



New opportunities for soy through targeted plant breeding for new products and new markets.

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CEO

Minnesota Soybean Research
& Promotion Council



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Traditional Plant Breeding

What have plant breeders accomplished?

- Higher yields
- Reduced lodging
- Disease resistance in crops
- Herbicide resistance
- Higher quality (protein quality maize, pro vitamin A, high oleic sunflower and canola)
- Better taste
- Storability
- Abiotic stress (salt tolerance, drought tolerance)
- Improved plant stature (semi-dwarf wheat, dwarfing rootstock for apples)



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Traditional Plant Breeding

Canola (“Can”, “ola” for “Canada, oil, low acid”)

Canola itself is a product of plant breeding.

Canola is rapeseed with less than 2% erucic acid, a compound that gives the oil a poor flavor and possible detrimental health effects.

Plant breeders at the University of Manitoba bred rapeseed to have less than 2% erucic acid and renamed it Canola.



Traditional Plant Breeding

Tomato – harvestability

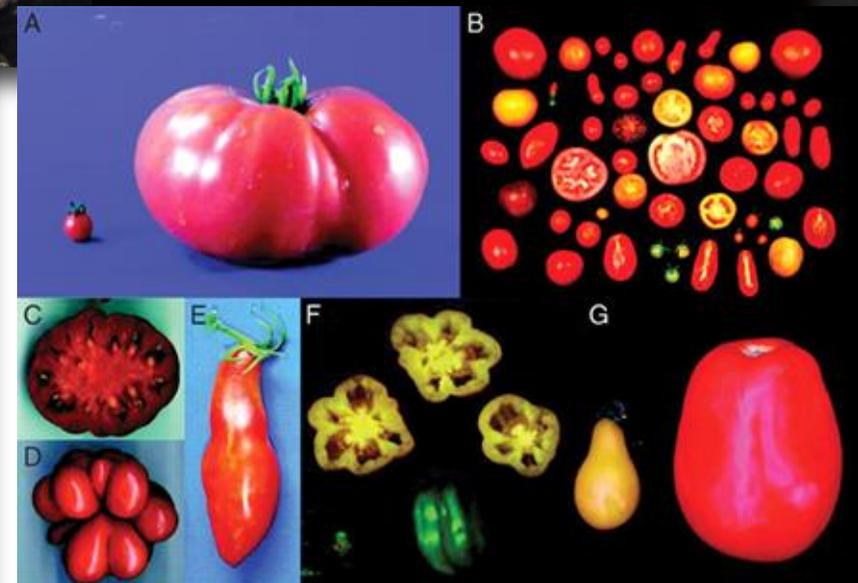
Until the 1960s, tomatoes were primarily hand harvested.

Plant breeders and engineers got together in the 1950s to simultaneously develop harvesting equipment and varieties.

Called the “square tomato”.

Facilitated machine harvest and revolutionized tomato industry.

- Tomato
- Fruit size
- Growth habit of different market classes
- Resistance to disease (e.g., leaf mold resistance transferred from wild tomato)
- Shelf life/slow ripening





