (days 1, 3, 6, 9 and 13) bags were removed from storage and arranged under a halogen light source for assessment, ensuring that the bags had the same orientation on each assessment date. A 12-square 3 x 4 acetate grid (50 mm x 50 mm) was overlaid on the bag and (confirming each square represented material) discolouration in each square was quantified based on a set of photographic standards for pink and brown discolouration (Hilton et al., 2009). Pinking and browning were each split into 2 categories of severity, including slight and severe. When no discolouration was recorded, bags were classified as clean. When there was uncertainty about whether the discolouration was browning or pinking it was classified as 'visible'. This prevented missing data on discolouration and allowed the discolouration to be included in the general 'discolouration' classification category upon analysis. As time progresses the material becomes easier to clarify so the amount of data classified as 'visible' decreased. Each grid square was given a single score as a discolouration co-ordinate at its most intense representation (see sample grid below), resulting in 12 tallies per scoring grid per bag on each assessment day. The percentage discolouration (= 100 x (number of grid squares with discolouration / 12)) and the intensity of discolouration (mean discolouration score / number of grid squares showing the discolouration) were determined on each assessment day for pinking, browning, visible and all discolouration. Data for Day 3 gave best discrimination between accessions.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/ildb/download.htm> in the EXCEL file named "GBR006 2007 Discoloration lettuce.xls"

II.1.2) Winter hardiness

P7 evaluated a total number of 20 accessions: 6 accessions in autumn/winter 2008/09 and 14 accessions in 2009/10. This total number is above the scheduled number (15 accessions) at 133 % of the aim.

METHODOLOGY

In 2008/2009 6 accessions of lettuce were tested on two locations with different climatic conditions in Austria (Langenlois and LVZ Wies). On each location, the 6 lettuce accessions were grown outside on the field covered by a fleece and as well in a plastic tunnel.

In 2009/2010 14 accessions of lettuce were tested for winter hardiness in one location: Vermehrungsgarten Arche Noah, A 3553 Langenlois. The evaluated accessions were cultivated outdoors and covered with a fleece. Each accession was sown on 21st and 22nd September 2009 in a 3.3 m row in one plot without replication. The plants were thinned out to 5 cm plant distance on 15.11.2009. The distance between rows was 30 cm. The accessions were cultivated in a silty soil. The winter was warmer than other years and there was a snow cover from 26.12.2009 on to 26.02.2010.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/ildb/download.htm> in the two following EXCEL files : "AUT046 2008-2009 Winter hardiness lettuce.xls" and "AUT046 2009-2010 Winter hardiness lettuce.xls"

II.2) SPINACH

P5 evaluated in 2008 and 2009 a total number of 69 accessions of spinach and orache (*Atriplex hortensis*): 51 spinach accessions in 2008 and 3 other spinach accessions and 15 orache accessions in 2009. Orache is leafy vegetable that is commonly used like spinach. This total number is slightly below the scheduled number (70 accessions) at 99 % of the aim.

METHODOLOGY

Plants were sown and raised to seedlings in a greenhouse and subsequently grown outdoors:

- sowing in in 54 small Vefi pots in a greenhouse; sowing dates: 12/08/08 and 15/04/09,
- after 8 days in 2008 and 15 days in 2009, planted into 2 ½ liter pots and placed outside on Mypex mats, 3 plants in each pot, peat soil.

Harvested on 16/09/08 or 30/05/09, after 4 weeks in pots, when the largest leaves reached approx. 10 cm, no sign of bolting, and no sign of insects/fungi problems. Ten to fifteen plants were harvested per accession, 3-5 leaves per plant (no dirty or tiny inner leaves).

Chemical analysis at Cereal Laboratoriet, Svalöv, Sweden:

- dry matter analysis (two repetitions)
- nitrate analysis (HPLC) (two repetitions), oxalic acid (HPLC)

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/spinach/download.htm> in two EXCEL files named ""Spinach-Chemical analysis-2008-SWE054.xls" and "Spinach&Orache-Chemical analysis-2009-SWE054.xls"

II.3) CHICORY

P9 evaluated in 2010 a total number of 93 accessions of which 70 accessions coming from the P2

genebank and 23 other accessions coming from P9 contacts. These 23 accessions were transferred to the P2 genebank in 2010. The total number of accessions evaluated is slightly below the scheduled number (93 % of the aim). This is due to the low germination of some accessions and sanitary problems in field during root production of witloof accessions.

METHODOLOGY

a) *Plants production*

- 86 accessions on the P9 field: a loamy-clay soil in Cesena, Northern Italy; plants produced from seeds in alveolated plates, on peat substrate; sowing date July 25, 2009; transplanted in the field on August 17, 2009; Plots of 3 m x 4 rows, row distance: 50 cm; plant distance: 50cm;
- 7 accessions on the P2 field and Vilmorin forcing chamber: root production on a sandy soil in Brion with a row distance of 22 cm, 2 repetitions of 36 plants per accession used; planting date: 12/05/09; uprooting at 24/11/09 and stored in cold rooms until mid-January 2010 for a 5 week forcing period. The witlooves were sent by post to P9.

b) *Sesquiterpene analysis*

Sesquiterpenes lactones (SL) were extracted from freeze-dried material by 2% formic acid in methanol/water 4/1 (v/v) and then purified from interfering compounds by solid phase extraction (SPE) with silica-based cartridges. Before SPE, half of the extract was treated with a water solution of enzyme cellulase and subsequently extracted with ethyl acetate to recover both free and bound lactones. SL were analytically determined by a HPLC apparatus equipped with a diode array detector (selected wavelength: 260 nm) and a C18 analytical column. Mixtures of methanol/water were used as mobile phases: A: methanol/water 14/86, B: methanol/water 64/36. Quantification was done relative to internal standard (santonin). SL were identified by a coupled system HPLC-mass spectrometry.

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/chicory/download.htm> in the EXCEL file named "Chicory-sesquiterpene-2010-ITA330.xls"

II.4) MINOR CROPS

II.4.1) Chemical content

P5 evaluated in 2008 20 accessions of rocket (*Eruca staiva*), which is exactly the scheduled number.

METHODOLOGY

Plants were grown in a greenhouse from germination to harvest:

- sowing in in 54 Vefi small pots in glasshouse, sowing dates: 11/08/08,
- after one week, planted into 2 ½ liter pots, 3 plants in each pot, peat soil.

Harvested on 11/09/08, after 3 weeks in pots, when the largest leaves reached a length of approx. 10 cm; no sign of bolting no sign of insects/fungi damage. Ten to fifteen plants were harvested per accession, 3-5 leaves per plant (no dirty or tiny inner leaves).

Chemical analysis took place at Cereal Laboratoriet, Svalöv, Sweden:

- dry matter analysis (on two repetitions)
- nitrate analysis (HPLC) (on two repetitions), Oxalic acid (HPLC)

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/minor/download.htm> in the EXCEL file namd "Rocket-Chemical analysis-2008-SWE054.xls"

II.4.2) Glucosinolates content

P9 evaluated, in 2008, 37 rocket accessions of which 32 *Eruca sativa* and 5 *Diplotaxis tenuifolia*. This number is above the scheduled number (30 accessions) at 123 % of the initial aim.

METHODOLOGY

a) *Plant production*

On loamy-clay soil, Cesena, Northern Italy. Plants produced from seeds in alveolated plates, on peat substrate; sowing date March 31 2008. Transplanted in the field on April 30th 2008. Plots of 3 m x 4 rows. Row distance: 40 cm; plant distance: 30cm.

b) *Chemical analysis*

To measure total glucosinolate content, mature leaves were harvested between June 6th and 12th, early morning, gently washed with tap water, dried with paper cloth, and kept in plastic bags at + 4 °C until sensory analysis. Samples for glucosinolates analysis were immediately frozen and freeze-dried. Glucosinolates were extracted with hot methanol. The extract was desulphonated by means of sulphatase enzyme. The water diluted extract was injected in a HPLC gradient system,

using a Diode Array Detector (monitoring wavelength 229 nm), with a C18 Zorbax Eclipse column, 3.0 x 150mm, 3.5mm, kept at 30°C. The mobile phase was water and acetonitrile, with the following gradient: 99% water at the starting time, decrease to 75% water at 17.5 min, back to 99%, at 20.0 min. Flow rate was 550 ml/min; injection volume 20 ml. Glucosinolate identification was carried out on the basis of the retention times, UV and mass spectra; the latter were obtained at the same HPLC conditions, on a LC-Mass Spectrometer, with API-ESI SCAN-mode ionisation (positive polarity), monitoring range 50-800 m/z+. Glucosinolate quantification was carried out using sinigrin as an external standard. Quantitative relative amounts of individual components were determined on the basis of the ratio between individual component HPLC area and total peak area. Checked after conversion in total content through calibration curve calculated on external standard (sinigrin).

RESULTS

Evaluation results are available at <http://documents.plant.wur.nl/cgn/pgr/minor/download.htm> in the EXCEL file named "Rocket-Glucosinolates-2008-ITA330.xls"

CONCLUSIONS: Task 2 has been successfully completed.

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• **Task 3: Transfer of the evaluation data**

Start date: Month 24

End date: Month 48

No of participating partner(s)	P0	P1	P2	P4	P5	P7	P8	P9 P10
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- The transfer of the evaluation data in a fixed format to the database managers was done year by year for all available data and data transfer was finalised on month 45.

CONCLUSIONS: Task 3 is completed.

Item	Partner involved	Years			Total scheduled	Total done	% realized
		2008	2009	2010			
Lettuce							
TOTAL Lettuce, of which :		87	44	53	106	124	117%
a) Discoloration evaluation	P1 - WHRI	28	0	0	24	28	117%
b) <i>Bremia lactucae</i> races resistance evaluation by seedlings tests	P4 - Palacky	30 accessions on 3 races	30 accessions on 12 races/isolates	30 accessions on 6 races/isolates	30 accessions on 20 races/isolates	30 accessions on 21 races/isolates	105%
c) Winter hardiness	P7 - Arche Noah	6	14	0	15	20	133%
d) <i>Bremia lactucae</i> field resistance evaluation	P8 - HDRA	16	0	0	17	16	94%
e) Root-knot resistance evaluation	P10 - KIS	7	0	23	20	30	150%
Spinach							
TOTAL Spinach, of which :		314	281	263	320	332	105%
a) <i>Peronospora farinosa</i> resistance evaluation	P0 - CGN	263 on 2 races	263 on 2 races	263 on 3 races	250 on 3-5 races	263 on 7 races	105%
b) Chemical evaluation	P5 - Nordgen	51	18	0	70	69	99%
Chicory							
TOTAL Chicory, of which :		36	83	152	265	271	102%
a) Diseases resistance	P2 - GEVES	36	83	59	165	178	108%
<i>Alternaria cicohorii</i>		22	23	23	60	68	113%
<i>Sclerotinia sclerotiorum</i>		14	17	0	30	31	103%
<i>Thielaviopsis basicola</i>				43	36	75	105%
b) Sesquiterpenes content	P9 - UNIBO	0	0	93	100	93	93%
Minor Leafy vegetables							
TOTAL Minor Leafy Vegetables, of which :		57	0	0	50	57	114%
a) Chemical evaluation	P5 - Nordgen	20	0	0	20	20	100%
b) Gucosinolates content	P9 - UNIBO	37	0	0	30	37	123%
TOTAL for all species	P0 - P1 - P2 - P4 - P5 - P7- P8 - P9 - P10	494	408	468	741	784	106%

