NAGREF
NATIONAL AGRICULTURAL RESEARCH FOUNDATION

Agricultural Research Center of Northern Greece (ARCNG)

P.O. Box 60458
57001 Thermi
GREECE

Photini Mylona

Senior Researcher
E-mail: phmylona@nagref.gr

seeera net plus
PLUS.SEE-ERA.NET

repsee
REGIONAL PROGRAMME
FOR COOPERATION
WITH SOUTHEAST EUROPE

SEELEGUMES

Research Activities 2011-2012

SEELEGUMES

Legume Genetic Diversity of Balkan Peninsula

- the large legume biodiversity of the Balkan Peninsula remains still unexplored
- local landraces were evolved under the micro-climatic environmental conditions, harboring invaluable genetic traits
- assessment of genetic diversity is timely and indispensable

SEELEGUMES

Current trends in agriculture and nutrition

- well-adapted cultivars in view of the forthcoming climate change
- production of high added value products
- of all legumes, chickpea is an important source of nutrients for human diet, particularly for sensitive groups and an excellent alternative to soybean for livestock feed

SEELEGUMES

Assessment of legume genetic diversity provides means for:

- coupling conservation and biotechnology actions
- conservation of legume genetic resources
- utilization in breeding strategies
- exploitation in production of high added value food products

SEELEGUMES

- **Large plant biodiversity of Greece**
- **Project timeframe - 24 months**
- ***Cicer arietinum***

Cicer arietinum

SEELEGUMES

Goals

- collect chickpea varieties and local landraces
- morphological and genetic characterization
- assess genetic variability

SEELEGUMES

Collection *Cicer arietinum* accessions

A/A	Cultivar Name	Location of origin
1	Amorgos	NAGREF
2	Andros	
3	Gavdos	
4	Gravia	
5	Evros	
6	Thiva	
7	Kerinia	
8	M14719	
9	Serifos	
10	Sifnos	
11	E210	
12	E216	NAGREF
	Local landraces	**all over Greece**
	52 accessions	

A total of 64 chickpea accessions

SEELEGUMES

Map of Greece indicating origin of *Cicer arietinum* collection of local landraces

SEELEGUMES

Experimental Plan

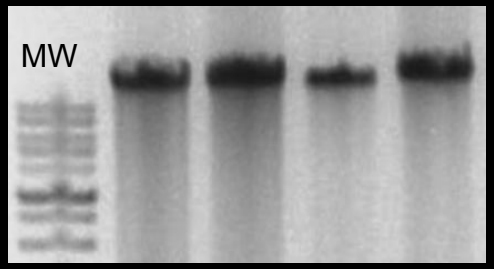
- Morphological characterization of *C. arietinum* accessions
- Growth of plants in greenhouse
- Molecular characterization
- Assessment of genetic diversity of Greek accessions

SEELEGUMES

Molecular characterization of *Cicer* accessions

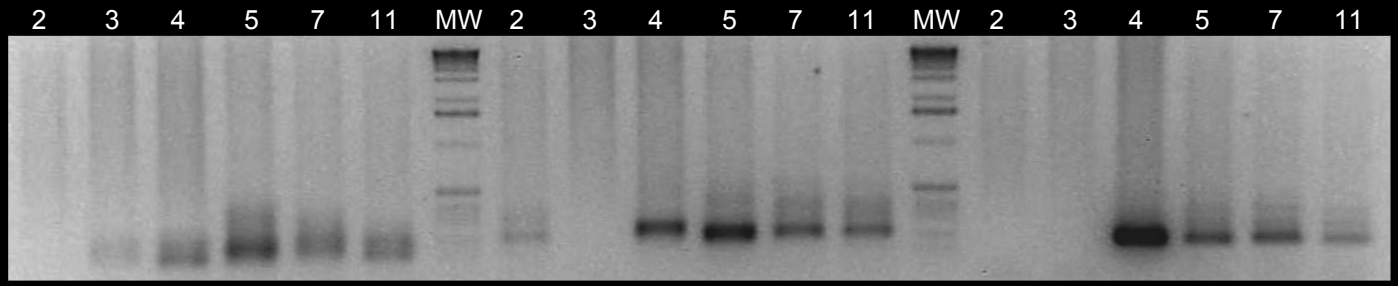
Isolation of genomic DNA

Extraction of gDNA has been performed from individual samples of selected accessions. Quality and quantity of isolated gDNA has been assessed spectrophotometrically.



