

# GRIN-Global Project

the global plant genebank  
information management system



# “So what is GRIN-Global?”

GRIN-Global (GG) is a software suite that enables genebanks to store and manage information associated with plant genetic resources (or germplasm) and deliver that information globally.

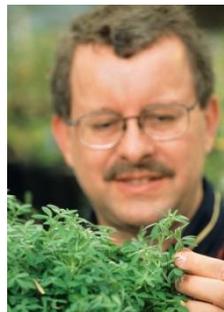
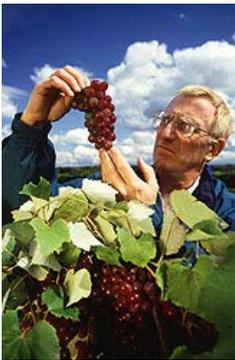


# Genebanks, Biodiversity, and Plant Genetic Resources

“Complementary conservation strategies couple the protection of wild plant populations and traditional crop varieties where they have evolved, with the collection and preservation of genetic diversity in gene banks.”

-- Stephanie L. Greene, Thomas Hart

[http://www.ncgia.ucsb.edu/conf/SANTA\\_FE\\_CD-ROM/sf\\_papers/greene\\_stephanie/sgreene.html](http://www.ncgia.ucsb.edu/conf/SANTA_FE_CD-ROM/sf_papers/greene_stephanie/sgreene.html)



# Why You Should Care

... a decline in global biodiversity threatens plant genetic diversity, the raw materials we rely on for food, fiber, fuel, medicine and industrial products...

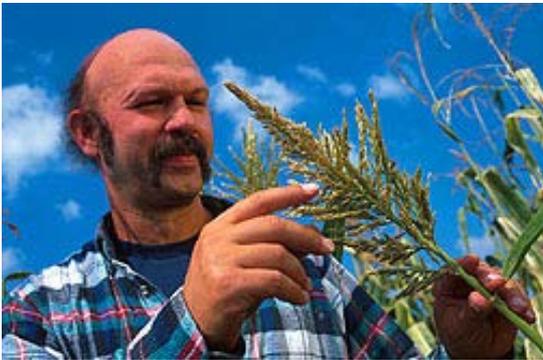


Seed banks are important infrastructures for preserving what diversity we still have left. Through massive monocultures rather than diverse farms, we're putting our livelihood at risk by not giving space to what various plant species we have left.

"If crops don't adapt to climate change, neither will we," says Cary Fowler, an expert in biodiversity. Key to ensuring that crops will be able to adapt is maintaining crop diversity. We're at risk of losing the very diversity of plant variety that will keep us alive in a warming environment. See Dr. Fowler's [TED talk](#) about the issue.

# ...Why You Should Care

Researchers, breeders, and farmers can obtain descriptions of plant traits and other information that enables them to identify and place orders for plant germplasm specifically suited for their needs.



# ...Why You Should Care

Those germplasm information users, as well as genebank staff responsible for conserving germplasm, require powerful information management systems with flexible search and reporting capabilities.



# The Need for GRIN-Global

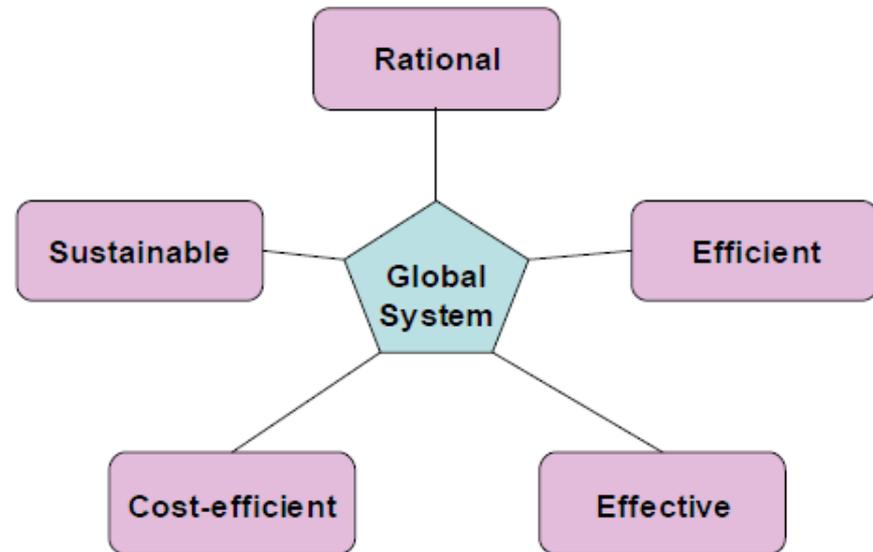


Many national genebanks lack effective technology for documenting and managing collection information digitally.

# Global Crop Diversity Trust



The Global Crop Diversity Trust recognized this common need of the world's genebanks-- consequently the Trust initiated the GRIN-Global project



Based on a slide by Cary Fowler

# GRIN -- a Superior Genebank Information Management System

The Germplasm Resources Information Network (GRIN), developed by the USDA's Agricultural Research Service National Plant Germplasm System, is recognized internationally as a superior genebank information management system



GRIN--1986-present:  
25 years of continuous  
development and  
enhancements



# Agriculture and Agri-Food Canada



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

Canada

**Agriculture and Agri-Food Canada**  
[www.agr.gc.ca](http://www.agr.gc.ca)

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Plant Gene Resources of Canada uses a version of GRIN that has handled more than 40,000,000 requests for information over a nine year period since May, 2001

[Canadian Plant Germplasm System](#)





# GRIN-Global Partners

In 2008, the Global Crop Diversity Trust awarded a grant to USDA/ARS and Bioversity International to enhance and expand GRIN to address global germplasm information management needs



Trust



Bioversity



ARS

# USDA/ARS Role

- Upgrade and expand the current GRIN system's design and user interface to develop GRIN-Global, a global plant genebank information management system
- Provide an enhanced GRIN database schema
- Construct a core set of technologies for updating data stored on a centralized information management system and for distributing centralized data to existing, off-site systems



# Bioversity International's Role

- Support deployment of GRIN-Global internationally, through regional PGR networks and its Regional Offices.
- Translate the new system into Arabic, French, Russian and Spanish, and implement it in developing countries.
- Implement and monitor barriers to adoption.