Work package number	WP 4		Start date 1-1-2007			Month 1		
			End date: 31-12-2010			Month 48		
Work package title: Utilization and marketing								
No of lead partner	P1							
No of participating partner(s)	P7	P8	P9	P10	P11			
Total person-months	16.3							
• Main objectives								
<p>To evaluate material for utilization and marketing purposes resulting in specialized and regional products, increasing the diversity of products for the consumer. This includes the evaluation for organic farming systems, which will result in products to fulfil consumer demands in this area.</p> <p>Deliverables & milestones involved: D22-26 and M33-40; for the status of individual D&Ms: see overview deliverables and milestones pages 39-45.</p>								
• Task 1: Selection of material for evaluation								
						Start date: Month 1		
						End date: Month 24		
No of participating partner(s)	P7	P8	P9	P10	P11			
<p>It was agreed during the start-up meeting that material to be evaluated for utilization and marketing would be largely selected by the partners carrying out the evaluation from their own collections. This preserved the 'localism' of the produce wherever possible, which was considered to be an important component of developing varieties for local markets. However, where partners did not have access to their own material for evaluation or required additional material, selection would be carried out in cooperation with partners with relevant material in their collections.</p> <p>This has been done:</p> <ul style="list-style-type: none"> • P2 selected accessions chicory and endive for evaluation of by P11 in years 1-3. • Ten accessions of rocket were selected by P3 (5 accessions) and P0 (5 accessions) for evaluation by P8 in year 3. • Ten accession of Valerianella were selected by P3 (5 accessions) and P7 (5 accessions) for evaluation P8 in year 3. <p>It was also originally agreed at the start up meeting that common standard varieties should be included in all trials to allow comparison of how crops grew between the trials, i.e. they were not reference varieties against which genebank accessions were to be judged). Standard varieties were identified by the WP leader (P1) together with P2 and P9 and input from breeding industry representatives for chicory/endive, lettuce, rocket and valerianella.</p> <p>The agreed common standard varieties were:</p> <p>Lettuce: Amorix – Red oakleaf Vanity – Batavia Miluna – iceberg type crisp Bacia – Romaine/long cos type Delight – short cos type Little gem – cos Nadine – butterhead Krizet – green oakleaf/salad bowl</p> <p>Chicory/endive Alma- plain endive Kalinka – plain endive Natacha- plain endive Minerva – curled endive Kentucky-curved endive Glory- curled endive Cigal- chicory Fiero-chicory</p>								

Punto-chicory
Leonardo-chicory
Valerianella
Gala
Rocket
Eruca –common type
Diplotaxis – common type
Diplotaxis -Grazia

However, at the second project meeting it was decided by all partners that common standards were not appropriate and that partners could use their own standards if they wished and/or the common standards. All selection of accessions for field assessment work was completed in years 1-3.

CONCLUSIONS

Task 1 was successfully completed. Accessions for evaluation for marketability and utilisation was successfully selected for assessment by P7,P8,P9, P10,P11 in years 1-3 of the project. In total 44 lettuce, 136 chicory/endive and 57 minor leafy vegetable crops (rocket and Valerianella) were selected for assessment.

• **Task 2:** Seed of selected accession sent to partners

Start date: Month 1
End date: Month 30

No of participating partner(s)	P7	P8	P9	P10	P11			
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P2 and P3 provided sufficient seed of the accessions of chicory and endive selected in task 1 for evaluation by P11. Seed was provided in years 1-3 of the project for assessment by P11 as part of Task 3 – see below; seed of 34 accessions was supplied in year 1 (25 P2, 9 P3), 36 (P2) for year 2 and 28 (P2) for year 3. Seed was supplied of the ten accessions of rocket selected in task 1 for assessment by P3 in year 3 of the project. P3 supplied seed of 5 accessions and P0 seed of the other 5 accessions. Similarly P8 obtained seed of 10 Valerianella accession for assessment in year 3 from other project partners. P3 supplied seed of 5 accessions and P7 supplied seed of 5 accession. In year 4 an assessment of 14 lettuce accessions for evaluation for winter hardiness by P7 took place. These accessions were from P7’s own collection and so they provided seed for the trial.

The partners provided their own seed of the remaining accessions which were evaluated. These were accessions in their own collections which were regenerated in WP2.

CONCLUSIONS

Task 2 was successfully completed. Seed of the accessions selected for assessment of their suitability for utilization and marketing in task 1 was either supplied to the relevant partner by other project partners (P0,P2,P3, P7) or was produced by the partners themselves as part of WP2.

• **Task 3: Activities on utilisation and marketing**

Start date: Month 18

End date: Month 36

No of participating partner(s)

P1

P7

P8

P9

P10

P11

Chicory and endive:

Thirty four accessions of chicory were assessed for utilisation and marketing ahead of the project schedule by P11 in year 1 (2007) in a field experiment on sandy aluvial soil in Rheinau (ZH), Switzerland. Details of the trial, photographs of the accessions and the results and conclusions have been uploaded as part task 4 to the chicory database produced in WP1. The marketing potential of the accessions was evaluated by 'Biopartner' the biggest distributor of organic produce in Switzerland. The assessment was carried out by Biopartner's head of purchasing department. Firstly the shelf-life of the selected varieties was tested in a cold store, then the varieties were presented and sold in the Biopartners' shop. Additionally the same varieties were offered in the grower's own farm shop. No additional information about the varieties was given to consumers or retailers.

In general the potential commercial value of the accessions was judged to be low with regard to modern cultivars. Furthermore certain accessions (*Cichoria rossa di verona*, *Cichoria variegata de Castelfranco*) showed too poor head growth rate (loose filling) to be marketable. Poor head growth and associated 'funnel' shape are common characteristics for older varieties. *Chicoria Variegata di Castelfranco* as well as *Cicoria rosso di Verona* were heterogenous including variability in coloration. Additionally these plants bolted at an early stage. However, although bolting too early, *Cichoria Catalogna* was considered to have a novel growth habit which was thought to have potential to arouse consumer interest. *Gloire de l'exposition* had commercial potential as it presented a novel head shape, strongly crisped leaves, a long shelf-life and an excellent taste. When provided in an organic food store (Biopartner) *Sedan Blonde Imperial*, *Agora*, *Grosse Boucle* appealed to customers but were similar to existing common commercial varieties. Thus although some of the genebank accessions were found to compare well to modern varieties for shelf-life and attractiveness, they did not have any particular unique selling point over existing available varieties and therefore it was not thought worth the time and effort developing for the market.

Thirty six accessions of chicory were assessed in year 2 (2008) for utilisation and marketing by P11 again on sandy aluvial soil in Rheinau (ZH), Switzerland. Again the details of the trial, results together with photographs and conclusions have been uploaded to the chicory database.

Generally the accessions' commercial potential was assessed to be rather low due to similarity to modern commercially available varieties. In addition for some accessions (*D'été d'Anjou*, *Cebolla*, *Mondejos*) a high susceptibility to tipburn lowered marketability/cultivation qualities. Compared to the year 1 assessment all but 2 accessions (*Hua Yie Sheng Tsai*, *Andorra*) showed a high degree of homogeneity. Interesting varieties were *Valdeprios* with dense filling, good flavour but no self-blanching and a poor head formation, which reduced marketability. The marketability qualities of accessions of the *Catalogna* type were overall assessed to be favourable but not suited to the market in Switzerland. Three genebank accessions had potentially good commercial value. The accession *Full Heart*: was flat, dense, tough, not self blanching but quite soft leaves; the accession *Isadora* was flat, dense, not self blanching but quite soft leaves and had no tipburn; the accession *Linda* had very strongly crisped leaves, nice head, was not too big but slow growth.

Fifty one accessions were assessed by P11 in year 3 (2009). These were grown on sandy clay at Agroscope ACW, Swiss Federal Research Station for Agriculture in Wädenswil, Switzerland. Twenty eight accessions were provided by P2, 17 accessions were sourced from the Swiss genebank and 6 accessions were sourced by P1. The latter were expired varieties of a professional Swiss seed producer (*Samen Mauser*).

Evaluation for marketing of chicory and endive by P11 only took place in the field in 2009, there was no marketing of produce as in previous years due to the unavailability of Biopartner staff. Only 18 of the accessions were assessed for marketability characteristics as the other accessions were deemed to be totally unsuited to the market. Criteria assessed for a varieties' marketability were: at least 50% homogeneity, tight head-growth, no 'wild-looking'-types. The data file has been uploaded to the chicory database.

In general the marketability of the assessed accessions was good to excellent. Homogeneity was lower for the leaf chicory accessions than the endives which were highly homogenous in their growth and appearance characteristics. *Pegaso scarava precoce orto prato* and *Manchette Verte Chioggia* were assessed to have high

potential for marketability and good homogeneity. Endive accession Youri stood out with excellent homogeneity and less bitterness.

An additional activity to the project proposal was a sensory analysis of 28 accessions of endive and chicory carried out by P9 in year 3. This involved use of a trained panel who assessed 3 sensory attributes: bitterness, astringency and taste and visual acceptability. The data have been collated and uploaded into the chicory database.

All data generated by partners P9 and P11 in previous years trials have been inputted in the fourth project year into the chicory database. P9 submitted one data file of information on sensory characteristics of 28 accessions of chicory and endive. P11 submitted 3 data files of marketability on a total of 108 accessions of chicory and endive grown in 2007, 2008 and 2009. Data files included photographs of the accessions.

Lettuce:

Seventeen accessions of lettuce were evaluated for agronomic performance by P10 in year 2 (2008). In 2008 the weather over the summer in the UK was very poor with low light levels and significantly higher than average rainfall; this affected plant growth significantly. The % marketable heads varied from 0% to 100%, average marketable head weight varied from 300gm down to 110gm. Where marketable heads were obtained accession were evaluated by a taste panel of 13 'tasters' following a protocol developed previously by the National Institute of Agricultural Botany in the UK. The results of the assessment have been included in to the Lactuca database.

In 2009 15 accessions of lettuces from the Arche Noah (P7) seed collection were grown at four selected organic farms in the region of Niederösterreich. They carried out field tests according to their usual practice. The organic farmers assessed the accessions according to the following criteria:

- plant development until marketing,
- harvest period,
- reasons for unmarketable heads,
- farmer's assessment of the variety,
- customers' assessment of the variety

The farmers indicated that they would be willing to grow the following varieties grow again:

'Neuseeländer Salat'(cos-type)- good uniformity at harvest time, well closed and very big heads (750-1159g per head), good storability, little post-harvest cleaning required.

'Pommeen Terre' (cos-type) - big compact heads, good plant development, no bolting, good storability'

Streits Dunkelgrüner Riesenkris'(cos-type) - uniform development, heading, no bolting, good storability

'Ricciolina'(cutting-type) – sold well, good plant development, good storability, good taste

'Salat aus Jaskovo'(crisphead-type) - uniform, early heading, big heads

'Flecika'(crisphead-type) - big head size, good storability, no bolting, sold well at the market

'Gelb Roter aus Zagreb'(butterhead) - uniform development, visually very nice but no storability and short harvest period

'RoterButterhäuptelLeitner'(butterhead)- good storability, visually nice and liked by customers'

In May 2009 the 15 varieties were evaluated by a group of about 50 customers. The tasting took place at the venues of open door days at an organic foodstore in A-3500 Krems and in the public garden of Arche Noah in A-3553 Schiltern. Customers were asked which variety they liked most and why (taste, appearance etc.). Because there were 15 varieties to be tasted not every visitor was able to try each. Therefore the numbers in the following list give an impression which varieties were preferred to others. The 15 accessions of lettuce were also evaluated by a panel of 4 Arche Noah staff . The results of the evaluation of marketing have been uploaded into the Lactuca database.

There was no variety with all the qualities required for the market, but there were some noted as being of commercial interest.