Selection of molecular markers

PCR analysis of gDNA



Cultivars are as follows:
2= Andros
3= Gavdos
4= Gravia
5= Evros
7= Kerinia
11= E210

Identification and calculation of MW of SSR bands using the GelAnalyser software.

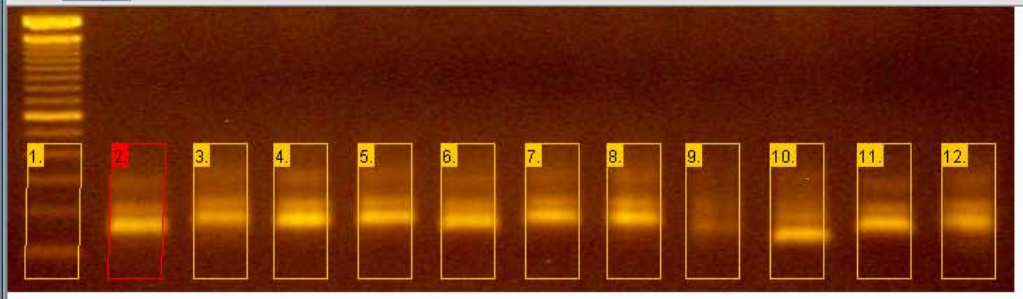
SEELEGUMES

GelAnalyzer - gel_9-5-2012_TA2_SSR.gap

File Analysis Windows Help

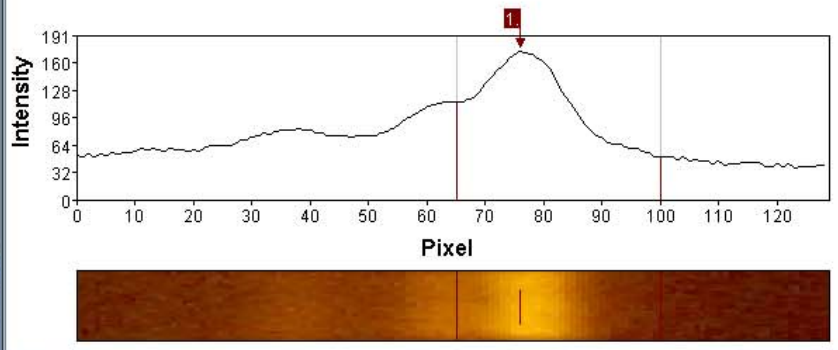
Image - gel-part1.jpg

Zoom: 75 %



Profile

Zoom: Fit profile



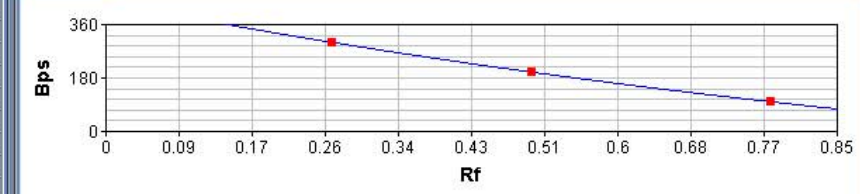
Analysis info

Show

Lane #	Band #	Rf	Raw volume	Cal. volume	MW
1.	1.	0.07	1297	-	398
1.	2.	0.264	1311	-	**300**
1.	3.	0.496	1158	-	**200**
1.	4.	0.775	1496	-	**100**
2.	1.	0.589	4020	-	164
3.	1.	0.527	4228	-	188
4.	1.	0.55	4600	-	179
5.	1.	0.527	4169	-	188
6.	1.	0.558	5730	-	176
7.	1.	0.527	3623	-	188
8.	1.	0.535	3934	-	185
9.	1.	0.589	1893	-	164
10.	1.	0.659	3261	-	139
11.	1.	0.589	4789	-	164
12.	1.	0.558	3042	-	176

