U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service

Grape Germplasm Enhancement For The Grape and Wine Industries

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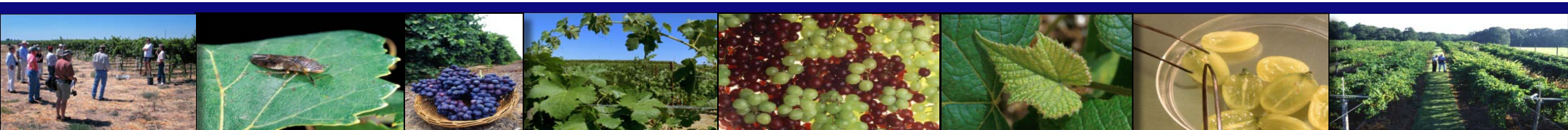
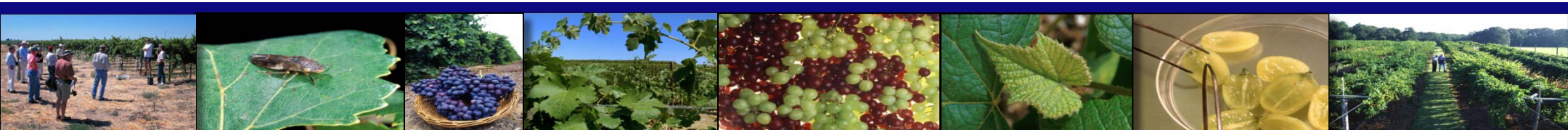


NGWI Research Priorities

- Quality
- Nutrition
- Efficiency
- Sustainability
- Technology transfer

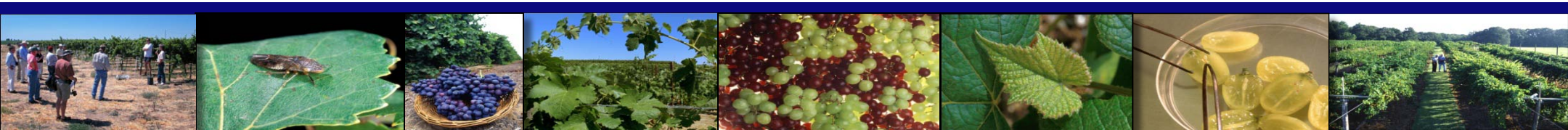


Germplasm Enhancement

New tools for the Grape Breeders Toolbox

Build on strengths and capabilities in ARS

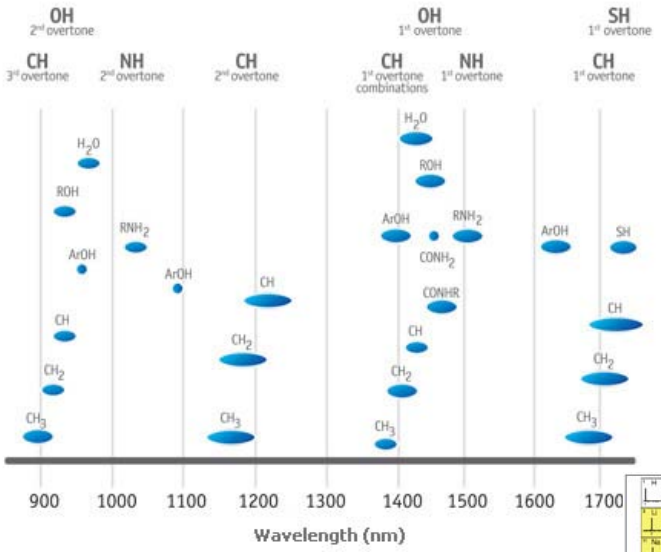
- Collections
- Trait analyses (*phenotyping*)
- Map key trait genes (*genetic analyses*) from the collection
- Germplasm fingerprinting (*genotyping*) and analyses

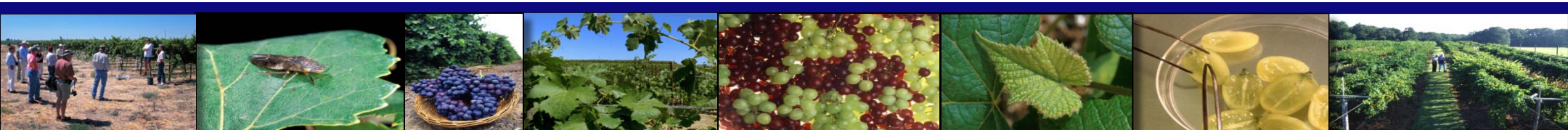


Phenotyping

TOOLBOX: Chemical profiling

- Profile small molecules (sugars, vitamins, phenolics, organic acids, minerals) in fruit, organs and tissues
  - FT-NIR spectroscopy, ICP-MS spectroscopy, sample across diverse environments, varieties and accessions
  - Faster and less expensive than web lab analyses