Among customers the following accessions were favoured:

'Roter Butterhäuptel Leitner' - because of its intensive taste and the redish colour

'Dubacek' - because of its shape and taste.

'Gelb RoterausZagreb' - because of its very nice yellow green shape and big leaves, although it should be noted that it post harvest 'shelf life' was only one day.

The organic farmers preferred the Cos-types because of their good growing habit. The butter head types generally bolted too fast and the heads were too small.

In the evaluation of taste the most favoured varieties were:

'Neuseeländer Salat'(Cos),
'Kaiser Selbstschluss'(Cos),
'Gelb Roter aus Zagreb'(butterhead),
'Flekica'(crisphead),
'Roter Butterhäuptel Leitner'(butterhead)
'Streits Dunkelgrüner Riesenkriss'(crisphead).

In general there was a keen interest among the farmers and the customers for the old and rare varieties. All of them, even the local supermarket asked for a continuing supply of some varieties.

Assessment of lettuce accessions for utilization and marketing by P10 was performed in field trials on 2 locations (Jablje and Križe) in late spring period of year 3 (2009). Accessions were divided into 2 groups – accessions belonging to batavia type without red leaf edge and accessions belonging to batavia group with red leaf edge. Appropriate standard varieties were chosen for each of the groups. All trials were set in 3 replications in randomized block design. In general the spring conditions in 2009 were favourable for lettuce and no special problems were encountered. The yields achieved were slightly higher than average yields of lettuce in Slovenia.

In both trials of the Batavia – green accessions the marketable yield of the standards and the tested accessions differed significantly especially in the Križe trial. In Križe trial two of the standards and one of the selections of accession GB5 had very high marketable yield (around 80 t/ha), but all of them expressed some bitterness at tasting. The yield of the other selection of the same accession was slightly lower. In both trials the accession GB142 was among those with the lowest yield. The genebank accessions were early to medium bolting while the standards bolted medium to late.

In both trials of the Batavia – green with red leaf edges accessions the marketable yield of all the tested accessions was the same or higher than the yield of standard varieties. The gene bank accessions and standard varieties were early to medium.

The trial data has been uploaded in to the Lactuca database.

There was little practical experimental work carried out in year 4 as the majority of the efforts by partners were directed at inputting data from the previous years' experiments to assess marketability and utilisation in to the databases in the agreed format. (Task 4)

Partner P7 evaluated 14 lettuce accessions for winter hardiness. Details of the trial were as follows:

- Location: Vermehrungsgarten Arche Noah, A 3553 Langenlois, Silty soil
- Condition: field conditions outdoor covered by a fleece.
- Planting set: 3.3 running meters per accession were directly sown in one plot without replication.. Row distance 30 cm.
- Sowing date see 21 and 22 Sept 2009.
- Thinned out to 5cm plant distance on 15.11.2009. Climate: The winter was comparatively warm with a snow cover from 26.12.2009 on to 26.02.1009.
- Cumulative percentage loss was scored on three dates

The % survival rate varied from 95% down to 75%. The trial details and data have been input into the Lactuca databases managed by P0.

Data for all the previous years' experiments by partner P7, P8 and P10 were collated and sent to the WP leader (P1) for verification. They were then sent to the Lactuca database manager (P0).

Minor crops

Partner P8 carried a market evaluation of 10 accessions of valerianella and 10 accessions of rocket for range of market outlets in year 3 (2009). The trial of rocket accessions consisted of five accessions supplied by P2 and five supplied by P0 with four commercial varieties as controls. The trial was Sown on 29/7/09 in module compost in greenhouse at Ryton and planted out on 28/8/09 as 4m plots, consisting of 4 rows with plants at 15cm spacing within the row and 30cm spacing between rows. Each accession was replicated by three plots. Plots were first harvested on 22/9/09. Accessions were assessed for bolting, infection by alternaria and yield. An assessment of consumer acceptability was carried out at the 'Organic Harvest' open day where visitors

were asked to 'score' accessions for strength of flavour, appearance and overall 'pleasantness'. More detailed evaluations were carried out by staff of P8 additionally scoring for off-taste, sweetness and texture. At the time of writing the trial is still in the ground and accession are still being assessed. Data has been collated and uploaded to the minor crops database.

Partner P8 also carried out a market evaluation on ten accessions of valerianella provided by partners by P3 (5 accessions) and P7 (5 accessions), with six commercial varieties as controls. The field trial was Sown on 23/7/09 and planted on 2/9/09. The trial was again arranged as 3 replicate 4m plots per accession, consisting of 4 rows, with plants at 15cm spacing within the row and 30cm spacing between rows. First harvest on 3/11/09. Accessions were assessed for yield and infection by powdery mildew. They were also assessed for consumer acceptance by the staff of P8. Attributes that were 'scored' were: strength of flavour, 'off' taste, sweetness, texture appearance and overall 'pleasantness'. The data were collated and uploaded to the minor crops database.

Partner P8 collated data for market evaluation in 2010 of 10 accessions of valerianella and 10 accessions of rocket for range of market outlets carried out in 2009. The data file was verified by the WP leader P1 and has been uploaded to the minor crops database by P0. The data on sensory traits of 37 Rocket accessions assessed by P9 was also submitted to the minor crops database.

CONCLUSIONS

Task 3 was completed. The target numbers for evaluation utilisation and marketing were exceeded for all crops: for lettuce 44 accessions were evaluated (target 40), chicory and endive 136 accessions evaluated (target 125) minor crops 57 accessions evaluated (target15). All partners identified genebank accessions that had potential for development for their local markets.

Work package number	WP 5		Start date 1-1-2007 End date: 31-12-2010		Month 1 Month 48	
Work package title: Coordination						
No of lead partner	P0					
No of participating partner(s)	P1	P2	P3			
Total person-months	32.6					
• Main objectives						
<ul style="list-style-type: none"> Objective 1: Effective management of the project <p>Deliverables & milestones involved: D27-40 and M40-56 pages 39-45.</p>						
• Task 1: Organization of project and WP meetings						
					Start date: Month 1 End date: Month 47	
No of participating partner(s)	P0	P2		Pall		
<p>In total five general project meetings were organized and four WP coordinator meetings. The general project meeting took place in Wageningen (NL, 2007), Angers (FR, 2007), Alnarp (SW, 2008), Cesena (IT, 2009) and Montfavet (FR, 2010). The WP coordinator meetings took place in Brion (FR, 2007), Schiltern (AUS, 2008), Wellesbourne (UK, 2009) and Aarau (SWIT, 2010). The organization of the meetings took place in close collaboration between the local organizer and the project coordinator and no problems were encountered in all of these collaborations.</p> <p>CONCLUSIONS: In total nine (five general and four WP) meetings took place during the duration of the project. The organization of all meetings was efficient and no problems were encountered.</p>						

• Task 2: Development and implementation website						
					Start date: Month 1 End date: Month 48	
No of participating partner(s)	P0		Pall			
<p>The Leafy Veg website was already developed and implemented in the first month of the project (January 2007). Both an external and internal (protected) website was developed. Updates took place on a regular basis. The external project website functioned as a platform for the exchange of information between the project and the 'outside world', which encompassed general public interested in conservation of biodiversity but also genebankers interested in leafy vegetables. Especially the newly developed leafy vegetable portal proved to be of interest for them. The internal Leafy Veg website functioned as a platform for exchange of information among the partners and on this part of the site all the administrative information on the project was present. It was generally felt that this internal website was important to the success of the project. Via the LetsStatX1 tool connected to the homepage of the project a number of parameters were monitored which gives an idea of the use of the website. It was observed that the website was reasonably visited, and that most visitors were of European origin.</p> <p>CONCLUSIONS: The development and implementation of the Leafy Vegetable website took place early in the project as a project wwebsite was considered to be crucial for the success of the project. Updating of the website took place during the entire project period. The internal as well as the external website functioned satisfactorily as a platform for the exchange of information both between the project and the 'outside world' and among the partners.</p>						

• **Task 3: Promote information flow between partners and contacts with the Commission**

Start date: Month 1
End date: Month 48

No of participating partner(s)

P0

Pall

- Flow between partners: General project and WP meetings as well as the leafy vegetable website, the e-reports and further contacts helped to promote the flow of information among the project participants. During the project duration there was no problem concerning the lack of shared information among the partners. The only thing that was changed during the project duration was the frequency of the e-reports as it was reported by a number of partners in 2008 that the frequency was too high (once in the on average three months), this was changed in once in the six months (an issue just before the annual WP coordinator meeting and a few months before the annual general meeting. This modification was considered satisfactorily.
- Flow between partners and EC Commission: This flow is mediated by the project coordinator. Extensive contacts have been present between the Commission and the Leafy Veg project. These contacts predominantly took place annually during the period after the evaluation of the technical and financial report by the independent Commission experts. Sometimes 'tough nuts had to be cracked', but the personal contacts between the project coordinator and the EC GENRES coordinator were always taking place in a good atmosphere, which helped significantly to overcome the problems encountered.

CONCLUSIONS: The flow of information among the partners and between the partners and the EC Commission is of crucial importance for the success of any EC project. This was not different for the GENRES Leafy Veg project. Overall the flow of information among the partners but also the flow of information between the EC Commission and the Leafy Veg project was considered good.

• **Task 4: Promote dissemination of project results**

Start date: Month 1
End date: Month 48

No of participating partner(s)

P0

Pall

- The total dissemination activities over the project time to various audiences (see for a detailed account on dissemination activities: section 5) are presented in the table below.

year	scientific publications			education	professional publications		newspaper radio	events
	oral	poster	peer review paper	BSc/MSc thesis	journal	web publication		
2007		2			12	8	2	1
2008	1	1			3			1
2009			1	3	6	10		3
2010	1	4	2(2)	3	1	2		3
total	2	7	3(2)	6	22	20	2	8

- From the table it becomes clear that professional publications are by far the most used dissemination outlet by the partners. This underlines the specific position of activities on genetic resources which are carried by genebanks: it is mostly not hard core scientific research. A lot of the work therefore is published in professional publications like abstracts books to conferences, (inter)national journals dedicated to genetic resources or more in general crops, etc.
- Workshops and events to disseminate the results of the project to various audiences have been held. However a workshop to disseminate the project results to the scientific community still needs to be held as the EUCARPIA Leafy Vegetable symposium was postponed from 2010 to 2011. The current scheme is that the symposium will take place in August 2011 in Lille (France).

- Breeding companies visited the project meetings on a regular basis and contributed to the discussions which took place during the annual general meetings.

CONCLUSIONS: During the project time a considerable dissemination output took place. Mostly partners published in professional journals or on websites. Furthermore demonstration events took place by the several NGOs connected to the project which were visited by a large number of people. Also breeding companies visited the project meetings on a regular basis and contributed to the discussions. It can therefore be concluded that this task has been carried out successfully.