Cal. curves

MW Cal | Quantity Cal



$y = 782.595 * e^{(-0.7244486 * x)} - 346.34784$

$R^2 = 1.0$

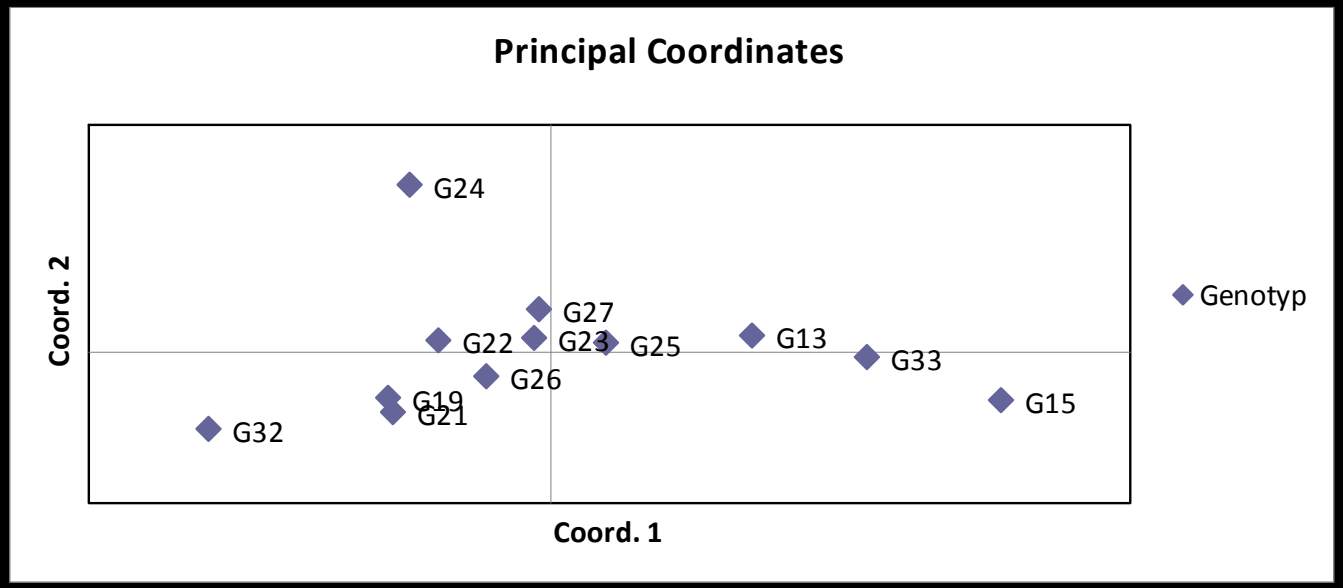
SEELEGUMES

Preliminary results of genetic analysis for

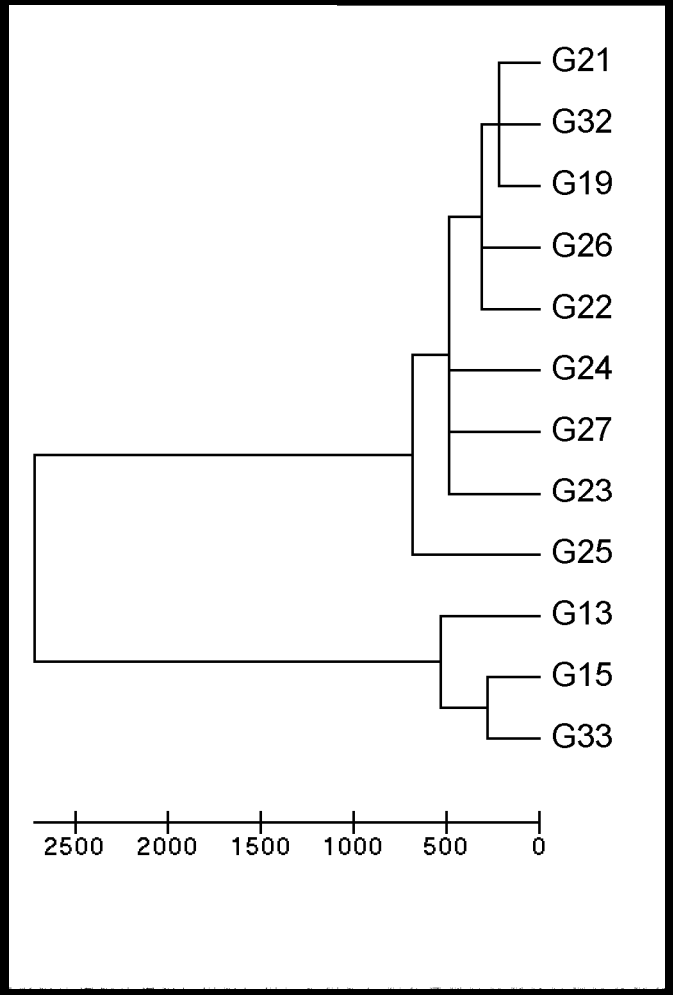
- 12 chickpea landraces
- Using a set of TA SSR markers
- Statistic analysis of genetic relationships

SEELEGUMES

A Principal Coordinate Analysis using Genetic Distance data



SEELEGUMES



Dendrogram for 12 chickpea landraces derived from UPGMA cluster analysis using simple matching dissimilarity index based on a set of SSR markers.