Český	English	Español	Français	Português	Русский	آبي بوعال
ID genetického zdr...	Accession ID	ID Entrada	ID de l'accession	ID do acesso	ID образца	م امضن ال ا فرعم
Předpona čísla ge...	Accession Prefix	Prefijo entrada	Numéro de l'acce...	Prefixo do acesso	Префикс образца	م امضن ال ا ددع part1
Číslo genetického ...	Accession Num...	Número de entrada	Numéro de l'acce...	Número do acesso	Номер образца	م امضن ال ا ددع Part2
Přípona čísla gen...	Accession Suffix	Sufijo entrada	Numéro de l'acce...	Sufixo do acesso	Постфикс обра...	م امضن ال ا ددع part3
Taxon	Taxon	ID especies taxo...	Taxon	Taxon	Таксон	ع اون ال ا في نصت ف
Název genetickéh...	Accession Name	Nombre Entrada	Nom de l'accession	Nome do acesso	Наименование ...	م امضن ال ا م سا
Původ	Origin	Origen	ID de l'origine gé...	Origine	Происхождение	اي ف ا ر عم چل ا فرعم

# Hence GRIN-Global

Genebanks can tailor a powerful information management system to meet their specific requirements because GRIN-Global has been developed with free or open source software and its source code is available.



# GRIN-Global manages many different types of data...

- Passport and Provenance  
(Accession ID, Taxonomy, Accession name, Origin, Material Type, Maintained By, Availability, Intellectual Property, Material Transfer Agreement Status)
- Phenotypic and Genetic Marker Observations
- Images of germplasm
- Germplasm inventory (e.g. number of seeds in storage)
- Requests for germplasm and order fulfillment
- and much more...

# GRIN-Global & Interoperability

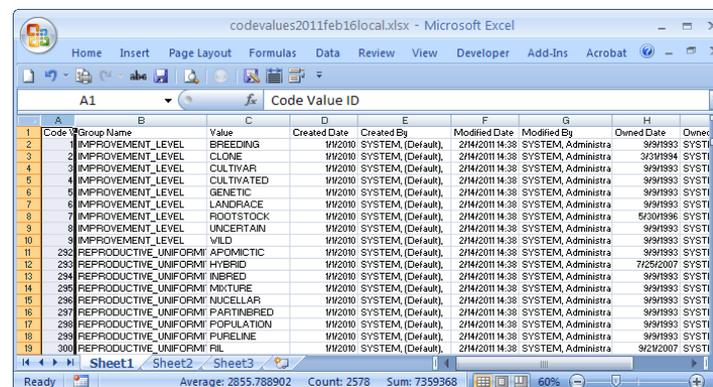
GRIN-Global will interoperate with databases that provide specialized genomic, ecogeographic, and many other types of information needed for multidisciplinary research objectives.

# GRIN-Global Design

New applications written with the .NET framework and browser-based components comprise a system flexible enough to handle the needs of both small and large organizations.

# ...Design...Web Services

- The GRIN-Global Application Program Interface (API) provides web services-software modules accessible over the internet via standard messaging protocols.
- The web services allow the data to be retrieved in various formats - XML, CSV, TXT - making it platform independent. Any application that can make HTTP requests can use the GRIN-Global API.

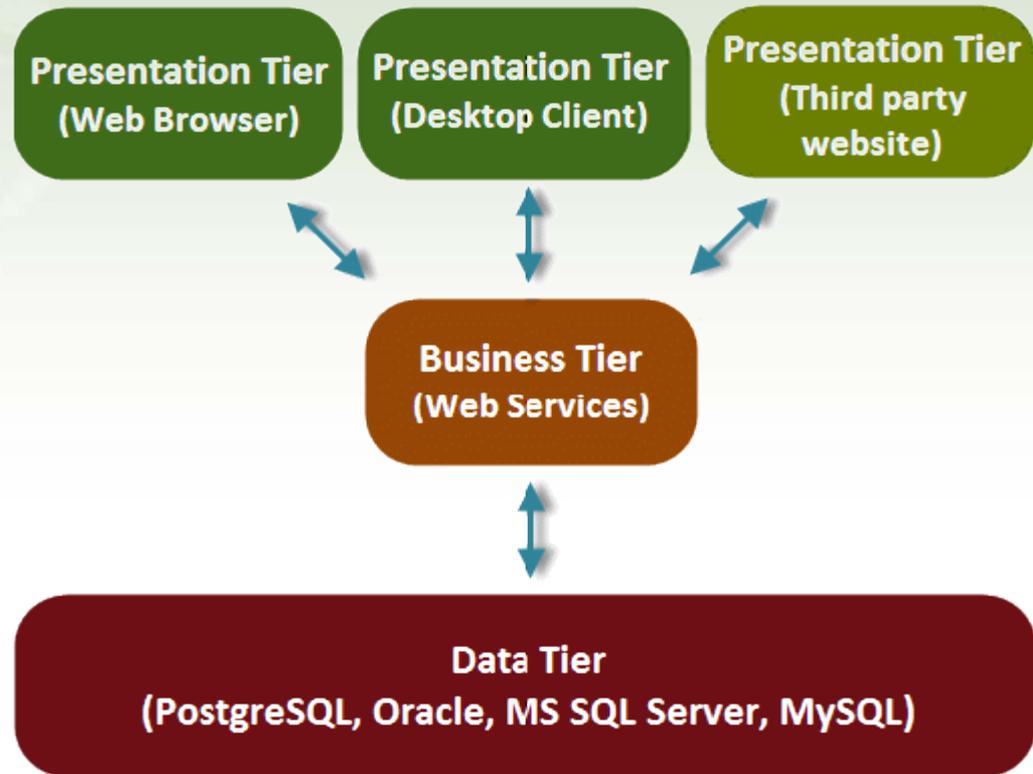


The screenshot shows a Microsoft Excel spreadsheet titled 'codevalues2011feb16local.xlsx'. The spreadsheet contains a table with columns for Code, Group Name, Value, Created Date, Created By, Modified Date, Modified By, Owned Date, and Owned By. The data rows are numbered 1 through 300, with some rows highlighted in yellow. The table lists various improvement and reproductive uniformity levels.