Overview of deliverables

<i>Deliverable number</i>	<i>Planned completion (month)</i>	<i>Description</i>	<i>Status</i>		
			<i>Achieved (month)</i>	<i>Start date</i>	<i>End date</i>
D01	30	Passport data of the four leafy vegetable (LV) collections donated	48	March 2007	Dec 2010
D02	48	Databases of the four LV crop groups developed and on the Internet	24	March 2007	Dec 2008
D03	48	Evaluation and characterization results in fixed formats linked to the databases	48	Nov 2007	Dec 2010
D04	48	Safety duplication system of the LV collections established	48	June 2008	Dec 2010
D05	48	Gaps in the four LV crop collection groups identified	48	Oct 2009	Dec 2010
D06	06	Minimum descriptors for the minor leafy vegetables concluded	03	Feb 2007	March 2007
D07	45	800 accessions of lettuce characterized	22	March 2007	Oct 2008
D08	45	110 accessions of spinach characterized	45	April 2007	Sep 2010
D09	45	180 accessions of chicory characterized	35	March 2007	Nov 2009
D10	45	190 accessions of minor crops characterized	45	April 2007	Sep 2010
D11	45	Characterization data entered in a fixed format to be sent to the database managers	48	Sep 2007	Dec 2010
D12	48	930 accessions of lettuce regenerated	47	March 2007	Nov 2010
D13	48	50 accessions of spinach regenerated	34	April 2007	Oct 2009
D14	48	200 accessions of chicory regenerated	47	March 2007	Nov 2010

D15	48	70 accessions of minor crops regenerated	46	April 2007	Oct 2010
D16	12	Seeds of the selected material of the four crop groups sent to the partners involved	29	March 2007	May 2009
D17	45	115 accessions of lettuce evaluated	45	April 2007	Sep 2010
D18	45	320 accessions of spinach evaluated	45	April 2008	Sep 2010
D19	45	265 accessions of chicory evaluated	48	April 2008	Dec 2010
D20	45	49 accessions of minor crops evaluated	24	April 2008	Dec 2008
D21	45	Evaluation data entered in a fixed format to be sent to the database managers	48	Nov 2009	Dec 2010
D22	12	Seeds of the selected material of the three crop groups sent to the partners involved	29	March 2007	May 2009
D23	45	40 accessions of lettuce evaluated for utilisation and marketing	45	April 2008	Dec 2010
D24	45	125 accessions of chicory evaluated for utilisation and marketing	36	April 2007	Dec 2009
D25	45	15 accessions of minor crops evaluated for utilisation and marketing	36	Jan 2009	Dec 2009
D26	45	Evaluation data entered in a fixed format to be sent to the database managers.	47	Jan 2010	Nov 2010
D27	01	Start-up project meeting	02	Feb 2007	Feb 2007
D28	03	Leafy Veg website is launched on internet and active.	02	Jan 2007	March 2007
D29	06	First WP coordinators meeting	09	Sep 2007	Sep 2007
D30	11	First annual project meeting	12	Dec 2007	Dec 2007
D31	14	First annual progress report	15	Jan 2008	March 2008
D32	18	Second WP coordinators meeting	19	July 2008	July 2008

D33	23	Second annual project meeting	23	Nov 2008	Nov 2008
D34	26	Second annual progress report	27	Jan 2009	March 2009
D35	30	Third WP coordinators meeting	30	June 2009	June 2009
D36	35	Third annual project meeting	35	Nov 2009	Nov 2009
D37	38	Third annual progress report	39	Jan 2010	March 2010
D38	42	Fourth WP coordinators meeting	42	June 2010	June 2010
D39	46	Final annual project meeting	47	Nov 2010	Nov 2010
D40	48	Fourth and final annual progress report	48	Nov 2010	Dec 2010

Overview of milestones

<i>Milestone number</i>	<i>Planned completion (month)</i>	<i>Description</i>	<i>Status</i>		
			<i>Achieved (month)</i>	<i>Start date (month)</i>	<i>End date (month)</i>
M01	03	Start made selecting material used for the evaluation activities, developing core collections if needed for lettuce and spinach	03	March 2007	March 2007
M02	03	Start made requesting passport data for the spinach, chicory and minor vegetable databases and lacking data for the Lactuca database (ILDB)	03	March 2007	March 2007
M03	06	Material selected for regeneration and characterization of the four crop groups	03	March 2007	March 2007
M04	12	Material selected for the evaluation activities of the four crop groups	03	March 2007	March 2007
M05	12	Inventory of system of safety duplication of the collections made and discussed during the second project meeting	12	June 2007	Dec 2007
M06	24	Passport data of most collections of the four databases delivered	11	March 2007	Nov 2007
M07	36	Databases with passport data for the four crop groups nearly finalized	24	March 2007	Dec 2008
M08	36	Part characterisation and evaluation data donated and start made including these in the databases	11	June 2007	Nov 2007
M09	36	Safety duplication of part of the collections realized	18	June 2007	June 2008
M10	36	Start made identifying gaps in the collections	48	Oct 2009	Dec 2010
M11	42	Start made with making the databases available via the Internet	24	Dec 2008	Dec 2008
M12	42	Safety duplication of collections inside the project realized	48	June 2008	Dec 2010
M13	45	Most characterisation and evaluation data donated for inclusion in the databases	48	Nov 2007	Dec 2010
M14	02	Start made developing minimum descriptors for the minor leafy vegetables	03	Feb 2007	March 2007

M15	06	Material for regeneration and characterization of the four crops selected	03	Feb 2007	March 2007
M16	06	Regeneration of material of some crops started pending the growing season	05	March 2007	May 2007
M17	12	Regeneration and characterisation for all crops started	08	March 2007	Aug2007
M18	24	Regeneration, characterisation of germplasm of the four collections will be continued	23	March 2007	Nov 2008
M19	36	500 accessions of lettuce characterized	22	March 2007	Oct 2008
M20	36	70 accessions of spinach characterized	22	April 2007	Oct 2008
M21	36	110 accessions of chicory characterized	22	March 2007	Oct 2008
M22	36	110 accessions of minor crops characterized	23	April 2007	Nov 2008
M23	36	600 accessions of lettuce regenerated	23	March 2007	Nov 2008
M24	36	30 accessions of spinach regenerated	22	April 2007	Oct 2008
M25	36	120 accessions of chicory regenerated	35	March 2007	Nov 2009
M26	36	40 accessions of minor crops regenerated	23	April 2007	Nov 2008
M27	12	Material selected for the evaluation activities of the four crop groups	12	Oct 2007	Dec 2007
M28	18	Evaluations started	18	April 2007	April 2007
M29	36	70 accessions of lettuce evaluated	44	April 2007	Sept 2010
M30	36	263 accessions of spinach evaluated	44	April 2008	Sept 2010
M31	36	170 accessions of chicory evaluated	48	April 2008	Dec 2010
M32	36	30 accessions of minor crops evaluated	21	April 2008	Sept 2008
M33	12	Material selected for utilization and marketing	04	April 2007	April 2007

M34	18	Activities on utilisation and marketing started	06	June 2007	June 2007
M35	36	25 accessions of lettuce evaluated for utilisation and marketing	36	April 2008	Dec 2009
M36	36	75 accessions of chicory evaluated for utilisation and marketing	36	April 2007	Dec 2009
M37	36	10 accessions of minor crops evaluated for utilisation and marketing	36	Jan 2009	Dec 2009
M38	45	40 accessions of lettuce evaluated for utilisation and marketing	45	April 2010	Dec 2010
M39	45	125 accessions of chicory evaluated for utilisation and marketing	45	April 2007	Dec 2009
M40	45	15 accessions of minor crops evaluated for utilisation and marketing	45	Jan 2009	Dec 2009
M41	01	Detailed workplan of the project defined at the start -up meeting of the project (time schedules for regeneration, characterisation and evaluation will be established)	02	Feb 2007	Feb 2007
M42	01	The project website will be developed	01	Jan 2007	March 2007
M43	05	First WP coordinators meeting organised	09	Aug 2007	Sept 2007
M44	10	The second project meeting (first annual project meeting) will be organised to discuss the progress and discuss the first annual progress report	12	Nov 2007	Dec 2007
M45	13	First annual progress report will be finalised and submitted to the European Commission	15	Jan 2008	March 2008
M46	17	Second WP coordinators meeting organised	19	Apr 2008	July 2008
M47	22	Third project meeting (second annual project meeting) will be organised to discuss the progress and discuss the second annual progress report	22	Sep 2008	Nov 2008
M48	25	Second annual progress report will be submitted to the European Commission	27	Jan 2009	March 2009
M49	29	Third WP coordinators meeting organised	30	Apr 2009	June 2009
M50	34	Fourth project meeting (third annual project meeting) will be organised to discuss the progress; this meeting will also review the overall progress of the project (mid-term review) in order to assess whether the following set of milestones have been fulfilled by the project	34	Sept 2009	Nov 2009

M51	37	Third annual progress report including a mid-term review of the coordinator will be submitted to the European Commission	39	Jan 2010	March 2010
M52	41	Fourth WP coordinators meeting organised	42	April 2010	June 2010
M53	45	Final project meeting to discuss the progress report of the fourth year and the final overall project report of the project organised. A workshop presenting the results of the project will be connected to this meeting to disseminate information of the project to interested stakeholders.	46	Sept 2010	Nov 2010
M54	48	Fourth annual progress report and the final overall report will be submitted to the European Commission	49	Nov 2010	Jan 2011

3. SUMMARY OF THE PROBLEM(S) ENCOUNTERED (IF ANY) ...

- Fortunately no significant problems were encountered that influenced seriously the realization of the objectives of the project.

4. MANAGEMENT OF THE ACTION

Meetings, workshops and seminars organised by the coordinator and the partners

Internal Leafy Veg meetings:

- **2007**
 - Project start-up meeting, Wageningen, the Netherlands, February 13-15
 - WP meeting, Angers, France, September 27
 - First annual project meeting, Angers, France, December 12-13
- **2008**
 - Second WP meeting Schiltern, Austria, July 2
 - Second annual project meeting Alnarp, Sweden, November 26 – 27
- **2009**
 - Third WP meeting, Wellesbourne, UK, June 11
 - Third annual project meeting, Cesena, Italy, November 17-18
- **2010**
 - Fourth WP meeting, Aarau, Switzerland, June 23 2010
 - Fourth general project meeting, Montfavet, France, November 16-17

Events/Demonstrations for a general audience:

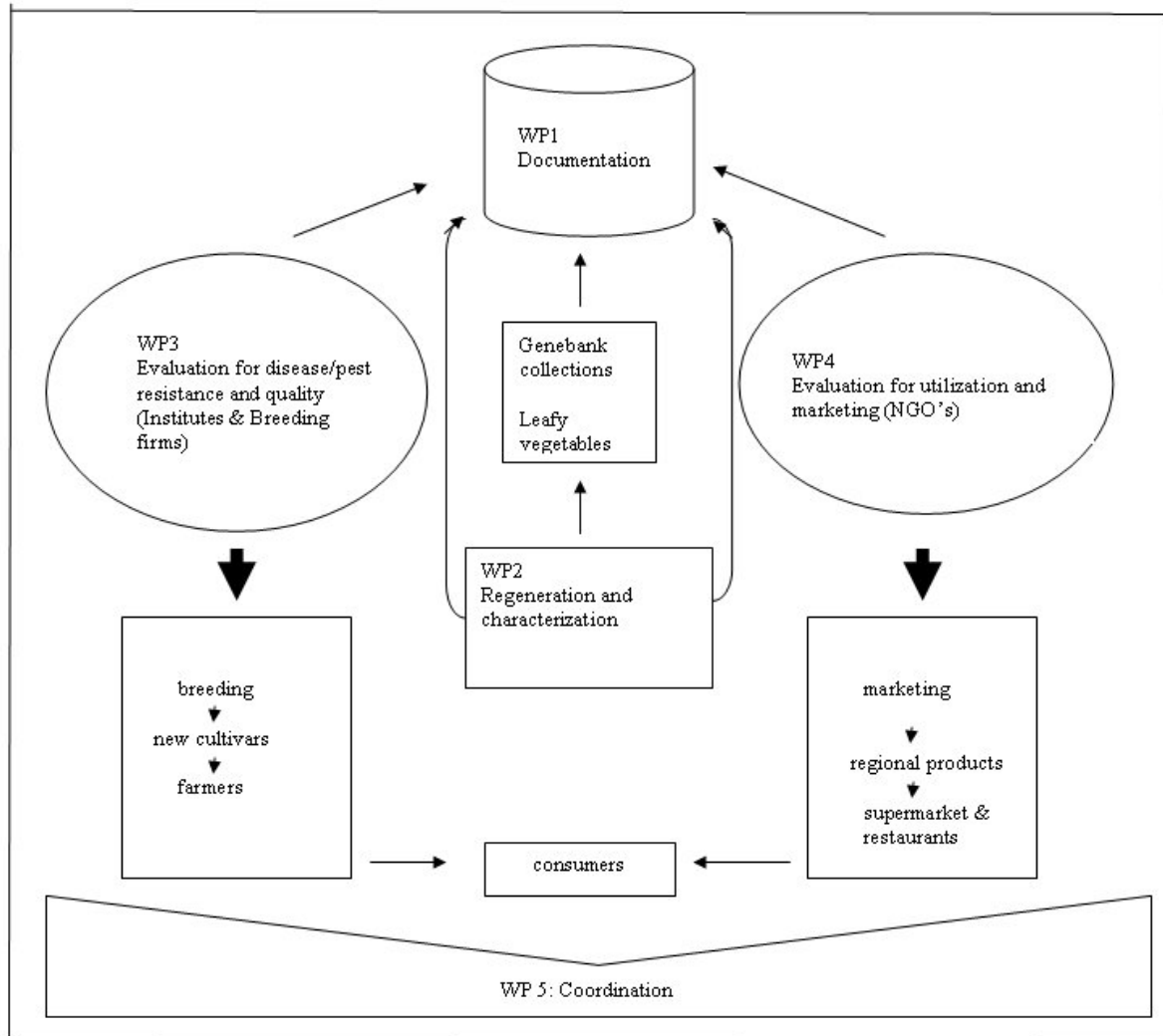
- **2007**
 - IPK: At the annual public day on 9th of June 2007 demonstration plots containing Lactuca and Eruca accessions from the Leafy Veg with an explanation of the EU Leafy Veg project were shown to a general audience.
- **2008**
 - IPK: At the annual public day on 7th of June 2008 demonstration plots containing Lactuca and Eruca accessions from the Leafy Veg with an explanation of the EU Leafy Veg project were shown to a general audience.
- **2009**
 - Garden Organic: Organic Harvest at Garden Organic Ryton. Public event with more than 700 people attending. 111 of these took part in a taste testing of Eruca accessions (and standards) from the trials. http://www.gardenorganic.org.uk/events/show_event.php?id=471
 - Arche Noah: In May 2009 a day was organized in which the general audience could taste and evaluate 15 accessions of the Lactuca collection involved in the Leafy Veg project at Arche Noah.
 - IPK: At the annual public day on 6th of June 2009 demonstration plots containing Lactuca and Eruca accessions from the Leafy Veg with an explanation of the EU Leafy Veg project were shown to a general audience.
- **2010**
 - CGN: Visit of breeders to the characterization field of lettuce located in Wageningen on June 9 2010.
 - IPK: At the annual public day on 12th of June 2010 demonstration plots containing Lactuca and Eruca accessions from the Leafy Vegetables with an explanation of the EU Leafy Vegetables project were shown to a general audience.
 - IPK: Demonstration plots were shown to visitors in the course of the State Horticultural Show (Landesgartenschau) in Aschersleben in June 2010.
- **(2011)**
 - Section-workshop during the EUCARPIA Leafy Vegetable symposium, Lille (France), August 24-26

Changes in the action's management structure (If any)

Only in 2008 two changes in the management structure of the action took place. Fortunately these changes did not have an impact on the pace of the project. These changes were:

- For partner 2 (GEVES), Mrs. Valerie Cadot has been replaced since November 2008 by Mr. Pascal Coquin (GEVES member staff).
- One partner withdrew from the project, namely USOFA (Slovenia); their task has been taken over by the Agricultural Institute of Slovenia (KIS); this change was reported to the Commission on May 21 2008.

Descriptive graph illustrating the distribution of the labour among the partners for all work packages



Work packages	WP1 Documentation	WP2 Regeneration and characterization	WP3 Evaluation	WP4 Utilization and marketing	WP5 Coordination
WP leaders	P0	P3	P2	P1	P0
<u>Lettuce</u> Task leader: Partners:	P0 -	P1 P0, P1, P2, P3, P4, P5, P6, P7, P10, P8	P1 P1, P4, P7, P8, P11	P1 P7, P10, P8, P11	P1
<u>Spinach</u> Task leader: Partners:	P0 -	P0 P0, P1, P5, P7	P0 P0 ¹ , P5		P0
<u>Chicory</u> Task leader: Partners:	P2 -	P2 P1, P2, P7, P8, P11	P2 P2, P10	P2 P10, P8	P2
<u>Minor LV crops</u> Task leader: Partners:	P3 -	P3 P0, P1, P2, P3, P5, P7, P8	P3 P5, P10, P8	P3 P11, P8	P3

CONCLUSION: Nine internal Leafy Veg meetings took place during the duration of the project. This proved to be of significant value for the progress of the project as the workplan as written down in the technical annex of the project could be discussed thoroughly. Furthermore events were organized for the general public but also for breeders. Also these events contributed to the success of the project.

5. SUMMARY OF ALL THE DISSEMINATION RESULTS

2007

SCIENTIFIC PUBLICATIONS

Oral: -

Poster:

Kik, C. & V. Meglic (2007). AGRI GEN RES targeted action: leafy vegetabled germplasm, stimulating use. Eucarpia Genetic Resources section meeting, Session 2 – poster presentations, Piestany, Slovak Republic, May 23-26, page 130-131 & poster

Sustar-Vozlic, J. & C. Kik (2007). AGRI GEN RES targeted action: leafy vegetables germplasm, stimulating use. Eucarpia Leafy Vegetables symposium, Conference abstracts – poster presentations, University of Warwick, UK, April 18-20, page 25 & poster

Peer reviewed: -

EDUCATION

PROFESSIONAL PUBLICATIONS

Journal:

Anonymous (2007). EU genebank promotes vegetative diversity. Commercial grower, March 22, page 27.

Anonymous (2007). Genetic resources to develop leafy vegetables. Horticulture Week, March 29, page 31.

Anonymous (2007). New European Leafy Veg project is not just rocket science! The Vegetable Farmer, April 2007, page 4.

Anonymous (2007). Project unlocks potential heritage vegetables. HDC News, April, page 3.

Anonymous (2007). New European Leafy Veg project is not just rocket science! The Organic Grower 1, 6.

Anonymous (2007). New European Leafy Veg project. The Organic Way 188, 5.

Anonymous (2007). Un patrimoine utile. Culture legumieres 100, June-August, page 10.

Anonymous (2007). Projet de recherche europeen sur les legumes feuilles. Reussir fruits et legumes 264, July-August, page 39.

Anonymous (2007). Europe: projet de recherche genetique sur les legumes feuillies. Flash vital 28, August, week 33/34.

Kik, C. (2007). European leafy vegetables project is not just rocket science. Bioversity Newsletter for Europe 34, 17.

Lebeda, A. & E. Kristkova (2007). Pracovnici Katedry botaniky PrF UP se podileji na reseni dalsiho mezinarodniho projektu EU. Zurnal UP 8, 4.

Sumption, Ph. (2007). New European Leafy Veg project is not just rocket science! Seed News 50, 12-13.

Web:

Anonymous (2007). Leafy Veg project launched. www.foodeast.com/news/newsarchive/news4023.asp

Anonymous (2007). UK: New European Leafy Veg project is not just Rocket Science! www.freshplaza.com/2007/0319/1-1_uk_hdra.html

Anonymous (2007). Nieuw Europees bladgroenteproject meer dan 'raketwetenschap' www.vmt.nl/index.php?page=nieuwsartikel&id=2393

Anonymous (2007). Zoektocht naar een gezondere rucola.

a. www.agd.nl/web/artikel/zoektochtnaargezondere_rucola.htm

b. www.missethoreca.nl/1054963/restaurantnieuwsbericht/zoektochtnaargezondere_rucola.htm

Anonymous (2007). Europees onderzoek naar gebruik genetische bronnen van bladgroenten. www.agriholland.nl/nieuws/

Anonymous (2007). Partners ontwikkelen gezondere sla. www.evmi.nl/nieuws/voeding-gezondheid/3445/partners-ontwikkelen-gezondere-sla.html

Anonymous (2007). New EC-funded project up to stimulate the use of rare genebank material in leafy vegetable production. www.bionity.com/news/e/63145/

NEWSPAPER/RADIO

- Anonymous (2007). Streef niet naar een supersla, behoudt ook oude slasoorten. Trouw, March 28.
- Anonymous (2007). Salatmeer als Versuchobject. Ascherslebener Zeitung. April 17, page 7.
- Interview Radio Gelderland of C. Kik in relation to Leafy Veg project.

EVENTS -

- IPK: At the annual public day on 9th of June 2007 demonstration plots containing Lactuca and Eruca accessions from the Leafy Veg with an explanation of the EU Leafy Veg project were shown to a general audience.

2008

SCIENTIFIC PUBLICATIONS

Oral:

Lebeda, A., Doležalová, I., Křístková, E., Kitner, M., Petrželová, I., Mieslerová, B. and Novotná, A. (2008). Wild Lactuca germplasm for lettuce breeding – recent status gaps and challenges. In: Prohens, J., Badenes, M.L. (Eds.): Modern Variety Breeding for Present and Future Needs. Editorial Universidad Politécnica de Valencia, Valencia, Spain, pp. 49-60.

Poster:

Křístková, E., Lebeda, A. et Superatová, L. (2008). Morphological variation within and between lettuce accessions of cv. 'Atrakce' in the Czech national germplasm collection. In: Prohens, J., Badenes, M.L. (Eds.): Modern Variety Breeding for Present and Future Needs. Editorial Universidad Politécnica de Valencia, Valencia, Spain, pp. 156-157. (Abstract).

Peer reviewed: -

EDUCATION

PROFESSIONAL PUBLICATIONS

Journal:

Lebeda, A., Doležalová, I., Křístková, E., Kitner, M., Petrželová, I., Mieslerová, B. and Novotná, A. (2008). Wild Lactuca germplasm for lettuce breeding – recent status gaps and challenges. In: Prohens, J., Badenes, M.L. (Eds.): Modern Variety Breeding for Present and Future Needs. Editorial Universidad Politécnica de Valencia, Valencia, Spain, pp. 49-60.

Kik, C. (2008). Leafy Veg: a GENRES project to establish a network active in conservation and utilization of plant genetic resources of the most important European leafy vegetables. In: Modern Variety Breeding for Present and Future Needs (J. Prohens & M.L. Badenes, Eds), Universidad Politecnica de Valencia, Valencia, Spain, p. 154.

Křístková, E., Lebeda, A. and Superatová, L. (2008). Morphological variation within and between lettuce accessions of cv. 'Atrakce' in the Czech national germplasm collection. In: Prohens, J., Badenes, M.L. (Eds.): Modern Variety Breeding for Present and Future Needs. Editorial Universidad Politécnica de Valencia, Valencia, Spain, pp. 156-157. (Abstract).

Web: -

NEWSPAPER/RADIO

EVENTS

- IPK: At the annual public day on 7th of June 2008 demonstration plots containing Lactuca and Eruca accessions from the Leafy Veg with an explanation of the EU Leafy Veg project were shown to a general audience.