SEELEGUMES

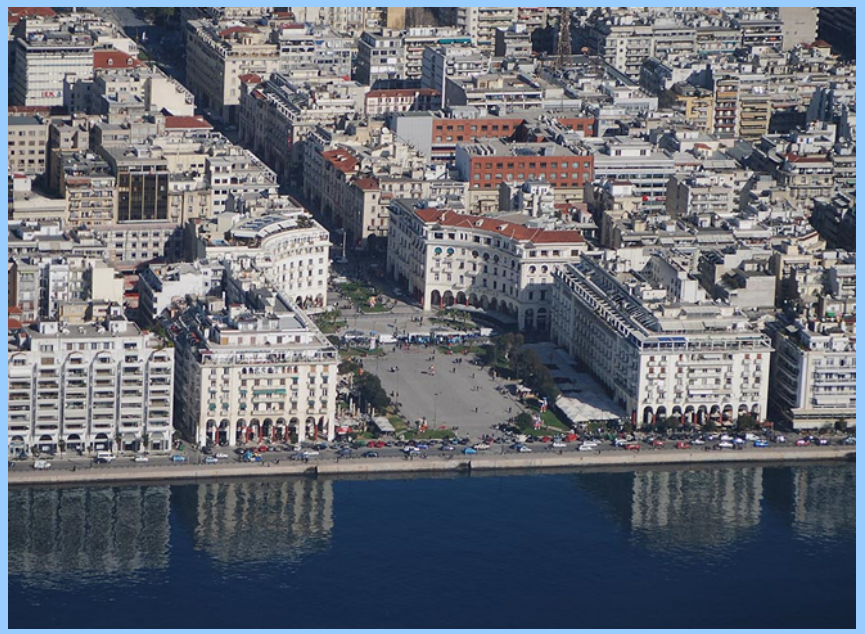
On going

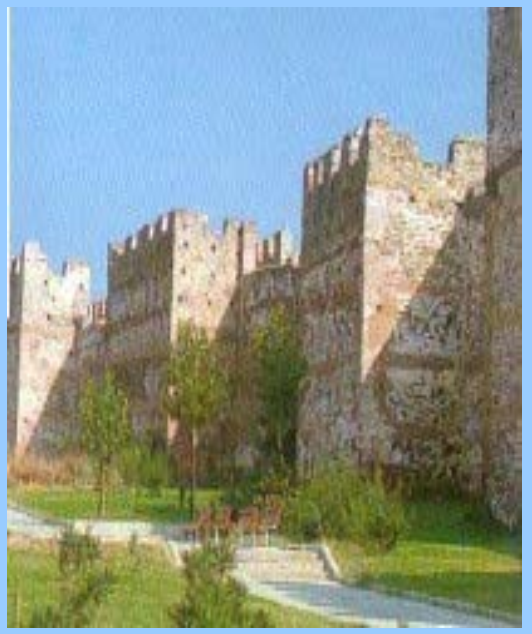
- Genetic analysis of genotypes using more SSR markers
- Estimation of correlation between genetic and geographic distance
- Determine population structure

SEELEGUMES

Also

- **Collection of 48 accessions of *Cicer arietinum* from Balkan countries**
- **Isolation of gDNA from each accession**
- **Assessment of chickpea genetic diversity by Peter Winter's group**





Thank you !

