

Task	Name	Details	Usage
Mapping	Star	RNA-seq to genome aligner	Genomics
	Tophat/cufflinks	RNA-seq to genome aligner and quantification tools	Genomics
Marker-based metagenome	Mothur	16S data clustering, classification, and ecological inference	Metagenomics
	Qiime	Customizable pipeline for marker-gene-based metagenomics	Metagenomics
	RDPipeline	RDP-based web interface for bacterial and fungal ribosomal marker gene analysis	Metagenomics
Mixed	Galaxy	Web-based platform of general purposes	Genomics; Metagenomics
	transPLANT	Exploring genomic data from crop and model plants	Genomics
Shotgun metagenome	Megan	Phylogenetic and functional assignment based on the lowest common ancestor algorithm	Metagenomics
	Metamos	Shotgun data assembly and analysis	Metagenomics
	(Mg-)Rast	Analyses of shotgun data	Metagenomics
Population genomics	Metabel	Software for meta-analysis of Genome-wide SNP association	Genomics
	Metal	Mining variation data and perform association studies	Genomics
	Plink	Tools for managing genomic variation data	Genomics; Metagenomics
	SVS	Genomic and phenotypic data analysis and visualization	Genomics
	Tassel	Genome variation studies	Genomics
	VcfTools	Tools for genome comparisons and mining plant variation data	Genomics; Metagenomics

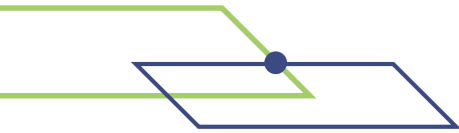


Table 2. Reference databases in agrigenomics (adapted from Esposito *et al.* 2016).

Task	Name	Aims	Usage
General	Genomes online database	Metadata repository for sequencing projects	Genomics; Metagenomics
	JGI Phytozome	Plant Comparative Genomics at the Joint Genome Institute	Genomics
	INSDC	DDBJ, EMBL-EBI, and NCBI, common repository	Genomics; Metagenomics
	PLANTGDB	Unified plant genomic database	Genomics
Taxonomic annotation	RDP/Silva/ Greengenes	Repositories of ribosomal RNA genes	Genomics; Metagenomics
Functional annotation	KEGG	Integrated resources for functional annotation of genes	Genomics; Metagenomics
	COG	Clusters of ortholog groups	Genomics; Metagenomics
	SEED	Functional annotated genes	Metagenomics
	RFAM	RNA families collection	Genomics
	DFAM	Repetitive DNA elements	Genomics
	UNIPROT	Functional annotated protein sequences	Genomics

Applications of Agrigenomics

Crop improvement



It is very important to increase crop yields and livestock productivity to alleviate hunger and poverty in the developing world. Genomics is a promising tool for solving this urging problem. Genomic information enables researchers to identify genes associated with valuable traits. Gene editing technologies such as CRISPR/Cas9 can be used to introduce genes to promote disease or drought resistance, enhance the taste, texture, and help crops adapt to high salinity soils, etc. Genome editing needs to be validated via molecular methods such as PCR or sequencing.



Crop adaptation

Adapting crops to future harsher conditions of a major concern for food security. Agrigenomics is a potential method to improve the adaptability of crops through increasing agrobiodiversity. It is expected that wild relatives represent an important reservoir of adaptations to extreme environmental stresses. NGS can be used to identify wild relatives carrying adaptations that can be used for improvement of crop adaptation in breeding programs. It can also be used to identify genes and polymorphisms associated with adaptations for targeted improvement.



Development of bio-products



Next-generation sequencing promotes the development and commercialization of bioproducts which affect applied fields like biocontrol, stress protection, and arable land. For example, the microorganisms that potentially play a role in crop health and disease suppression can be identified with a culture-dependent approach using a next-generation sequencing-based platform and powerful bioinformatics analysis. NGS may impact (i) the detection of new bio-resources for biocontrol and plant growth promotion; (ii) the optimization of formulation; (iii) risk assessment studies for bio-products; and (iv) stabilization of the biocontrol effect under field conditions.

Animal breeding and management

Recent advances in NGS and phenotyping platforms have accelerated the genomics-assisted breeding. Genomics is consistently increasing the diversity of alleles available for animal breeding. Genomic information can accelerate breeding programs by selecting a combination of genomic markers associated with desirable traits. And genome-wide arrays are used to predict the future health and performance of the newborn animals. Microorganisms colonized in the gut of livestock can be sequenced and analyzed to enable optimization of animal feed and diagnosis of infections.