2009

SCIENTIFIC PUBLICATIONS

Oral: -

Poster: -

Peer reviewed:

Van Treuren R & ThJL van Hintum (2009) Comparison of anonymous and targeted molecular markers for the estimation of genetic diversity in *ex situ* conserved *Lactuca*. *Theor Appl Genet* 119:1265–1279

EDUCATION

Grygarová K (2009). Morphologic variation of genetic resources of lettuce (*Lactuca sativa* L.) cv. Atrakce. Bachelor thesis, Palacký University in Olomouc, Faculty of Science, Department of Botany, 78 p. (CZ)

Melichaříková Z. (2009). Morphologic variation of genetic resources of lettuce (*Lactuca sativa* L.). Bachelor thesis, Palacký University in Olomouc, Faculty of Science, Department of Botany, 59 p. (CZ)

Starnini Iacopo, 2009. Determinazione dei glucosinolati e valutazione sensoriale di campioni di rucola dei generi *Eruca* e *Diplotaxis*. (Glucosinolate determination and sensory evaluation of rocket salad samples belonging to *Eruca* and *Diplotaxis* genera). Food science and technology MSc thesis, Academic year 2008-2009. University of Bologna. Tutor prof. L.F. D'Antuono.

PROFESSIONAL PUBLICATIONS

Journal:

Anonymous (2009). Heirloom cos lettuce performs well against downy mildew. *Horticulture Week*, May 1, 2009, 22.

Anonymous (2009). Heritage varieties showing promise. *The Organic Grower*. Winter 2008/9, 7.

Anonymous (2009). Cutting Edge. *The Organic Way*, 15.

Anonymous (2009). Evis Frühlingsfest und Treffpunkt Unternehmer. *Kremser Bezirksblatt*. Nr.22, 27 Mai 2009

Lerch F (2009). Neue Salatsorten im Test. *Arche Noah Magazin* April 2009, 4.

Suanjak M & F Lerch (2009). Grüne Salat als Überwinterungskultur. *Arche Noah Magazin* Juli 2009, 10-11

Web:

http://www.gardenorganic.org.uk/news/press_story.php?id=504&PHPSESSID=a9404bc3d34761607f7c33e48c3bc121

http://www.gardenorganic.org.uk/news/news_topic.php?id=504

http://www.gardenorganic.org.uk/news/news_topic.php?id=502

<http://www.gardenandgreen.co.uk/#/lettuces/4533648022>

<http://questionersgardentime.blogspot.com/2009/05/organic-heritage-lettuce-outperforms.html>

<http://www.hartley-botanic.co.uk/19211928-lettuce-growers-should-go-old-school.php>

http://www.naturalchoices.co.uk/Garden-Organic-offers-rare-sale-of?id_mot=2

<http://www.hortweek.com/news/893241/Heritage-Seed-Library-release-rare-endangered-vegetable-varieties-public/>

<http://www.hortweek.com/news/bulletin/GrowerBulletin/article/893241/?DCMP=EMC-GrowerBulletin>

<http://www.hortweek.com/news/rss/Search:+edibles/905230/Growers-will-invited-put-heirloom-lettuce-varieties-paces/>

NEWSPAPER/RADIO

EVENTS

- Garden Organic: Organic Harvest at Garden Organic Ryton. Public event with more than 700 people attending. 111 of these took part in a taste testing of *Eruca* accessions (and standards) from the trials. http://www.gardenorganic.org.uk/events/show_event.php?id=471
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- IPK: At the annual public day on 6th of June 2009 demonstration plots containing *Lactuca* and *Eruca* accessions from the Leafy Veg with an explanation of the EU Leafy Veg project project were shown to a general audience.

2010

SCIENTIFIC PUBLICATIONS

Oral:

Lohwasser, U. (2010). "Leafy Vegetables" - ein europäisches Projekt zur verbesserten Nutzbarmachung verschiedener Blattgemüsearten. Jahrestagung der Gemeinschaft zur Förderung der privaten deutschen Pflanzenzüchtung e.V. (GFP), Abteilung Gemüse und Heil- und Gewürzpflanzen, Bonn, Deutschland, 03.11.2010

Poster:

Pasini F., Cerretani L., Caboni M.F., D'Antuono L.F., 2009. Relating rocket salad (*Diplotaxis* and *Eruca* spp.) glucosinolate content and sensory attributes. Poster presentation. 8th Pangborn Sensory Science Symposium, 26-30 July 2009, Florence, Italy.

D'Antuono L.F., Manco M.A., Ferioli F., 2010. Sensory evaluation of endive germplasm. Poster presentation, Fourth European Conference on Sensory and Consumer Research. A Sense of Quality. 5-8 September 2010, Vitoria-Gasteiz, Spain.

Pasini F., Verardo V., Caboni M.F., D'Antuono L.F., 2010. Evaluation of glucosinolates and phenolics in rocket salad (*Eruca sativa* and *Diplotaxis tenuifolia*) germplasm. Poster presentation. International Scientific Symposium "Biodiversity and Sustainable Diets" 3-5 November 2010, FAO, Rome, Italy.

Ferioli F., Manco M.A., D'Antuono L.F., 2010. Variability of sesquiterpene lactone and phenolic content in chicory and endive germplasm. Poster presentation. International Scientific Symposium "Biodiversity and Sustainable Diets" 3-5 November 2010, FAO, Rome, Italy

Peer reviewed:

Van de Wouw, M., R. van Treuren & Th.J.L. van Hintum (accepted). Authenticity of old cultivars in genebank collections: a case study on lettuce. *Crop Science*.

Van Treuren, R., I.W. Boukema, E.C. de Groot, C.C.M. van de Wiel & Th.J.L. van Hintum (2010). Marker-assisted reduction of redundancy in a genebank collection of cultivated lettuce. *Plant Genetic Resources: Characterization and Utilization*, 8: 95-105.

Van Treuren R, P Coquin, U Lohwasser (manuscript). Genetic resources collections of leafy vegetables: composition and gaps.

Solberg S (manuscript) Nitrate and oxalic acid content of spinach - genetic variation and potential in Nordic gene bank material.

EDUCATION

Atkinson L., 2010. Genetic Characterisation of Post Harvest Spoilage in Lettuce. PhD thesis, University of Warwick (UK).

Baldacci Giulia., 2010. Caratteri analitici e sensoriali di cicoria (*Cichorium intybus* L.) ed indivia (*Cichorium endivia* L.). (*Analytical and sensory characters in chicory (Cichorium intybus L.) and endive (Cichorium endivia L.)*). Food science and technology MSc thesis, Academic year 2009-2010. University of Bologna. Tutor prof. L.F. D'Antuono.

Pasini F., 2011. A Chapter in Food science and biotechnology PhD thesis. University of Bologna. Tutor prof. M.F. Caboni (in progress)

PROFESSIONAL PUBLICATIONS

Journal:

Thumm S, Graichen M-L, Börner A & Lohwasser U (2010). Netzwerk für Resistenzzüchtung bei Salaten im Aufbau. Gemüse - das Magazin für den professionellen Gemüsebau, 8/2010.

Web:

- <http://www.semencemag.fr/biodiversite-ressources-genetiques.html>
- Solberg 2010. Characterisation and evaluation of nitrate and oxalic acid content of spinach - an EU project. Web publication on www.nordgen.org. (http://sesto.nordgen.org/sesto/index.php?scp=ngb&thm=projects&mod=prodet&procod=&pro_recnum=&proide=487).

EVENTS

- CGN: Visit of breeders to the characterization field of lettuce located in Wageningen on June 9 2010.
- IPK: At the annual public day on 12th of June 2010 demonstration plots containing Lactuca and Eruca accessions from the Leafy Vegetables with an explanation of the EU Leafy Vegetables project were shown to a general audience.
- IPK: Demonstration plots were shown to visitors in the course of the State Horticultural Show (Landesgartenschau) in Aschersleben in June 2010.

OTHER

- In 2009 WHRI secured a jointly funded minor leafy vegetable breeding project with a breeding company. This project has accessed accession from the collections maintained by CGN, WHRI and GEVES and utilized market evaluation data produced by Garden Organic and UNIBO.

Overview of the dissemination activities throughout the project period

year	scientific publications			education BSc/MSc thesis	professional publications		newspaper radio	events
	oral	poster	peer review paper		journal	web publication		
2007		2			12	8	2	1
2008	1	1			3			1
2009			1	3	6	10		3
2010	1	4	2(2)	3	1	2		3
total	2	7	3(2)	6	22	20	2	8

6. INPUT FOR THE COORDINATOR'S WEBSITE

1. The final report and factsheet will be included on the Leafy Veg external website immediately upon approval of the report by the Commission.
2. The website will be updated concerning the highlights for 2010 and dissemination activities
3. The Leafy Veg website will be maintained for the foreseeable future.

7. ANNEXES

Annex 1: Partners at the start-up meeting of GENRES Leafy Veg project in Wageningen (the Netherlands) in February 2007 and final meeting in 2010 in Montfavet (France).

a. Wageningen meeting



b. Montfavet meeting



Annex 2: Entry page of the International leafy vegetables databases that can be accessed on-line at <http://documents.plant.wur.nl/cgn/pgr/LVintro/>



The International Leafy Vegetables databases

Following up on activities within the ECPGR working group on leafy vegetables, this website was developed within the framework of the EU GENRES project entitled "[Leafy vegetables germplasm stimulating use](#)" (AGRI-2006-0262). The website provides access to the updated International *Lactuca* Database (ILDB) and to three newly developed databases containing information on accessions of spinach, chicory and minor leafy vegetables, respectively. Data were collected of accessions that in principal are available for distribution. It was aimed to cover all known European collections as much as possible and to include the main collections from outside Europe as well. EURISCO or the old ILDB was used as data source in case no current passport data were received upon request. The databases also provide access to characterization and evaluation data generated within the framework of the EU GENRES project.



Lettuce

This link provides access to the [International Lactuca database](#), which is maintained and hosted by the Centre for Genetic Resources, the Netherlands (CGN).



Spinach

This link provides access to the [International spinach database](#), which is maintained and hosted by the Centre for Genetic Resources, the Netherlands (CGN).



Chicory

This link provides access to the [International chicory database](#), which is maintained and hosted by the Groupe d'Etudes et de Contrôle des Variétés et des Semences (GEVES).



Minor Leafy Vegetables

This link provides access to the [International minor leafy vegetables database](#), which is maintained by the Leibniz-Institute of Plant Genetics and Crop Plant Research (IPK) and hosted by the Centre for Genetic Resources, the Netherlands (CGN).

Annex 3: Consumer acceptance (a. GardenOrganic event) and farmers' market (b. ProSpecieRara event) involving landraces and old leafy vegetable varieties used in the project.

a. Garden Organic event



b. ProSpecieRara event



Annex 4: Conservation of genetic resources at genebanks. a. leafy vegetables field at IPK Gatersleben (Germany) in 2007 and b. Dr. Dave Astley from the Genetic Resources Unit of Warwick-HRI (UK) explaining the conservation of vegetables in their genebank in 2008.

a. IPK



b. Warwick-HRI



Annex 5: Overview of the historical utility crops garden at Wildnegg Castle (Switzerland), where Schlossdomäne Wildnegg and ProSpecieRara actively maintain a garden which shows the wealth of diversity of utility crops grown in Switzerland.



Annex 6: Leafy vegetables descriptors used in the project.

Cultivated lettuce (*Lactuca sativa* L.)