Legume plant breeding

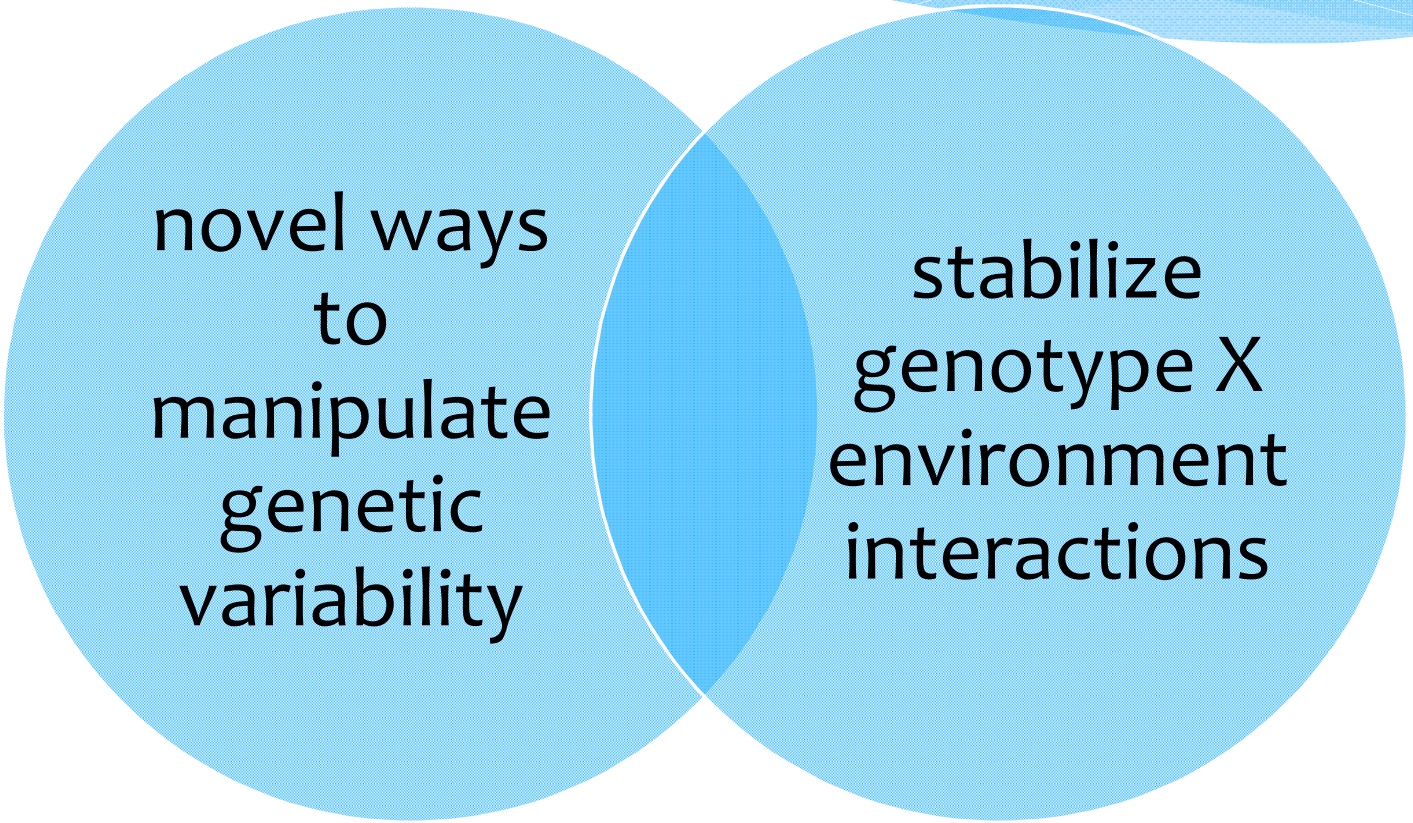
Perspectives and Actions

D. N. Vlachostergios
Fodder Crops & Pastures Institute
vlahostergios@mycosmos.gr

Legume crops in Europe

- Occupy 3-5% of the Europe's arable land
- Supply only 30% of the protein crops consumed as animal feed in the EU
- EU imports significant amounts of protein crops
- Significant decrease of legume research projects in Europe

Genetics and Plant Breeding



What are the Breeding targets for a modern legume breeding program?

Breeding for:

Resistance to Biotic stresses

diseases, pests, competiveness to weeds

Resistance to Abiotic stresses

drought, salinity, degraded soils, cold tolerance, climatic change etc.