Traditional Plant Breeding

The seedless watermelon is a result of creative plant breeding

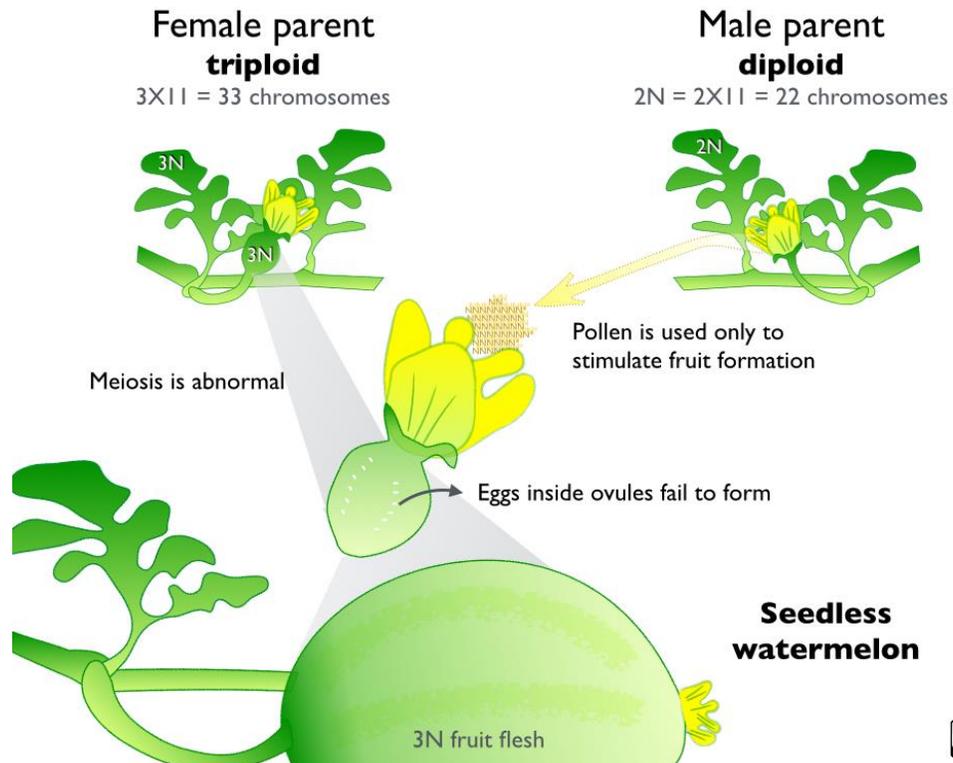
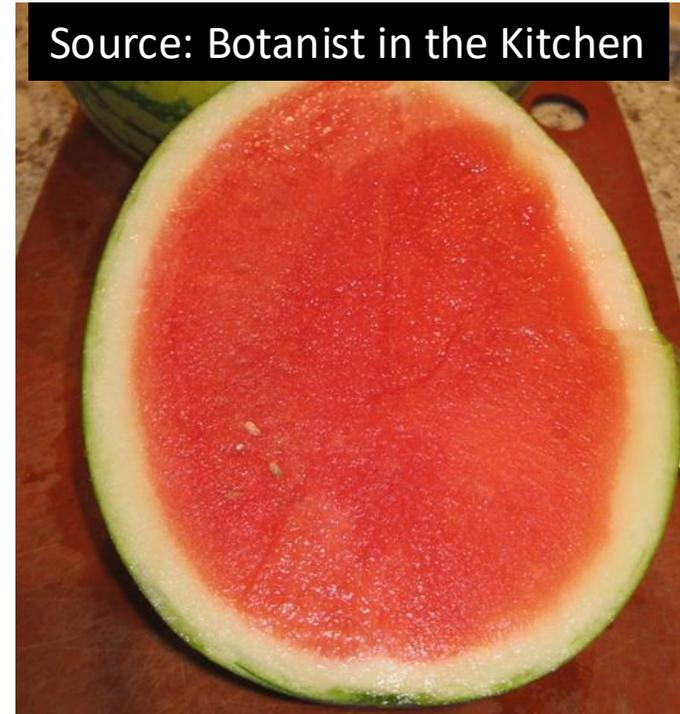