Code	Group Name	Value	Created Date	Created By	Modified Date	Modified By	Owned Date	Owned By
1	IMPROVEMENT_LEVEL	BREEDING	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
2	IMPROVEMENT_LEVEL	CLONE	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	3/31/1994	SYSTEM
3	IMPROVEMENT_LEVEL	CULTIVAR	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
4	IMPROVEMENT_LEVEL	CULTIVATED	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
5	IMPROVEMENT_LEVEL	GENETIC	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
6	IMPROVEMENT_LEVEL	LANDRACE	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
7	IMPROVEMENT_LEVEL	ROOTSTOCK	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	5/5/1998	SYSTEM
8	IMPROVEMENT_LEVEL	UNCERTAIN	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
9	IMPROVEMENT_LEVEL	WILD	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
10	IMPROVEMENT_LEVEL	WILD	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
11	REPRODUCTIVE_UNIFORMITY	AFONCTIC	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
12	REPRODUCTIVE_UNIFORMITY	HYBRID	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	7/25/2007	SYSTEM
13	REPRODUCTIVE_UNIFORMITY	INBRED	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
14	REPRODUCTIVE_UNIFORMITY	MIXTURE	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
15	REPRODUCTIVE_UNIFORMITY	NUCELLAR	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
16	REPRODUCTIVE_UNIFORMITY	PARTIBRED	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
17	REPRODUCTIVE_UNIFORMITY	POPULATION	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
18	REPRODUCTIVE_UNIFORMITY	PURELINE	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/19/1993	SYSTEM
19	REPRODUCTIVE_UNIFORMITY	FIL	1/1/2010	SYSTEM, (Default)	2/14/2011 14:38	SYSTEM, Administra	9/21/2007	SYSTEM

# ...Design...3 Tiers

The system architecture uses three tiers - database, business, and presentation - that can be developed and modified independently.



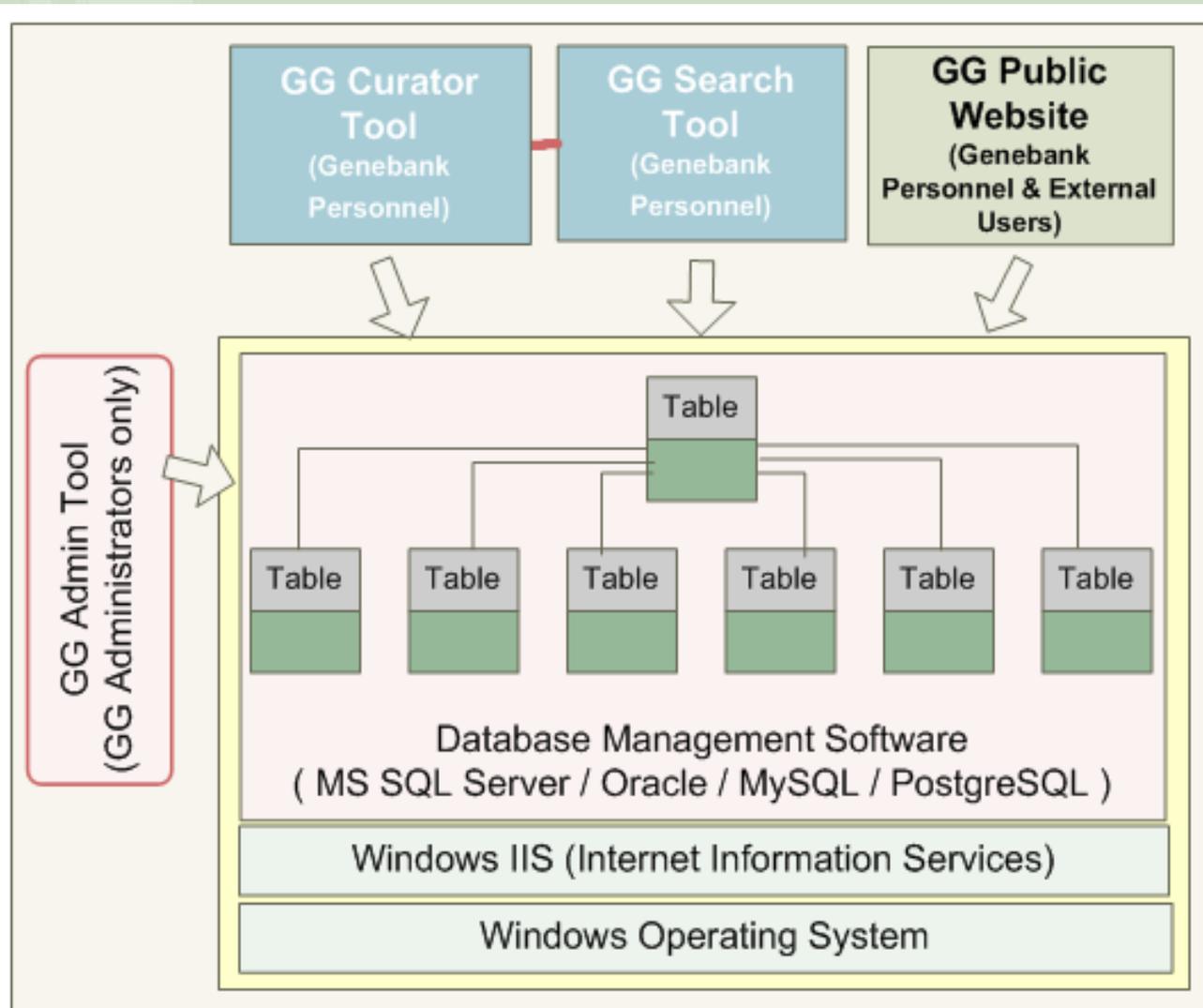
# ...Design...Open Source

- Supports free or open source database management systems:

MySQL, Oracle Express, MS SQL Express, or PostgreSQL

- By providing all source code for system components, GRIN-Global enables genebanks to tailor the application to meet their specific requirements

# GRIN- Global Environment



# GRIN-Global Environment

- The GRIN-Global (GG) program suite runs in a Windows environment. Besides the basic Operating System, GG also requires the Windows IIS.
- One of the four supported database engines (SQL Server, Oracle, MySQL, or PostgreSQL) is required. The database software houses the many GRIN-Global data tables. GG is a relational database system -- these tables are related by key fields. The major related “families” of tables include Accessions, Inventory, Taxonomy, and Orders.
- Users access the data via the GRIN-Global applications: the Curator Tool (CT), the Search Tool, and the Public Website. The CT and the Search Tool are closely integrated - the CT has a Search button which invokes the Search Tool; however, the Search Tool can also run as a stand-alone application.