Adaptation to Modern Culture Systems

(sustainable culture systems as organic culture systems, low-input culture systems etc

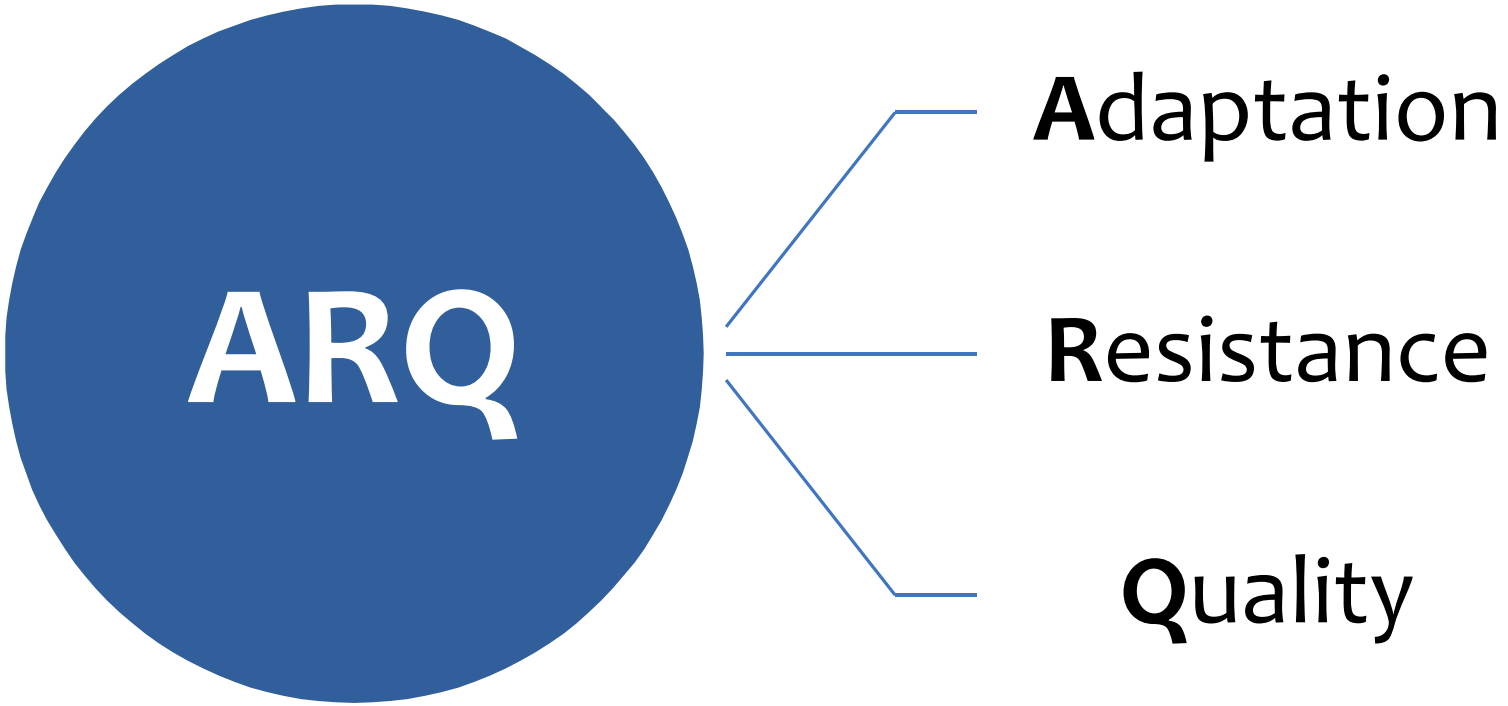
What are the Breeding targets for a modern legume breeding program?

Breeding for:

Resource use efficiency (WUE, PUE)

Quality for food and feed products (pulses: taste, color, shape, nutritional value and the ability to retain the quality characteristics, fodder crops: low level of anti-nutritional factors, high level of protein content)

What is the legume ideotype that fit in the modern agricultural needs?



What is the method for the development of varieties with ARQ?

The crucial point during the breeding process is the need for a reliable and early indication about the genetic potential of the material evaluated in the field.

