Genomics: Agricultural Innovation

Center Forward Basics
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Overview

Agricultural genomics uses technology to study and classify the genes of plants in order to develop new, specific varieties of crops. These new crops can help address various food problems around the world and can improve the productivity and sustainability of many plant varieties and livestock productions. Genomic innovations have contributed to advances in crop developments such as selecting agriculturally desirable traits. These promising traits often include higher yield crop, stress tolerance, and pest resistance. Overall, the use of genomics can speed the development of crops and livestock with traits that increase sustainability or meet consumer demand.

History of Genomics

For hundreds of years, agronomists, breeders, and gardeners have used classical plant breeding methods to improve the productivity of plants. Currently, modern genomic techniques and methods provide tools to combat previously unsolved breeding programs such as increasing crop productivity and stress tolerance. Additionally, farmers around the world are using the science of genomics to accelerate and improve plant and animal breeding practices in cattle farming and other food products. Studying these plants helps farmers and scientists understand genes that contribute to growth rate, seed and fruit characteristics, and susceptibility to climate change or infectious agents.

Types of Plants

Changing environmental conditions have made it important to develop higher yield plants. Specifically, if researchers know what genes control specific then they can develop plants that are resistant to specific diseases. The following plants have been studied in order to use their genomic information to shape agricultural processes:

- Conifers: 30,000 genes
  - Confiders include cone-bearing, primarily evergreen plants such as cedar, fir, pine, and spruce. Researchers are working towards developing high-performance trees and are adapting the plants to temperature change and pest resistance.
- Tomato: 34,000 genes
  - Researchers are working to increase the amount of light tomatoes can be under in order to increase total crop yield by an estimated 20%.
- Potato: 39,000 genes
  - Potatoes are susceptible to a wide range of pests and diseases. Researchers have identified over 800 genes associated with disease and pest resistance in order to create hardier, less susceptible varieties of potatoes.
- Apple: 47,000 genes
  - Scientists have planted genetically engineered apples that have the

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Center Forward brings together members of Congress, not-for profits, academic experts, trade associations, corporations and unions to find common ground. Our mission: to give centrist allies the information they need to craft common sense solutions, and provide those allies the support they need to turn those ideas into results.

In order to meet our challenges we need to put aside the partisan bickering that has gridlocked Washington and come together to find common sense solutions.

For more information, please visit www.center-forward.org

Key Facts

- During the last decade, genome sequencing projects have been completed for a number of important crop species. Some of these plants include:
  - Soybeans
  - Citrus
  - Rice
  - Sorghum
  - Potatoes
  - Spinach
  - Tomatoes
  - Corn
  - Canola

ability to resist browning when sliced or bruised. These apples are now being sold to the public.

- Corn: 32,000 genes
  - Researchers have studied corn's genes that influence leaf and ear size, water control, and drought responsiveness.
- Cotton: 70,000 genes
  - Scientists and farmers are working together to identify genetic variants that optimize fiber length, quantity, and quality to develop new cotton strains.

The Importance of Genomics

The use of genomics in agricultural practices allows for the incorporation of genomic modification technologies that will lead to crop improvements. Specifically, plant genomics, genetics, and breeding research and education can address future challenges in food security, bioenergy, climate change, and sustained intensifications. Crop improvement can help future generations and adequately deliver food supplies to a growing world. Genomics maximizes the utility, diversity, and yield of resources in order to contribute to sustained food security in the future.

Links to Other Resources

- HudsonAlpha Institute for Biotechnology
- International Journal of Genomics - The Promise of Agriculture Genomics
- National Human Genome Research Institute - Agriculture
- Nature Journal - Genomics and our future food security
- Springer Link - Application of Genomics in Agriculture
- USDA - Animal Breeding, Genetics, and Genomics
- USDA - Plant Breeding, Genetics, and Genomics Programs