# Alternative GRIN-Global Configurations

## Alternative 1: Standalone PC

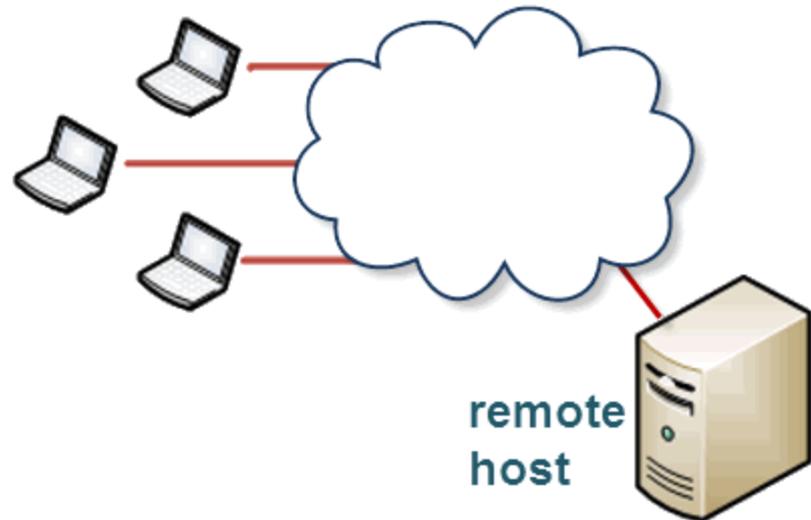
The entire GRIN-Global application suite installed on one PC



local host

## Alternative 2: PC Networked to a Server

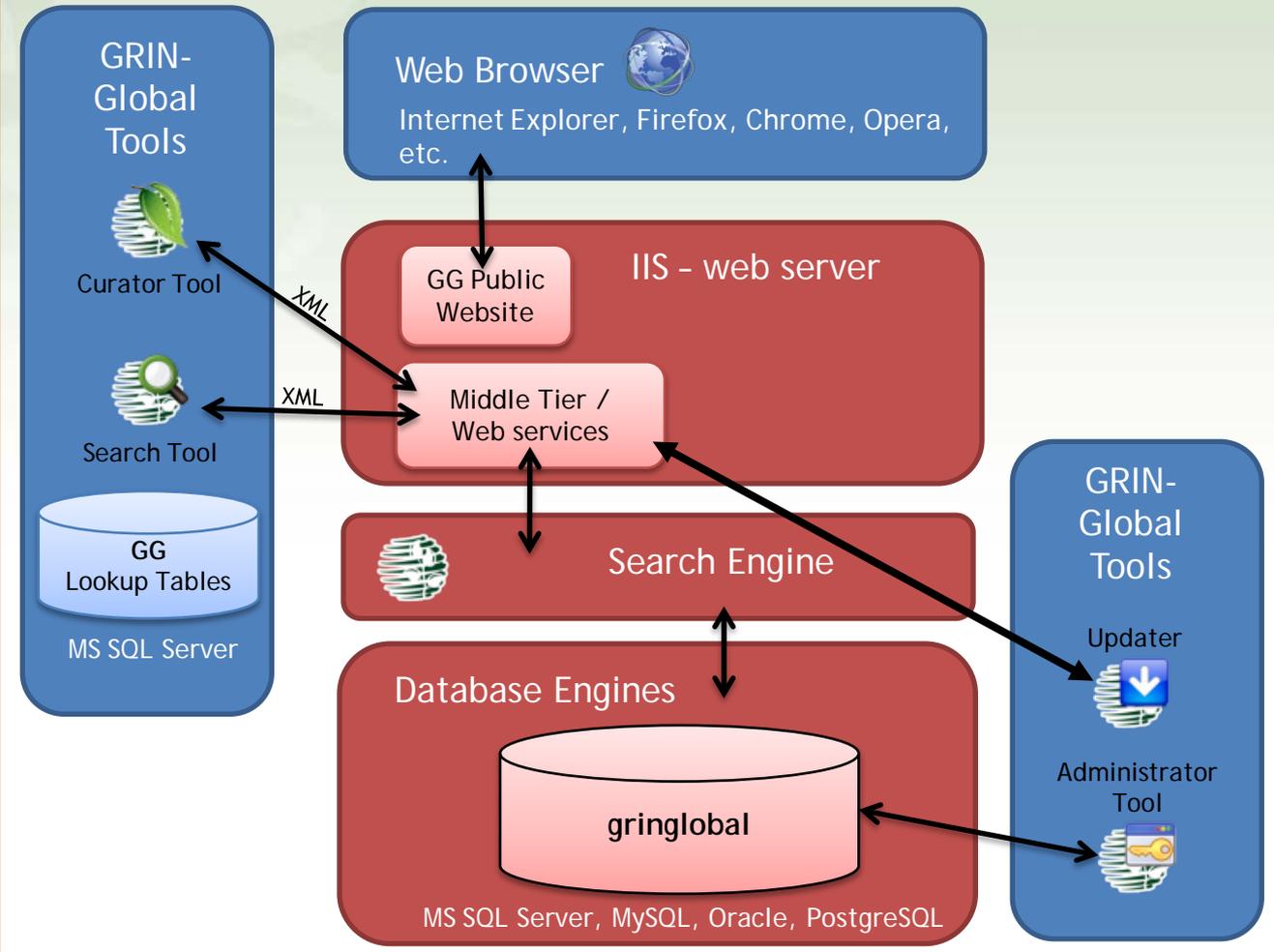
Client application installed on each PC; server applications on the remote server