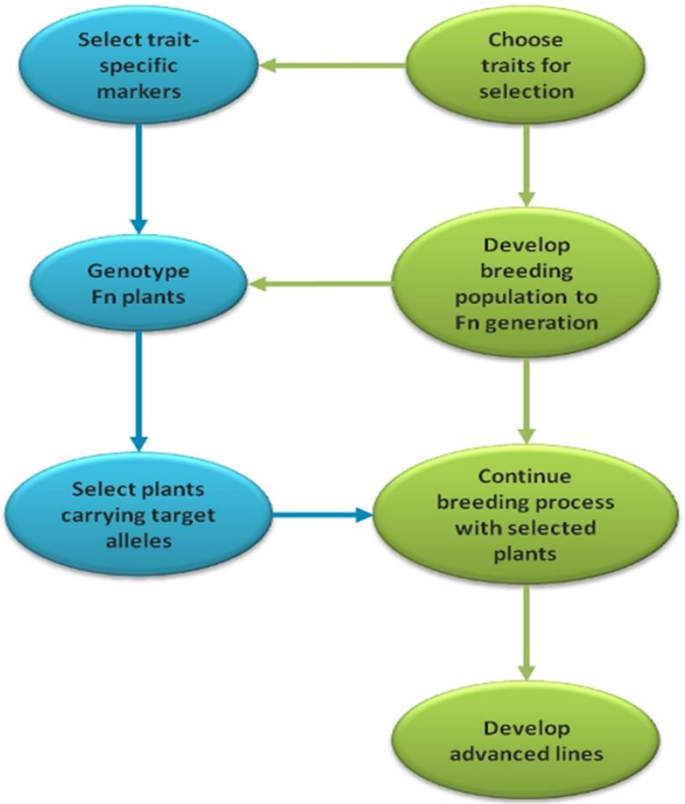
Classical breeding has proved to be effective, although it is often constrained by environmental fluctuations that make breeder's efforts more difficult and time-consuming.

New technologies could be exploited to make the procedure more efficient and precise

New technology-New breeding tools

Genomics

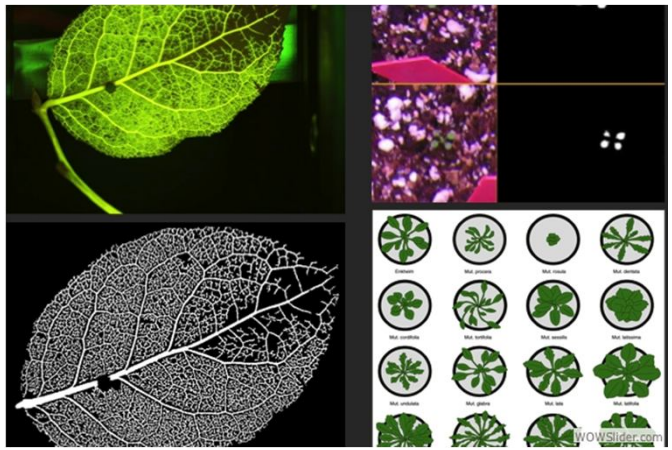
- Complete genome sequences allows a more efficient characterization of agronomically important genes and along with marker assisted selection may contribute efficiently in achievement of plant breeding targets