Descriptor name	Descriptor state	Note
Seed colour	1 = white/cream 2 = yellow 3 = brown 4 = black	
Flower anthocyanin content	0 = absent 1 = present	
Leaf anthocyanin content	0 = absent 3 = weak 5 = medium 7 = strong	At harvest maturity
Outer leaf colour	1 = yellow green 2 = green 3 = grey green 4 = blue green 5 = red green	At harvest maturity
Outer leaf colour intensity	3 = light 5 = medium 7 = dark	At harvest maturity
Head shape	0 = head not formed 1 = elliptic 2 = broad elliptic 3 = circular 4 = transverse elliptic	At harvest maturity
Heart formation	0 = absent 3 = slight 5 = moderate 7 = well developed	At harvest maturity in longitudinal section
Homogeneity	1 = completely heterogeneous 3 = slightly homogeneous 5 = moderate homogeneous 7 = very homogeneous 9 = completely homogeneous	At harvest maturity

**Wild *Lactuca* spp. (*L. serriola* and related species from primary gene pool
L. saligna, *L. virosa*)**

Descriptor name	Descriptor state	Note
Seed colour	1 = white/cream 2 = yellow 3 = brown 4 = black	
Spines on stem	0 = absent 3 = few 5 = moderate 7 = many	
Spines on leaf midrib	0 = absent 3 = few 5 = moderate 7 = many	
Leaf incision of rosette leaves	1 = not incised 2 = pinnatilobed (up to 1/3) 3 = pinnatifid (1/2)	Depth of incisions from blade margin to main vein

	4 = pinnatipart (2/3) 5 = pinnatisect (more than 2/3)	
Leaf incision of cauline leaves	1 = not incised 2 = pinnatilobed (up to 1/3) 3 = pinnatifid (1/2) 4 = pinnatipart (2/3) 5 = pinnatisect (more than 2/3)	Depth of incisions from blade margin to main vein
Flower anthocyanin content	0 = absent 1 = present	
Flowering time (optional)		Number of days after sowing until first Flower head

Spinach (*Spinacia oleracea* L.)

Descriptor name	Descriptor state	Note
Seed spines	0 = absent 1 = present	
Stem anthocyanin content	0 = absent 3 = weak 5 = medium 7 = strong	
Leaf shape excluding basal lobes	1 = elliptic 2 = broad elliptic 3 = circular 4 = ovate 5 = broad ovate 6 = triangular	Score at 7th leaf stage
Leaf colour	1 = yellow green 2 = grey green 3 = dark green	Score at 7th leaf stage
Leaf colour intensity	3 = light 5 = medium 7 = dark	Score at 7th leaf stage
Leaf blistering	3 = weak 5 = medium 7 = strong	Score at 7th leaf stage
Bolting time		Number of days from sowing until 15% of plants have stem of 5 cm
Monoeciousness	0 = 0% 3 = 25% 5 = 50% 7 = 75% 9 = 100%	Percentage of monoecious plants

Leaf chicory (*Cichorium intybus* L.) **POV TG/154/3**

Descriptor name	Descriptor state	Note
UPOV n°7: Leaf: colour (excluding midrib)	1 = green 2 = yellowish green 3 = reddish green 4 = red	
UPOV n°8: Leaf: intensity of colour	3 = light 5 = medium	

	7 = dark	
UPOV n°11: Leaf: anthocyanin colouration at harvest maturity	0 = absent 1 = present	
UPOV n°19: Plant: head formation	0 = absent 1 = present	
Head: colour of outer leaves	1 = green 2 = yellowish green 3 = reddish green 4 = red 99 = other	Main colour of outer leaves
UPOV n°32: Time of beginning of bolting	1 = very early 3 = early 5 = medium 7 = late 9 = very late	
Morphotype (cultigroup)	1 = Barba di Cappuccino 2 = Améliorée 3 = Catalogna 4 = Pan di Zucchero 5 = Rossa di Treviso 6 = Rossa di Verona 7 = Palla rossa (Rossa di Chioggia) 99 = others	

Industrial chicory (*Cichorium intybus* L.) UPOV TG/172/3

Descriptor name	Descriptor state	Note
Root: shape	3 = cylindrical 5 = cylindro-conical 7 = conical	
Insertion of root crown	3 = raised 5 = flat 7 = depressed	
Dry matter content of root (optional)	3 = weak 5 = medium 7 = high	
UPOV n°3: Leaf: attitude	3 = erect 5 = semi-erect 7 = horizontal	
UPOV n°4: Leaf: length	3 = short 5 = medium 7 = long	3 = De Magdeburg 5 = Halles 7 = Flandres
UPOV n°5: Leaf/ width	3 = narrow 5 = medium 7 = broad	3 = Dageraad 5 = Halles 7 = Flandres
UPOV n°18: Bolting tendency (from an early sowing)	3 = low 5 = medium 7 = strong	

Witloof (*Cichorium intybus* L. var. *foliosum*) POV TG/173/3

Descriptor name	Descriptor state	Note
UPOV n°6: Leaf: length	1 = short 5 = medium 7 = long	

	9 = very long	
UPOV n°10: Leaf: intensity of green colour	3 = light 5 = medium 7 = dark	All observations on the leaf should be made on the full grown leaf.
Leaf: anthocyanin content	0 = absent 1 = present	All observations on the leaf should be made on the full grown leaf.
UPOV n°21: Bolting tendency (from an early sowing)	3 = weak 5 = medium 7 = strong	
Head: shape	1 = cylindrical 2 = cylindrico-globular 3 = globular	
UPOV n°27: Head: length	1 = very short 3 = short 5 = medium 7 = long 9 = very long	
Head: colour	1 = yellow 2 = red	All observations on the head should be made at the time of harvesting of the heads before exposure to daylight.

Endive - cut and plain chicory (*Cichorium endivia* L.) UPOV TG/118/4

Descriptor name	Descriptor state	Note
UPOV n°1: Plant: botanical type	1 = plain type 2 = intermediate type (between cut and plain types) 3 = cut type	
UPOV n°2: Plain-type varieties only: Plant: sub-type	1 = Grosse Bouclée 2 = A coeur Plein 3 = Géante maraîchère 4 = Cornet 99 = other	
UPOV n°3: Non-plain type varieties only: Plant: sub-type	1 = Wallonne type 2 = De Louviers type 3 = D'été à Coeur Jaune type 99 = others (including intermediate types between cut and plain types)	
UPOV n°7: Heart : colour	1 = yellowish green 2 = green	
UPOV n°8: Heart: intensity of green colour	3 = light 5 = medium 7 = dark	
UPOV n°14: Leaf: colour	1 = yellowish 2 = green 3 = greyish green	All the observations on the leaf should be made just before harvest maturity on leaves excluding the outer and central leaves.
UPOV n°15: Leaf: intensity of green colour	3 = light 5 = medium 7 = dark	
UPOV n°28: Flower: colour	1 = white	

UPOV n°30: Time of bolting

- 2 = pink
- 3 = blue
- 4 = violet blue

- 3 = early
- 5 = medium
- 7 = late

Rocket (*Eruca spp.*)

Growth habit

- 1 = semi-erect
- 2 = erect

At harvest maturity

Leaf shape

- 1 = round
- 2 = elliptic
- 3 = obovate
- 4 = spatulate
- 5 = ovate
- 6 = lanceolate
- 7 = oblong

Leaf margin

- 1 = nearly entire
- 2 = slightly waved
- 3 = deep sinuate, pinnatipartite

Leaf colour

- 1 = light green
- 2 = green
- 3 = dark green
- 4 = violet

Colour of flowers

- 1 = white
- 2 = creamy
- 3 = sulphureous
- 4 = yellow

Venation of the petals

- 0 = absent
- 1 = present

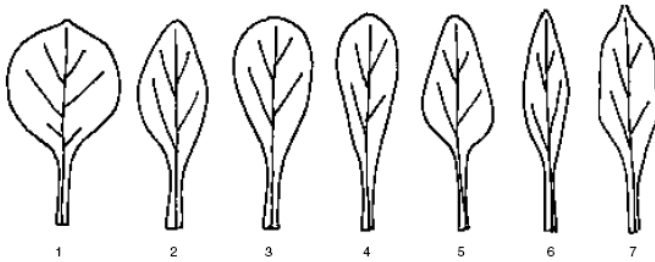


fig. 1: leaf shape
(source: IPGRI, Descrittori per la Rucola, 2002)

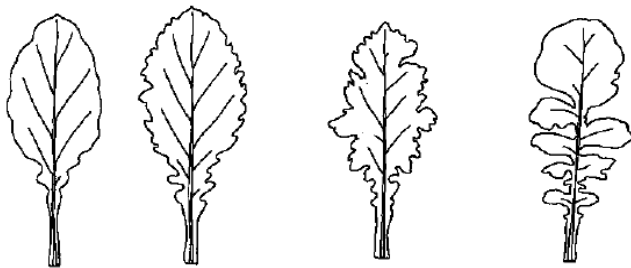


fig. 2: leaf margin
(source: IPGRI, Descrittori per la Rucola, 2002)

Corn salad (*Valerianella* spp.)

Growth habit	1 = horizontal 3 = semi-erect 5 = erect
Leaf shape	1 = elliptic 2 = broad spatulate 3 = narrow spatulate
Leaf margin	1 = entire 2 = dentate
Colour of leaves	3 = light green 5 = green 7 = dark green
Leaf glossiness	3 = weak 5 = medium 7 = strong
Leaf blistering	3 = weak 5 = medium 7 = strong

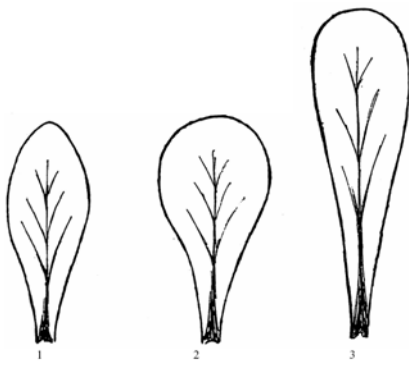


fig. 1: leaf shape (source: UPOV, Guidelines for corn salad, 2006)

Appendix 7a: *Lactuca* species belonging to the primary, secondary and tertiary gene pool of lettuce, and the number of accessions included in the international *Lactuca* database (ILDB).

Gene pool	Species	Authority	ILDB
Primary	<i>L. sativa</i>	L.	10198
Primary	<i>L. aculeata</i>	Boiss.	2
Primary	<i>L. altaica</i>	Fisch. & C.A. Mey.	7
Primary	<i>L. azerbaijanica</i>	Rech. f.	0
Primary	<i>L. dregeana</i>	DC.	4
Primary	<i>L. georgica</i>	Grossh.	1
Primary	<i>L. scarioloides</i>	Boiss.	0
Primary	<i>L. serriola</i>	L.	987
Secondary	<i>L. saligna</i>	L.	103
Secondary	<i>L. virosa</i>	L.	141
Tertiary	<i>L. acanthifolia</i>	(Willd.) Boiss.	0
Tertiary	<i>L. aurea</i>	(Sch.Bip. ex Vis. & Pančić) Stebbins	0
Tertiary	<i>L. longidentata</i>	Moris	0
Tertiary	<i>L. orientalis</i>	Boiss.	0
Tertiary	<i>L. quercina</i>	L.	4
Tertiary	<i>L. sibirica</i>	Benth. ex Maxim.	1
Tertiary	<i>L. taraxacifolia</i>	Schumach. & Thonn.	0
Tertiary	<i>L. tatarica</i>	C.A. Mey.	8
Tertiary	<i>L. viminea</i>	(L.) J. Presl & C. Presl	20
Tertiary	<i>L. watsoniana</i>	Trel.	0
Total			11476

Appendix 7b: Number of accessions of *Lactuca* species of the primary, secondary and tertiary (separated by vertical lines) lettuce gene pool included in the ILDB per reported geographic region within the total distribution area. Reported regions not represented in the ILDB are denoted by '0'. Totals per continent are denoted in bold.