More details on the next two slides

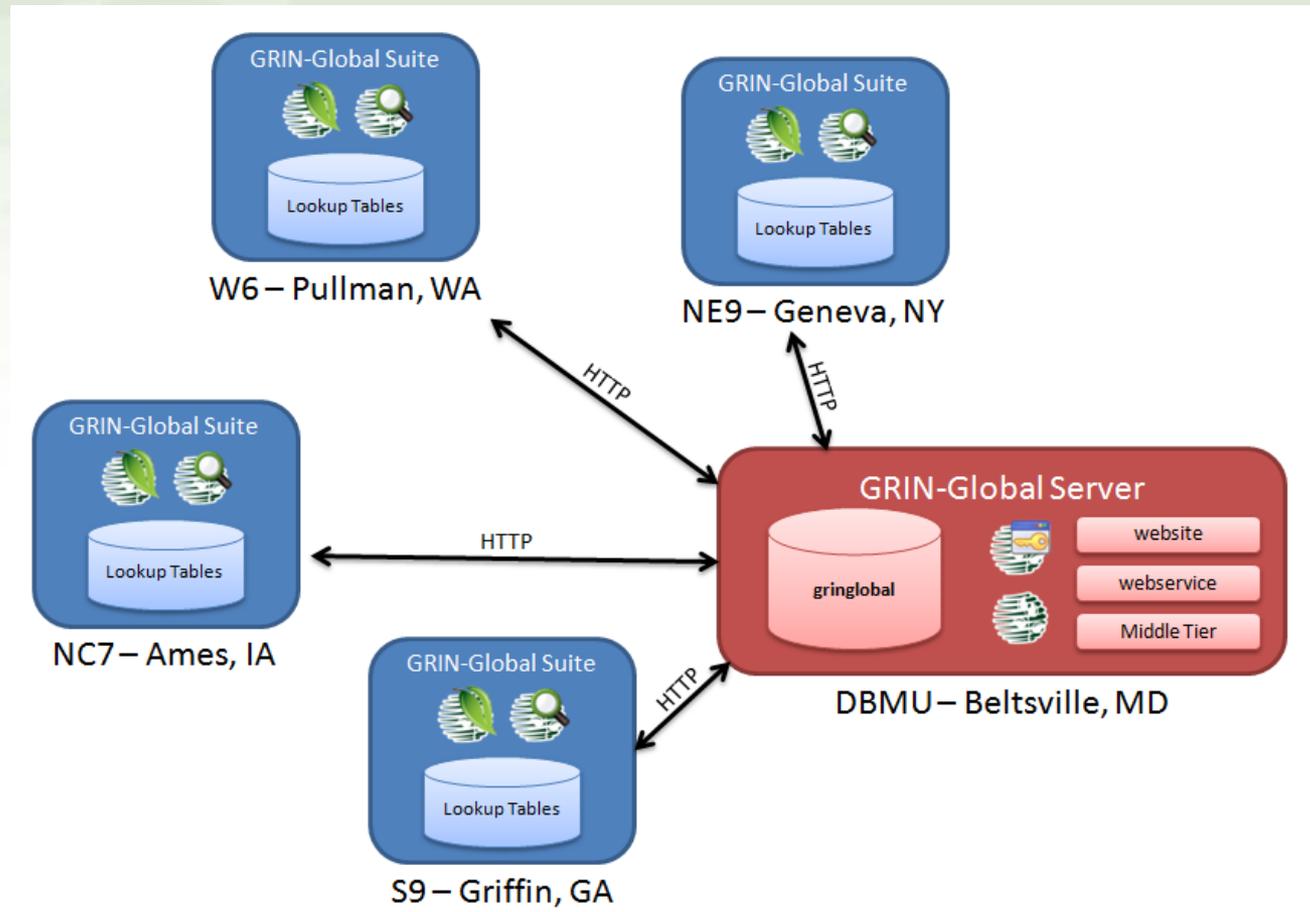
# GG System Architecture Overview – Single PC

Self-contained in a Personal Computer



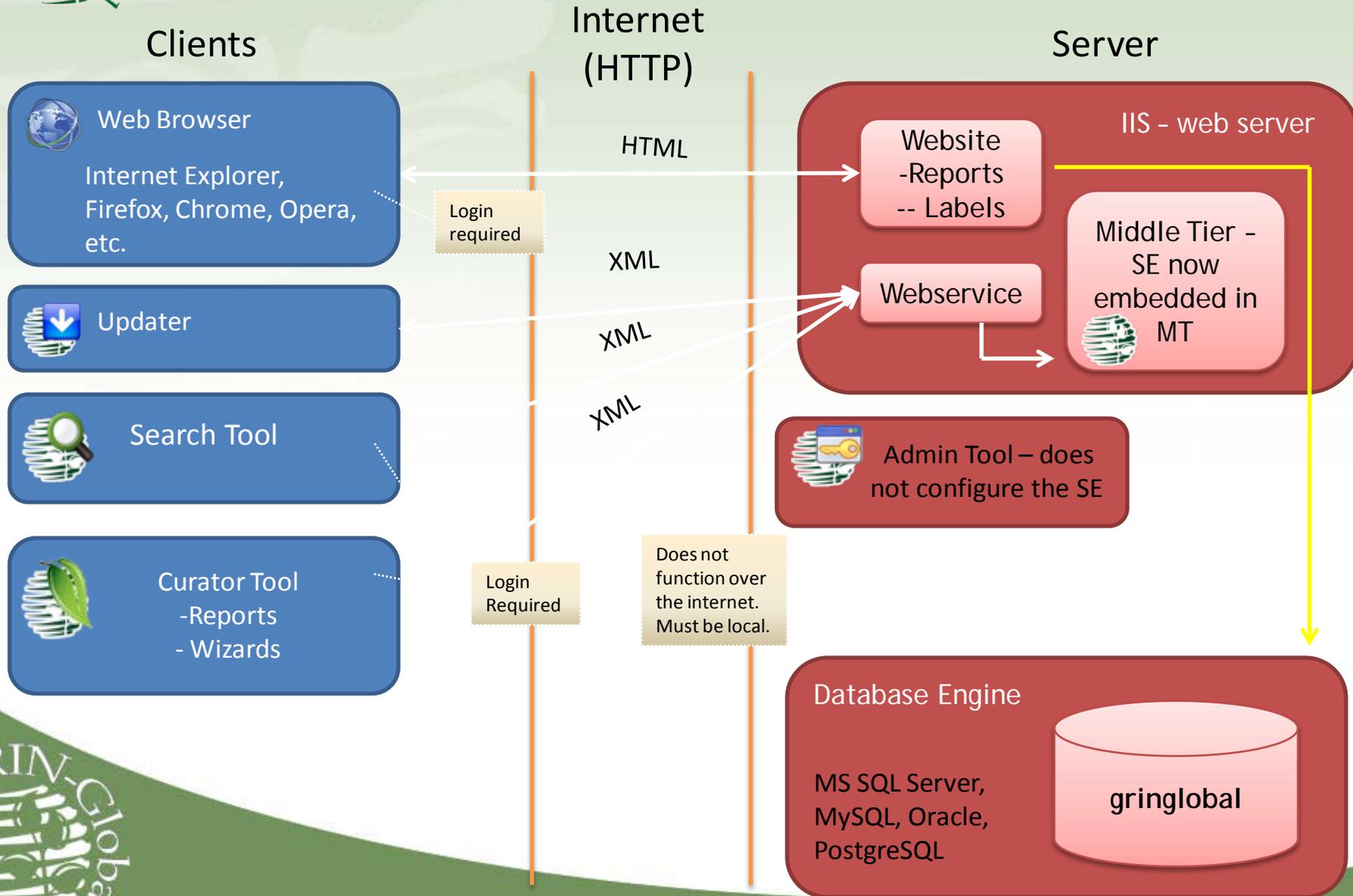
# GRIN-Global System Architecture Overview