Antimicrobial resistance



Antimicrobial resistance (AMR) is a major cause of morbidity and mortality in humans and animals on a global scale. NGS is a promising method to understand and prepare for emerging AMR threats. To be specific, sequencing such as whole genome sequencing can be used to comprehensively monitor AMR epidemiology through exploring the rise and spread of resistant pathogenic strains and lineages. The sequencing-based platform also allows researchers to track the evolutionary origins of antimicrobial resistance microbes and determine the corresponding therapies.



Our Comprehensive Agrigenomics Solutions

CD Genomics is dedicated to providing a comprehensive list of genomics and microarray solutions for agriculture, including genome, exome, transcriptome, and metagenome sequencing, genome-wide association studies (GWAS), and targeted sequencing and genotyping that focus on a subset of regions or genes such as single nucleotide polymorphisms (SNPs).

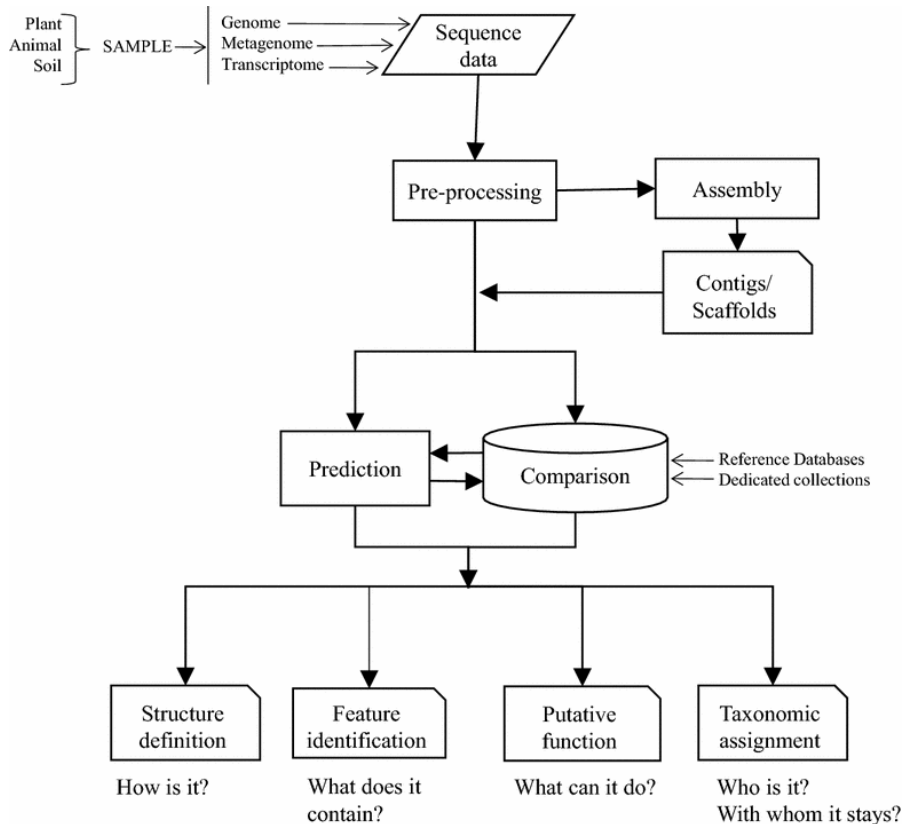


Figure 1. General description of a standard workflow in agrigenomics (Esposito *et al.* 2016).

Our services help customers in the following aspects:

- ◆ Understand the complex genomes of crops
- ◆ Develop a reference genome sequence
- ◆ Analyze the genetic traits in plants and animals
- ◆ Analyze gene expression in plants or animals under different conditions
- ◆ Predict gene functions and associate genes with phenotypic traits
- ◆ Screen genomic markers associated with desirable traits
- ◆ Protect crops and livestock from pathogen infections or genetic diseases
- ◆ Accelerate breeding programs or crop improvement through genotyping
- ◆ Validate genome editing using CRISPR sequencing
- ◆ Address antimicrobial resistance and achieve food safety

If you are interested in our agrigenomics solutions, please feel free to contact us!