Region	<i>L. sativa</i>	<i>L. aculeata</i>	<i>L. altatica</i>	<i>L. azerbaijanica</i>	<i>L. dregeana</i>	<i>L. georgica</i>	<i>L. scarioloides</i>	<i>L. serriola</i>	<i>L. saligna</i>	<i>L. virosa</i>	<i>L. acanthifolia</i>	<i>L. aurea</i>	<i>L. longidentata</i>	<i>L. orientalis</i>	<i>L. quercina</i>	<i>L. sibirica</i>	<i>L. taraxacifolia</i>	<i>L. fatarica</i>	<i>L. viminea</i>	<i>L. watsoniana</i>
Europe	5702							458	37	67	0	0	0	2	1	2	10	0		
East	1107							119	6	2		0		2	0	0	2			
North	406							19	3	3				0	1	0				
South	2096							116	27	23	0	0	0	0				4	0	
West	2093							204	1	39				0		2	4			
Asia	1029	2	1	0	0	0	0	344	48	15	0	0	0	2	0	0	4	7		
Central	8	0				0		77	3				0		0	0	0	0		
East	152	0						0					0		0	0				
North	83	0				0		24	4	7				0	0	0	1	0		
South	108	0	0	0		0	0	9	0	1			0	0			0	0		
Southeast	14																			
West	664	2	1			0	0	234	41	7	0	0	0	2		3	7			
Africa	64				0			14	0	0			0			0	0			
Central	1																			
East	3							1		0										
North	58							13	0	0			0					0		
South	1				0			0												
West	1															0				
America	322							16	0	1							0			
Caribbean	12																			
Central	3							0	0											
North	281							16	0	0							0			
South	26							0	0	1										
Oceania	18							0	0	0										
Unknown	3063	0	6	0	4	1	0	155	18	58	0	0	0	0	0	0	2	3	0	

Appendix 7c: Number of accessions of *Spinacia* species belonging to the primary spinach gene pool included in the international spinach database (ISDB) per reported geographic region within the total distribution area. Reported distribution areas not represented in the ISDB are denoted by '0'. Totals per continent are denoted in bold.

	<i>S. oleracea</i> L.	<i>S. tetrandra</i> Steven ex M. Bieb.	<i>S. turkestanica</i> Iljin	Unknown
Europe	636	1	1	96
East	79			23
North	82			25
South	158			10
West	317	1	1	38
Asia	741	8	5	95
Central	4		4	1
East	133			37
North	20	1	1	10
South	111	0	0	16
Southeast	1			1
West	472	7	0	30
Africa	10			5
Central				
East	3			
North	7			5
South				
West				
Americas	14			26
Caribbean				
Central	1			
North	13			26
South				
Oceania	3			
Unknown	365	3	8	
Total	1769	12	14	222

Appendix 7d: Number of accessions of *Cichorium* species belonging to the primary, secondary and tertiary (separated by vertical lines) chicory gene pool included in the international chicory database (ICDB) per reported geographic region within the total distribution area. Reported distribution areas not represented in the ICDB are denoted by '0'. Totals per continent are denoted in bold.

	<i>C. endivia</i> L. ssp. <i>endivia</i> L.	<i>C. endivia</i> L. ssp. unknown	<i>C. endivia</i> L. ssp. <i>pumilum</i> (Jacq.) Cout	<i>C. calvarum</i> Sch. Bip.	<i>C. intybus</i> L. var. <i>intybus</i> L.	<i>C. intybus</i> L. var. <i>foliosum</i> Hegi	<i>C. intybus</i> L. var. <i>sativum</i> (Bisch.) Janch.	<i>C. intybus</i> L. var. unknown	<i>C. spinosum</i> Jacq.	<i>C. botae</i> De Fiers	Unknown
Europe	326	13	3	0	126	427	41	42	0	0	121
East	2				25	2	10	11			3
North	4				7	2					
South	131	9	3		49	158	4	17			26
West	189	4			45	265	27	14			92
Asia	8	1	3	0	3	5	2	10	0	0	7
Central											
East	4										
North					1	2	2	3			
South	1		2		2			6			5
Southeast											
West	3	1	1			3		1			2
Africa	6			0				1	0	0	2
Central											
East	1							1			1
North	5										1
South											
West											
Americas	21	15		0	1	6	6	6	0	0	1
Caribbean											
Central											
North	14	15			1	6	4	5			
South	7						2	1			1
Oceania									0	0	
Unknown	186		3		62	187	20	2			53
Total	547	29	9	0	192	625	69	61	0	0	184

Appendix 7e: Number of accessions of species related to artichoke (A), asparagus (B), lamb's lettuce (C), rhubarb (D) and rocket salad (E) included in the international minor leafy vegetables database (IMDB). Cultivated species are denoted in bold.

A. Artichoke (*Cynara*) - 163 accessions

Species	IMDB	Species	IMDB
<i>C. alba</i>	1	<i>C. humilis</i> L.	3
<i>C. cardunculus</i> L.	131	<i>C. scolymus</i> L.	27
<i>C. cornigera</i>	1		

B. Asparagus (*Asparagus*) - 356 accessions

Species	IMDB	Species	IMDB
<i>A. acutifolius</i> L.	8	<i>A. maritimus</i> Mill.	1
<i>A. africanus</i> Lam.	2	<i>A. officinalis</i> L.	224
<i>A. albus</i> L.	2	<i>A. oligoclonus</i> Maxim.	1
<i>A. aphyllus</i> L.	1	<i>A. pastorianus</i>	1
<i>A. arborescens</i> Willd. ex Schult. & Schult. f.	1	<i>A. plumosus</i>	1
<i>A. asparagoides</i> (L.) Druce	4	<i>A. pseudoscaber</i> Grecescu	1
<i>A. brachyphyllus</i> Turcz.	1	<i>A. racemosus</i> Willd.	8
<i>A. bucharicus</i> Iljin	1	<i>A. scoparius</i> Lowe	2
<i>A. caspicus</i>	1	<i>A. scandens</i> Thunb.	2
<i>A. cochinchinensis</i> (Lour.) Merr.	3	<i>A. setaceus</i> (Kunth) Jessop	9
<i>A. dauricus</i> Link	3	<i>A. stipularis</i> Forssk.	2
<i>A. declinatus</i> L.	3	<i>A. tenuifolius</i>	1
<i>A. densiflorus</i> (Kunth) Jessop	19	<i>A. umbellatus</i>	2
<i>A. falcatus</i> L.	4	<i>A. verticillatus</i> L.	14
<i>A. gonocladus</i> Baker	1	<i>A. virgatus</i> Baker	4
<i>A. loricinus</i> Burch.	4	<i>A. sp.</i>	24
<i>A. litoralis</i> Steven	1		

C. Lamb's lettuce (*Valerianella*) - 77 accessions

Species	IMDB	Species	IMDB
<i>V. carinata</i> Loisel.	1	<i>V. lusitanica</i>	1
<i>V. coronata</i> (L.) DC.	2	<i>V. pumila</i> (L.) DC.	4
<i>V. dentata</i> (L.) Pollich	2	<i>V. ramosa</i>	2
<i>V. eriocarpa</i> Desv.	2	<i>V. sp.</i>	4
<i>V. locusta</i> (L.) Laterr.	59		

D. Rhubarb (*Rheum*) - 326 accessions

Species	IMDB	Species	IMDB
<i>R. altaicum</i> Losinsk.	3	<i>R. palmatum</i> L.	12
<i>R. australe</i> D. Don	6	<i>R. rhubarbarum</i> L.	162
<i>R. compactum</i>	3	<i>R. rhaponticum</i> L.	23
<i>R. crispum</i>	1	<i>R. ribes</i> L.	2
<i>R. emodi</i>	1	<i>R. tanguticum</i> (Maxim. ex Regel) Maxim. ex Balf.	3

Appendix 7 (continued)

<i>R. hybridum</i> Murray	6	<i>R. tataricum</i> L. f.	7
<i>R. macrocarpum</i>	1	<i>R. tibeticum</i> Maxim.	2
<i>R. maculatum</i>	1	<i>R. undulatum</i>	1
<i>R. maximowiczii</i> Losinsk.	3	<i>R. webbianum</i>	1
<i>R. moorcroftianum</i>	1	<i>R. wittrockii</i> C.E.Lundstr.	2
<i>R. officinale</i> Baill.	13	<i>R. sp.</i>	72

E. Rocket salad - 1232 accessions

Species	IMDB	Species	IMDB
<i>Bunias erucago</i> L.	2	<i>Diplotaxis</i> sp.	41
<i>Diplotaxis acris</i>	1	<i>Eruca pinnatifida</i> (Desf.) Pomel	13
<i>Diplotaxis assurgens</i>	15	<i>Eruca sativa</i> Mill.	495
<i>Diplotaxis berthautii</i>	2	<i>Eruca vesicaria</i> (L.) Cav.	171
<i>Diplotaxis brachycarpa</i>	3	<i>Eruca</i> sp.	7
<i>Diplotaxis brevisiliqua</i>	3	<i>Erucaria cakiloidea</i>	1
<i>Diplotaxis catholica</i>	16	<i>Erucaria erucarioides</i>	1
<i>Diplotaxis cossomiana</i> (Reut. ex Boiss.) O. E. Schulz	1	<i>Erucaria hispanica</i>	8
<i>Diplotaxis cretacea</i>	3	<i>Erucaria microcarpa</i>	1
<i>Diplotaxis eruroides</i> (L.) DC.	31	<i>Erucaria ollivieri</i>	1
<i>Diplotaxis glauca</i>	2	<i>Erucaria pinnata</i>	1
<i>Diplotaxis gomez-campoii</i>	1	<i>Erucastrum abyssinicum</i>	1
<i>Diplotaxis gracilis</i>	2	<i>Erucastrum arabicum</i>	1
<i>Diplotaxis griffithii</i>	2	<i>Erucastrum brevirostre</i>	2
<i>Diplotaxis harra</i> (Forssk.) Boiss.	31	<i>Erucastrum canariense</i>	1
<i>Diplotaxis hirta</i>	1	<i>Erucastrum cardaminoides</i>	7
<i>Diplotaxis ibicensis</i>	7	<i>Erucastrum elatum</i>	8
<i>Diplotaxis iloricitana</i>	4	<i>Erucastrum gallicum</i>	6
<i>Diplotaxis muralis</i> (L.) DC.	24	<i>Erucastrum ifniense</i>	2
<i>Diplotaxis ollivieri</i>	2	<i>Erucastrum leucanthum</i>	10
<i>Diplotaxis siettiana</i>	2	<i>Erucastrum littoreum</i>	6
<i>Diplotaxis sifolia</i>	25	<i>Erucastrum nasturtiifolium</i>	20
<i>Diplotaxis simplex</i> (Viv.) Spreng.	13	<i>Erucastrum pachypodium</i>	1
<i>Diplotaxis tenuifolia</i> (L.) DC.	49	<i>Erucastrum rufanum</i>	4
<i>Diplotaxis tenuisiliqua</i>	26	<i>Erucastrum strigosum</i>	1
<i>Diplotaxis villosa</i>	1	<i>Erucastrum varium</i>	33
<i>Diplotaxis viminea</i> (L.) DC.	3	<i>Erucastrum virgatum</i>	38
<i>Diplotaxis virgata</i>	68	<i>Erucastrum</i> sp.	7
<i>Diplotaxis vogelii</i>	1	<i>Pseuderucaria teretifolia</i>	3

8. SUMMARY OF THE MANPOWER BY WP FOR THE ENTIRE PERIOD

workpackage	person months involved
1	22
2	104
3	61
4	16
5	33
total	236