## – Networked to a Server



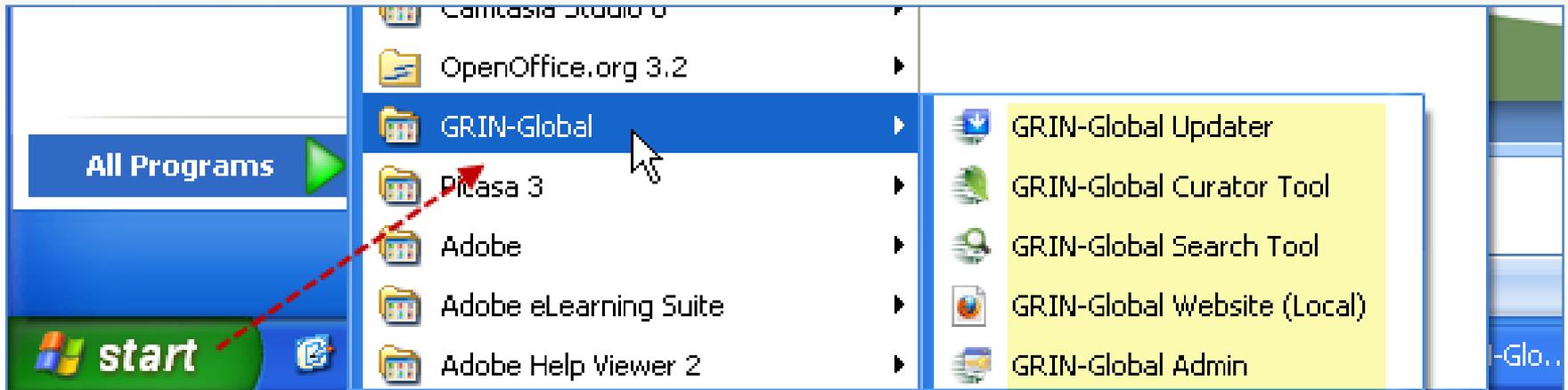


# Current Status of G-G System Architecture 2014



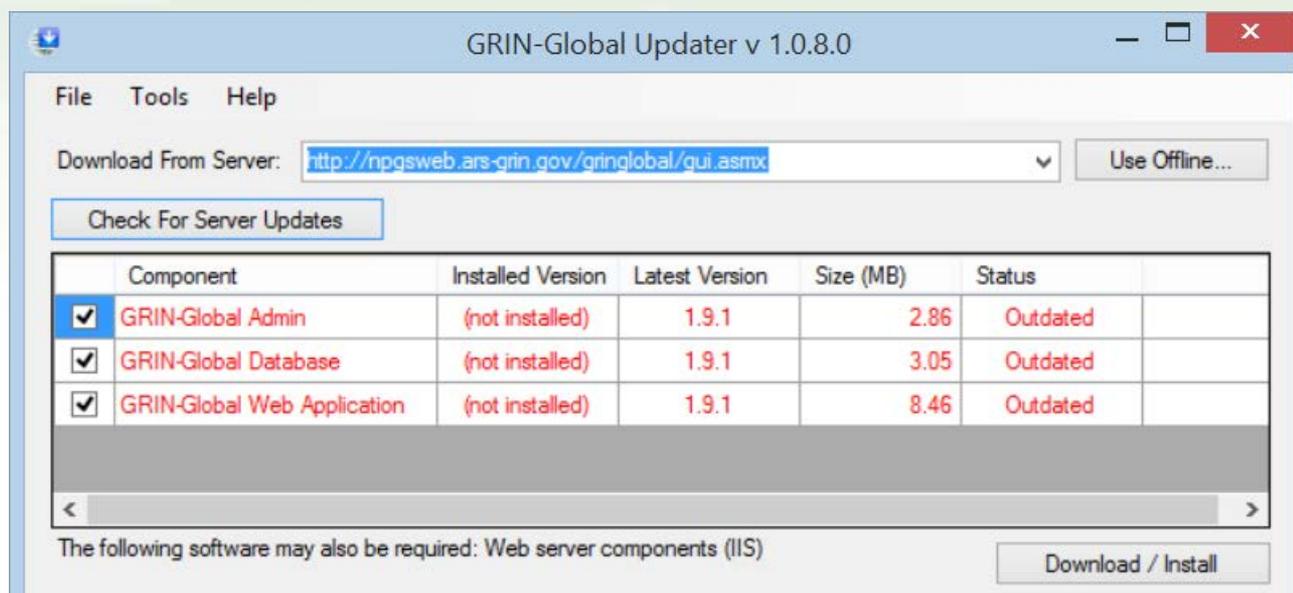
# GRIN-Global Suite of Software Components

After GRIN-Global is installed, its components are accessible from the Windows Start button.



# Updater

The GRIN-Global program updater is used to install the server GG components.



# Curator Tool

The Curator Tool is a GRIN-Global application designed primarily for curators and genebank workers creating and managing their genebank's data

The screenshot displays the GRIN-Global v2.0.3994.23426 application window. The interface includes a menu bar (File, Help), a search bar, and navigation buttons for 'Accession Wizard' and 'Order Wizard'. The main area is divided into a left sidebar for file navigation and a central table for accession data.

