US Peanut Genomics Initiative

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The Peanut Foundation

The Peanut Foundation (TPF) established the Peanut Genomic Initiative (PGI) in 2004 to organize and coordinate peanut genomic research. The PGI participated as the peanut industry's representative on the Legume Crop Genomics Initiative organized by the USDA-ARS. Participation in this group caused the industry to realize that the peanut genomic effort was at least 6 years behind the soybean effort and 10 years behind most of the other major crops in this area. Due to the effort of the Peanut Genomics Initiative and The Peanut Foundation the peanut genomics research is now only about 3 years behind soybean and about 5 years behind the other major crops.

The US peanut industry by action of the American Peanut Council decided in December 2006 to formally begin a program to develop the peanut genome, biotech peanuts and the science needed to develop all aspects of that technology. The Peanut Foundation was asked to lead and coordinate this very large and complex effort.

Soybeans, alfalfa, and dried beans should have a relatively complete genomic map by the end of 2008. The peanut industry, collaborating with these other legume crop researchers and using the Legume Information System (developed under a USDA grant), will be able to obtain about a third of the peanut genome by the end of 2008. The balance of the genome will be developed in a collaborative effort between researchers in China, India, Australia, South America, and Africa. Two international meetings have been held (2006-Guangzhou, China, 2007-Atlanta, GA) to coordinate this effort. A strategic plan has been developed and agreed to by all researchers involved. Data from China, India, Brazil, and Australia is already being sent to the Legume Information System (LIS) in Sante Fe, NM. This data is accessible by all US researchers and the LIS is funded by USDA.

We have developed a 7 year Strategic Plan to complete the key portions of the peanut genome map and also develop biotech peanuts that will put us on equal footing with other crops. The annual accomplishments reports, meeting reports, and Strategic plans (international and domestic) can be found at http://www.peanutbioscience.com/. We have also hired Dr Richard Wilson to help guide this effort. Dr. Wilson was the National Program Leader for Plant Genomics for USDA/ARS.

Completing the Strategic Plan will cost a little over $10 million over the 7 year period (A breakdown is attached). We have completed Year 2 and have already received $3,620,000 of that sum. Our goal through Year 2 was $3,841,000 leaving us short by $221,000. We are applying for a USDA CAP grant in 2009 that if successful will total approximately $4,000,000.

The US industry contributed $652,650 in 2007 (Year 1) and $757,261 in 2008 (Year 2) as follows:

	2007	2008
Peanut Foundation	$252,650	$307,261
State Grower Commissions	$100,000	$100,000
National Peanut Board	$150,000	$200,000
Multicrop Funds (USDA Funded)	$150,000	$150,000
Total	$652,650	$757,261

Federal and Private Foundations contributed $1,070,000 of the total amount in 2007 (Year 1) and $1,140,000 in 2008 (Year 2) as follows:

	2007	2008
National Science Foundation	$300,000	$100,000
National Research Initiative	$500,000	$250,000
Consortium for Plant Biotechnology Research	$ 70,000	$ 70,000
Gates Foundation (through ICRISAT)	$200,000	$720,000
Total	$1,070,000	$1,140,000

In addition, we have Federal and Private Foundations multi-year grant pledges remaining in the amount of $1,070,000 to place against Year 3 & 4 from the following:

National Science Foundation	$100,000
National Research Initiative	$100,000
Gates Foundation (through ICRISAT)	$800,000
Consortium for Plant Biotechnology Research	$ 70,000
Total	$1,070,000

The Peanut Genomics Initiative members have applied for future grants from the following:

Department of Energy
Clinton Foundation
USDA (various)
National Science Foundation

In summary we are obtaining funds from many sources and we believe we can raise the necessary funds to complete the Strategic Plan as long as the peanut industry continues to provide support at $500,000 to $900,000 a year with the higher amounts needed in the earlier years.

There are three paths towards our goal of developing superior peanuts through genetics

I. Develop Improved Transformation Systems and biotech peanuts.

This system uses genes from other plants, fungi, and bacteria. The PGI/TPF effort has already developed biotech peanut plants with resistance to sclerotinia, TSWV, Insects, Nematodes, and drought. The first biotech peanuts will be available for commercial use in about 4-6 years.

There are two difficulties in this approach:

A. A lot of these genes have been patented by corporations like Dow and Monsanto and that makes them expensive. Based on discussion over the last few years there

would be an upfront cost during development of $100,000 or more with a yearly fee after release of the bioengineered plant, usually a minimum of $35,000 and would probably be higher on most genes. Other genes belong to universities or are in the public domain and could be used with less expense.

B. The approval process from a stable transformed peanut through the entire regulatory process takes about 4 years and could cost as much as $40,000,000 although the Government and/or the developing university may fund some of it for peanuts and other "minor" crops

II. Develop Molecular Markers for resistant genes to all the primary peanut diseases and quality attributes.

These are genes that already exist in peanuts although they may be hidden in the wild species collection in Griffin, other collections around the world or in domesticated species. These Markers, which may be made up of multiple genes, can be used by peanut breeders to find desirable traits that might otherwise remain hidden and to develop them into varieties much faster than is possible today. These genes will come from peanuts so the varieties won't need EPA regulatory approval and the peanuts developed aren't considered GM. We hope to have 10 markers available within 3 years.

III. Create a Mutated Peanut Collection using chemical knockouts to eliminate unwanted peanut traits.

We plan to create a large number of mutations and then scan them to see where we have eliminated unwanted peanut traits. This effort could result in peanuts that are less allergenic, have more complete protein, more resistance to fungal growth and with improved quality attributes. We will combine this effort with efforts to make genetic changes in the peanut protein using tools only available through gene manipulation. We are also developing an animal model in cooperation with soybeans to test the allergenicity of any new peanuts.

In conclusion, these are 3 paths to the same goal and they aren't mutually exclusive. Biotech peanuts are already being grown in trials and there's nothing to preclude anyone from developing others and the work we're doing will make that quite a bit easier. We need all three paths to insure we get the best possible varieties with the most economical returns to the industry. As an example, Molecular Markers are extremely important and no one outside of this industry Initiative is working on it. We also plan to develop and maintain a web-based worldwide **Peanut Information System** to organize the enormous amount of data and allow comparison with other plant genomes developed around the world.

The industry has developed an all-inclusive strategy that gives us the best chance of developing the most desirable traits in the shortest amount of time. Full industry financial support is all that is needed to make peanuts more competitive in both financial return and quality with other major US crops. These other crops are 3-5 years ahead of us now but we can catch up with sufficient industry funding of this Peanut Genomic Initiative.

Estimated Cost per Year

Here is the estimated cost for this effort over the next 7 Calendar Years ($000):

Year (CY)	1 2007	2 2008	3 2009	4 2010	5 2011	6 2012	7 2013	Total
Molecular Markers	500	500						1,000
10 Key Traits	375	375						750
Genomic Map			600	600	600	600	600	3,000
Trait Analysis	100	100	300	300	300			1,100
Transformation Systems								
Biotech Peanut	333	333	334					1,000
Registration		50	50	200	400	200	100	1,000
Mutated Peanut Collection								
Chemical Mutation	300	300	100	100	100			900
Genetic Changes	125	125	125	125				500
Animal Test Model		125	125	125	125			500
Peanut Information System	100	100	100	100	100	100	100	700
Total Needed Per Year	1,833	2,008	1,734	1,550	1,625	900	800	10,450
Total Received	1,723	1,897						
Yearly Difference	(110)	(111)						

Note: This effort can be accelerated by additional funding in earlier years.