Genotyping

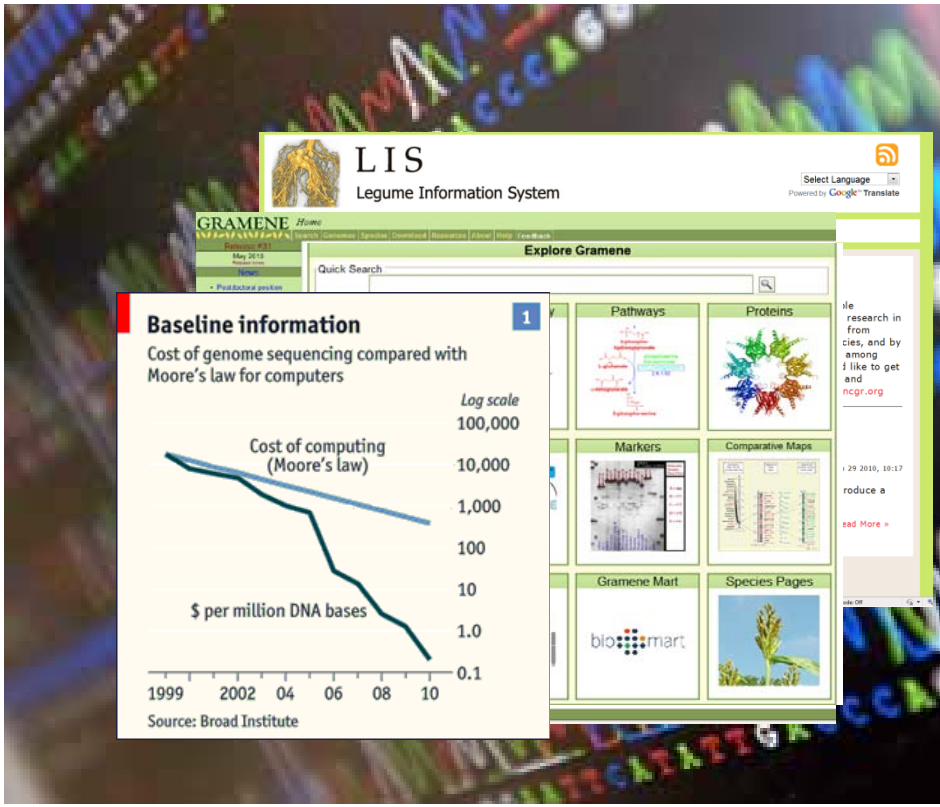
TOOLBOX: Full genome sequencing with latest information on plant genes

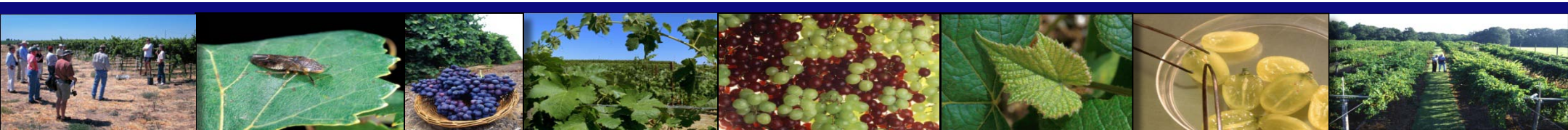
Improved marker detection

- From SNPs to next generation sequencing, to single molecule sequencing (PacBio)

Improved genome map

- Integrated resource for markers, genes, and trait information. Linked out to knowledge-space of plant genetics and genomics (SoyBase, Legume Information System, TAIR, GRIN, MaizeGDB, Gramene, GrainGenes)