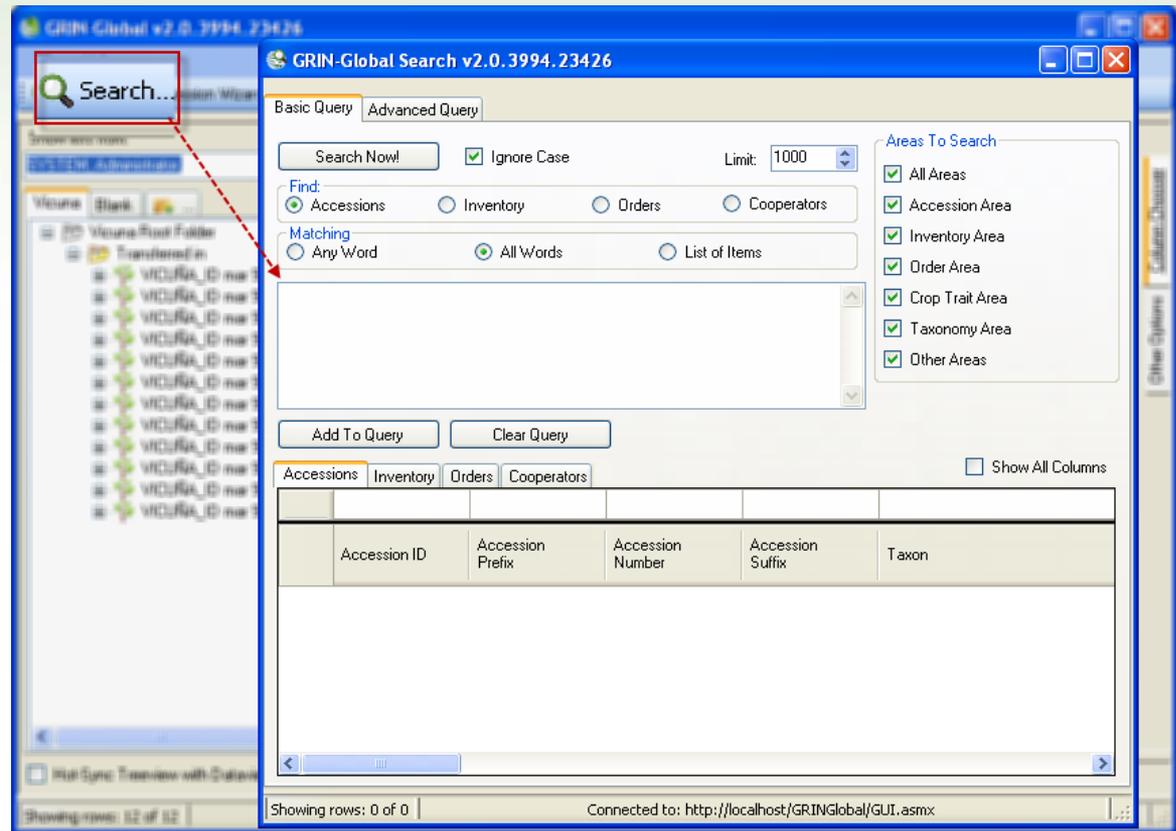
**Accessions Table:**

Accession ID	Accession Prefix	Accession Number	Taxon	Is Core?	Is Backed Up?	Backup Location
2797	VICUÑA_ID mar	95001	Phaseolus vulgaris	N	N	
2798	VICUÑA_ID mar	95005	Phaseolus vulgaris	N	N	
2799	VICUÑA_ID mar	95006	Phaseolus vulgaris	N	N	
2800	VICUÑA_ID mar	95008	Phaseolus vulgaris	N	N	
2801	VICUÑA_ID mar	95009	Phaseolus vulgaris	N	N	
2802	VICUÑA_ID mar	95010	Phaseolus vulgaris	N	N	
2803	VICUÑA_ID mar	95011	Phaseolus vulgaris	N	N	
2804	VICUÑA_ID mar	95012	Phaseolus vulgaris	N	N	
2805	VICUÑA_ID mar	95017	Phaseolus vulgaris	N	N	
2806	VICUÑA_ID mar	95020	Phaseolus vulgaris	N	N	
2807	VICUÑA_ID mar	95021	Phaseolus vulgaris	N	N	
2808	VICUÑA_ID mar	95023	Phaseolus vulgaris	N	N	

The interface also features a 'Data Editing' section with 'Edit Data', 'Save Data', and 'Cancel' buttons, and a 'Refresh Data' button. The status bar at the bottom indicates 'Showing rows: 12 of 12' and 'Connected to: http://localhost/GRINGlobal/GUI.aspx'.

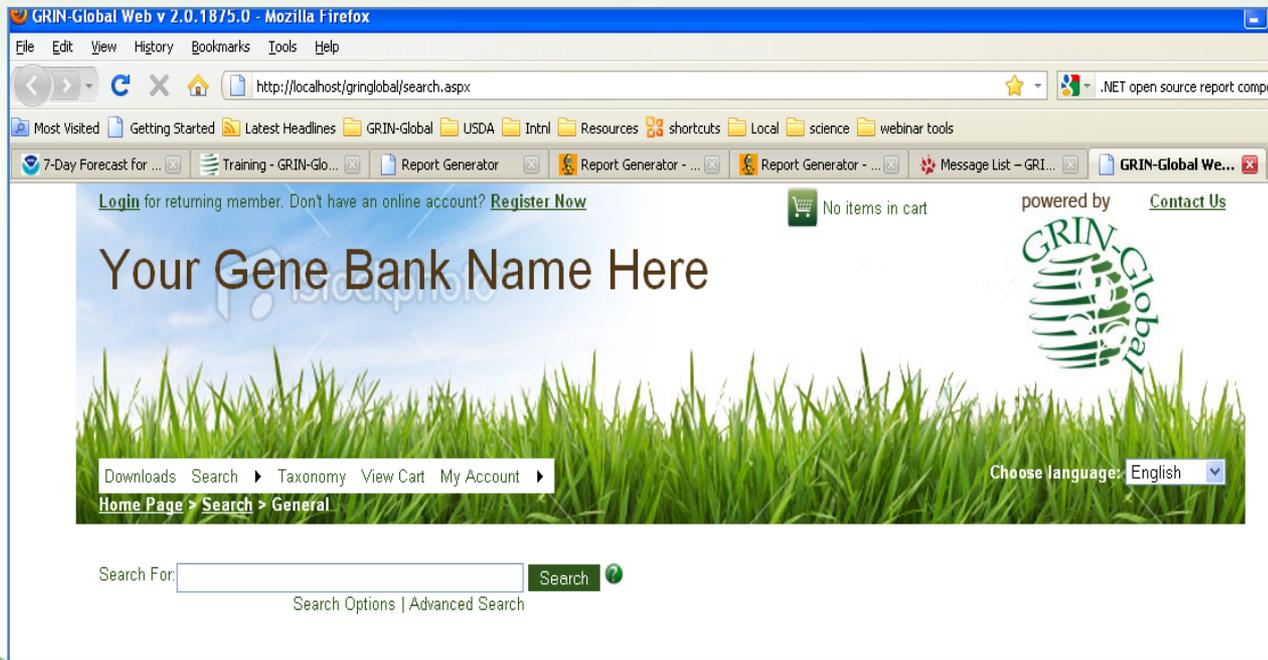
# Search Tool

The Search Tool can be launched from the Curator Tool, or launched directly from the Windows Start Programs list