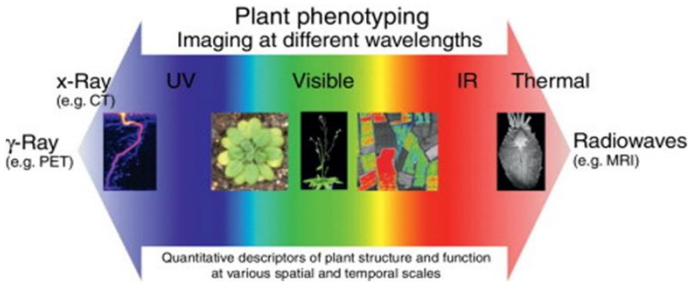
New technology-New breeding tools

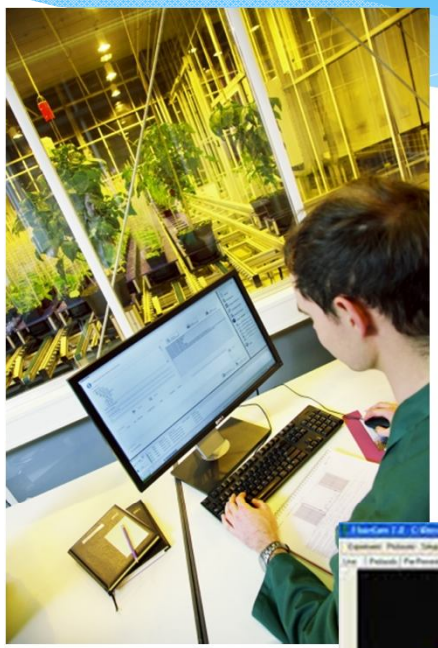
Phenomics

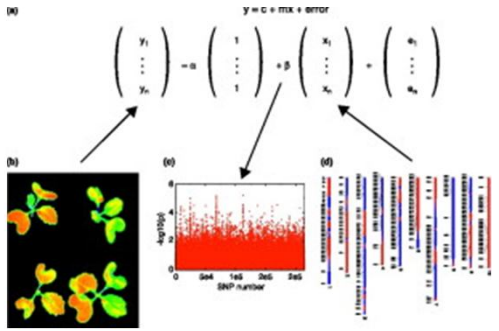
- Non-destructive phenotyping provides a valuable new tool which allows the dissection of plant genotypes into a series of component traits in various developmental stages

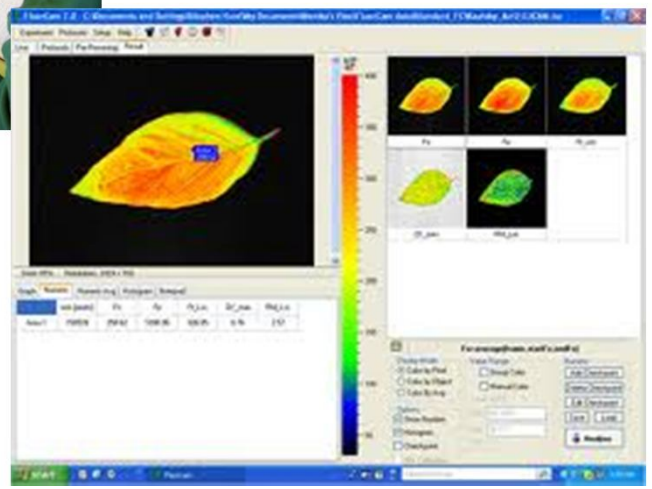


High through-put Phenotyping









In conclusion

The skill and success of plant breeders will be determined by their ability to use their resources efficiently, retaining those proven methodologies and augmenting them with novel approaches to meet their breeding targets.

Fodder Crops & Pastures Inst.

FCPI was founded in 1933

Located in Central Greece in the city of Larissa

Crops of research interest

Fodder Crops cultivated for grain production

Vicia faba, Lathyrous cicera, Cicer arietinum, Soybean, Lupines

Fodder Crops cultivated for silage or hay production

Medicago sativa, Trifolium sp., Vicia sativa, Pisum sativum

Pulses

Lentil, Chickpea, Phaseolus sp. , Lathyrous sativus

Scientific personnel

Dr. C. Tsadilas – Senior Researcher (Director)

Dr. D. Vlachostergios

J. Researcher
(vlahostergios@mycosmos.gr)

Dr. D. Baxevanos

J. Researcher
(baxevano@gmail.com)

Objectives of the Fodder Crops & Pastures Inst.

Applied breeding research for the development of new varieties in fodder crops, pastures and pulses with stability and high yield production (Long-term research programs)

Basic breeding research is conducted mainly in collaboration with other Institutes and Agricultural Universities.

Cultivation technique and culture systems (Intercropping, Low-input and organic culture systems)

Seed production for breeder's seed, pre-basic and basic seed of the cultivars developed in the FCPI and registered in Greek National Catalog.

Funding resources

Breeding methodology

Honeycomb selection

- Basic principal: The unit of evaluation and selection is the individual plant grown at the critical distance, where the range of phenotypic expression is enlarged and the negative effect of the competition on selection efficiency is eliminated
- In honeycomb field layout each single plant holds the centre of a circular complete replicate.
- Honeycomb Selection is supported by a special statistical program

Pre-breeding programs

Evaluation of different kinds of genetic material: varieties, breeding lines, genebank resources, populations, mixtures

Weed tolerance & Weed suppression ability of common vetch varieties under low-inputs

WT: the ability of the variety to yield high despite the presence of weeds

WSA: the ability of the crop to suppress weed development

Indirect selection Indices: Relationship among phenotypic growth traits, yield, WT and WSA

Selection for enhanced yield and tolerance to viral and vascular diseases within lentil landraces (Funding: FP7/2011-15)

Evaluation of Greek landraces in order to develop lentil varieties with resistance to Fusarium wilt and viral diseases

Identification of molecular markers that are tightly linked with the resistance genes in order to develop a protocol for Marker Assisted Selection

Viral infection

Infection of Fusarium wilt