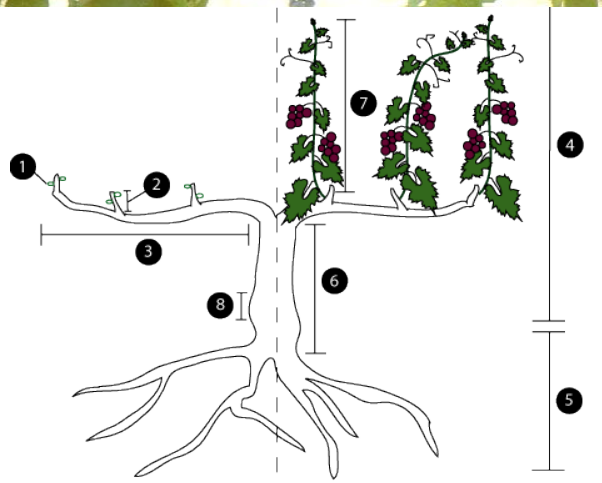


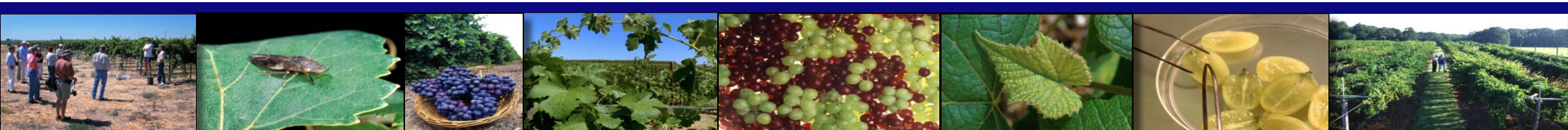


Molecular Analyses

TOOLBOX: Candidate genes for rootstock-scion improvement

- Compare rootstock-scion interactions at the molecular level (Zhong)
  - Profile proteins and RNAs as long distance signals
  - Identify candidate genes that promote good rootstock-scion growth
  - Enable genetic improvement of rootstocks

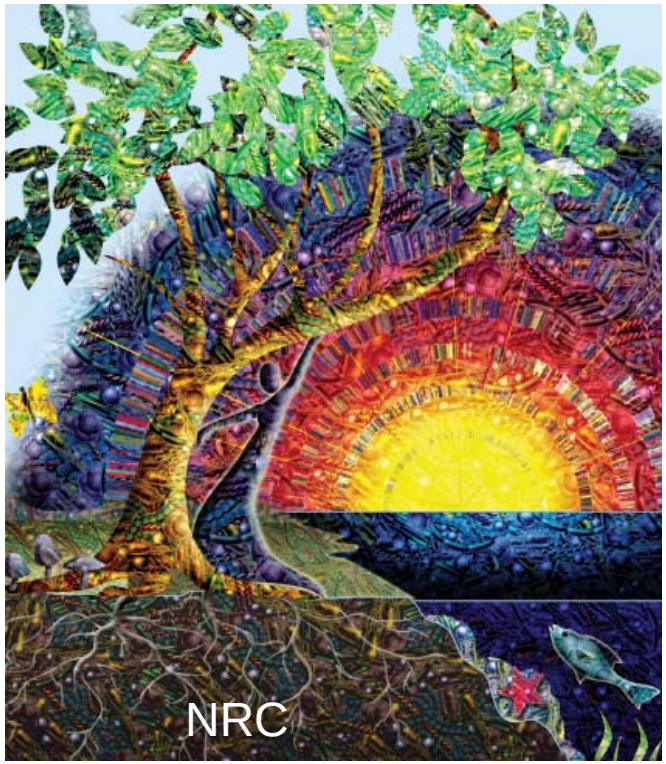


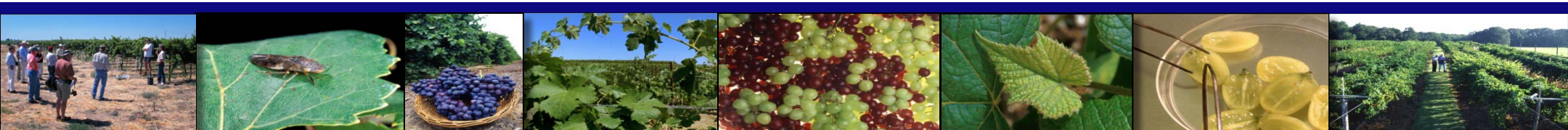


Molecular Analyses

TOOLBOX: Genomes of grape pathogens and associated microbes

- Identify new targets by sequence genomes for all plant pathogens (Goodwin)
- Survey microbial populations from diverse soils by DNA sequencing (Vance)