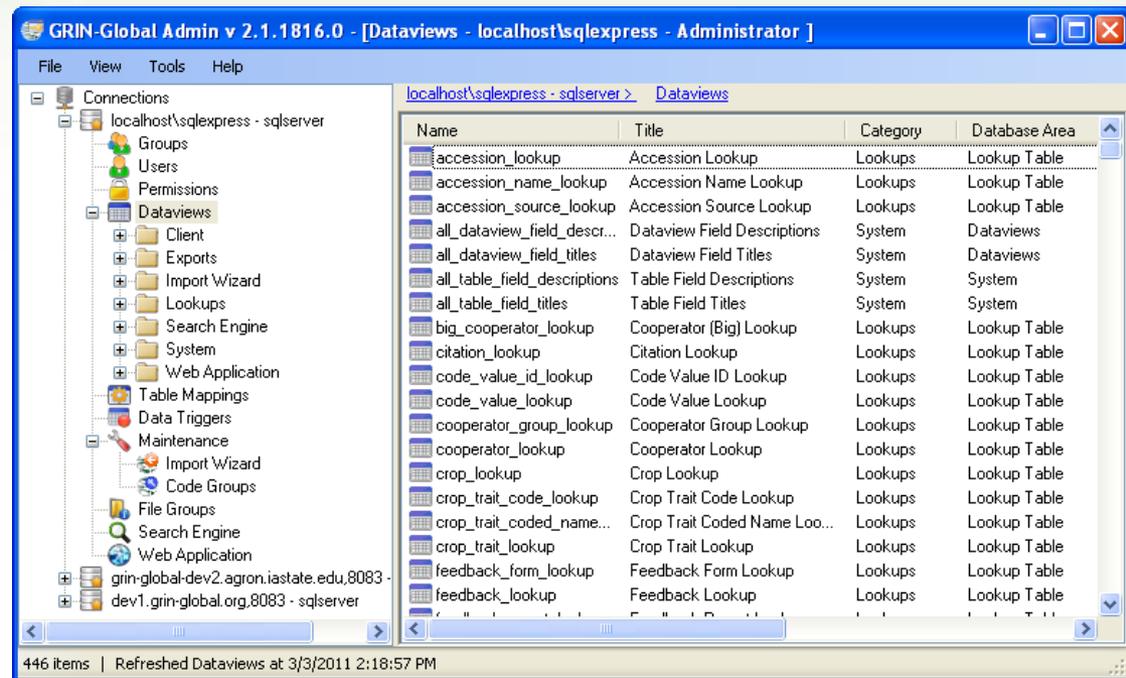
# Public Website

Through the Public Website, clientele can search the GG database, access germplasm information, and order germplasm through a “shopping cart facility.”



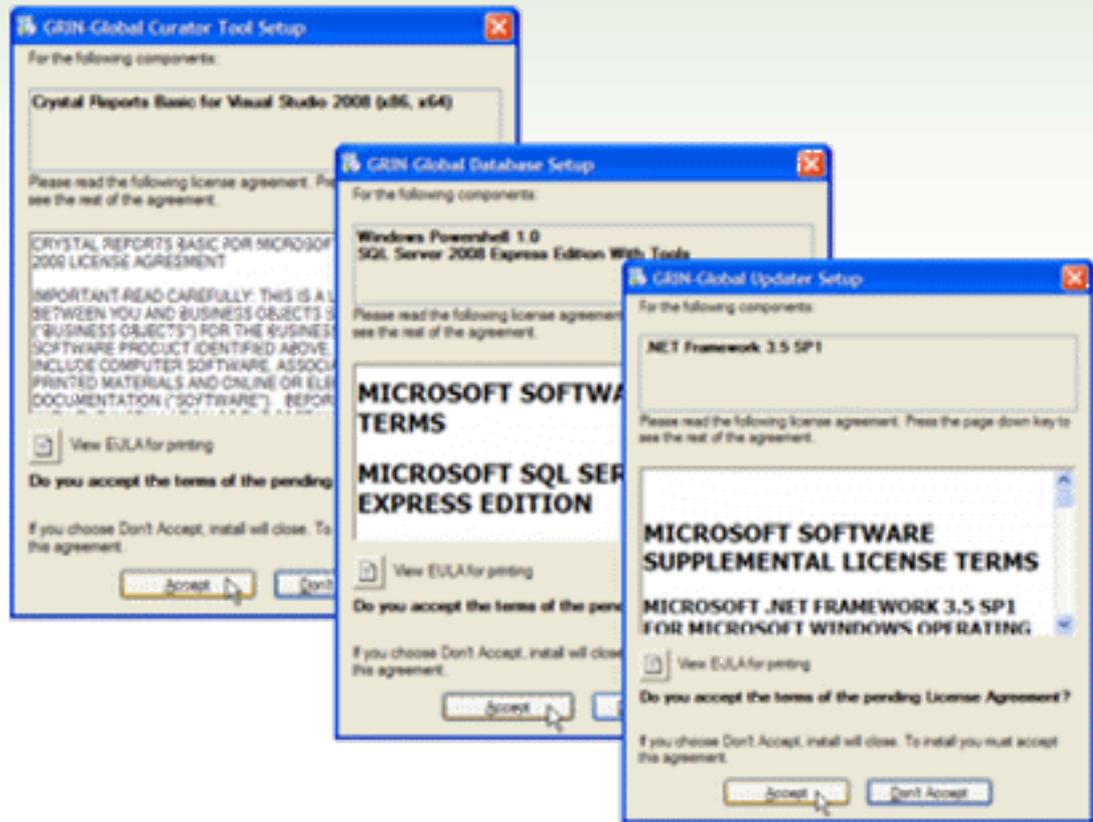
# Admin Tool

The Admin Tool for GRIN-Global administrators handles diverse functions including adding or modifying user accounts and their security permissions; importing data; and creating and editing dataviews.



# Installed Components

When GRIN-Global is stored on the user's PC ("localhost"), several programs are installed (if they haven't been already).



# For additional information, please visit:

- [www.grin-global.org](http://www.grin-global.org) (project background)
- [www.grin-global.org/index.php/Training](http://www.grin-global.org/index.php/Training) (training and documentation references including videos, exercises, and presentations)