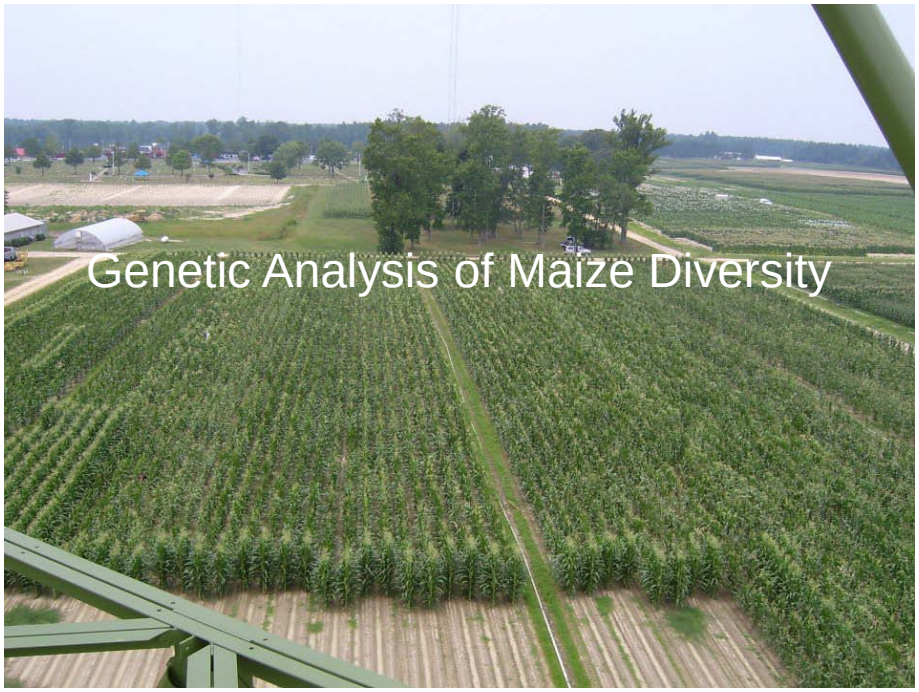


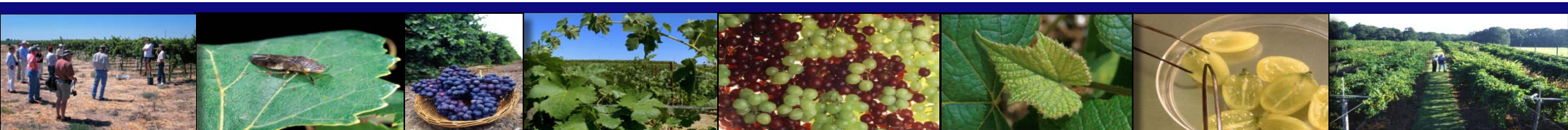


Genetic Analyses

Genetic analyses of target traits

- Nutritional composition of seeds (Ithaca, NY; St Louis, MO)
- Flowering time, root, shoot, fruit architecture (Albany, CA; Ithaca, NY)
- Adaptation to environmental stresses, e.g. cold, heat, acidic soils (Geneva, NY; Davis, CA)
- Speed breeding (genomic selection) (Ithaca)

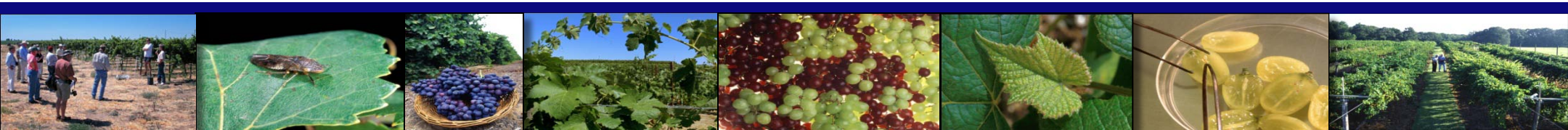




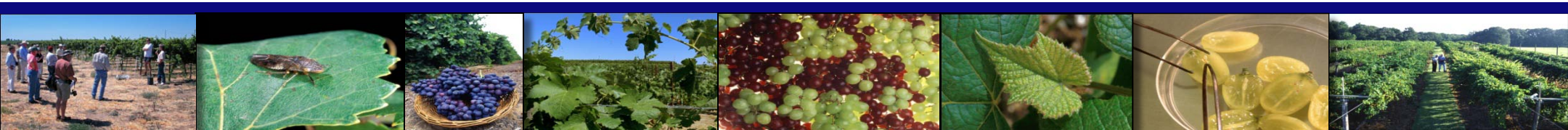
Biotech Traits

TOOLBOX: Next generation tools for germplasm improvement

- Intragenics
- 100% plant DNA based tools for genetic improvement of rice, potato, citrus (Albany, CA)
- 100% plant DNA based control elements for targeting gene expression
- Transgene removal systems



Summary

Build on existing strengths

- Collections & genotyping
- Genetics analyses
- Database & computational expertise
- Molecular analyses