Image: Katherine A. Preston botanistinthekitchen.wordpress.com

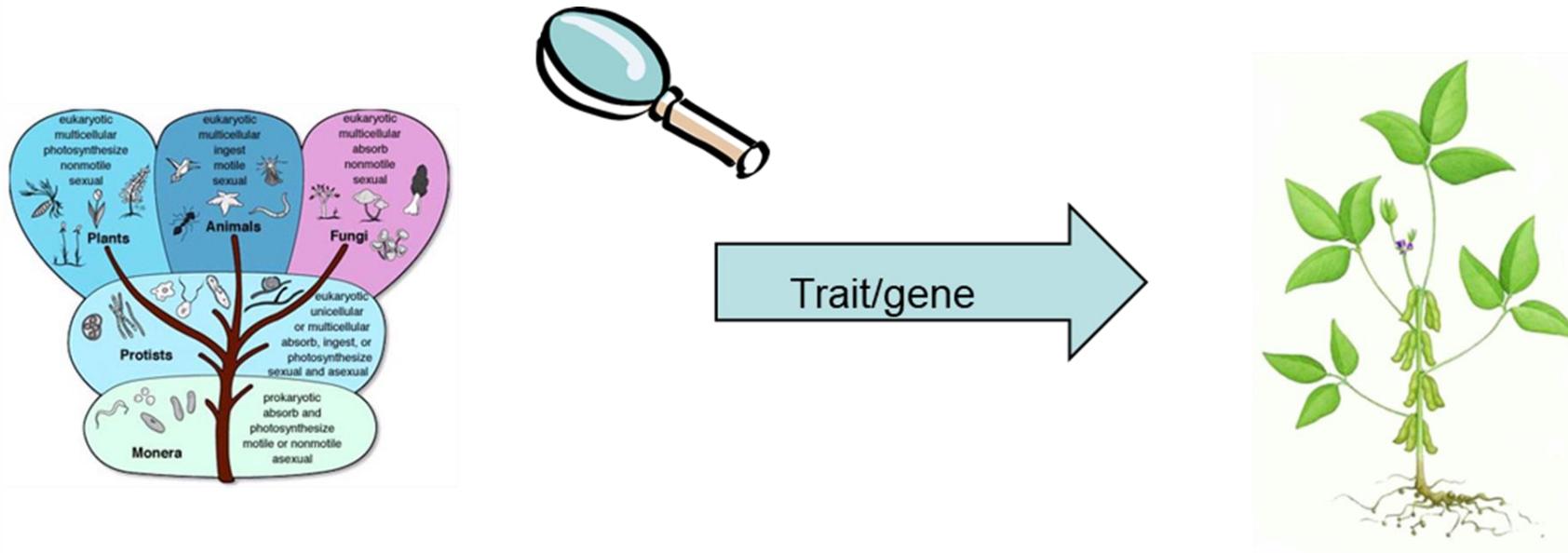


Source: Botanist in the Kitchen



Genetic Engineering

Introducing a new trait through **genetic engineering** →
Transgenic plants

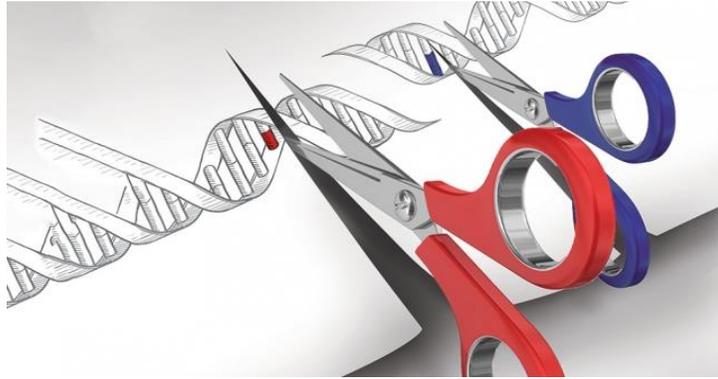


Transgenic organism -- An organism whose genome has been modified through externally applied new DNA.

Example: E3 Soybeans, BT Corn, and many more



Gene Editing



“Field of research dedicated to developing **site-directed DNA sequence modification** methodologies and applications.” Curtain et al. (2012)

Most applications currently do not involve insertion of foreign DNA but rather modify DNA in ways that could also occur in nature.

Non-browning bananas recently developed



MAY 11, 2023

Tropic's non-browning gene-edited banana cleared for production in the Philippines

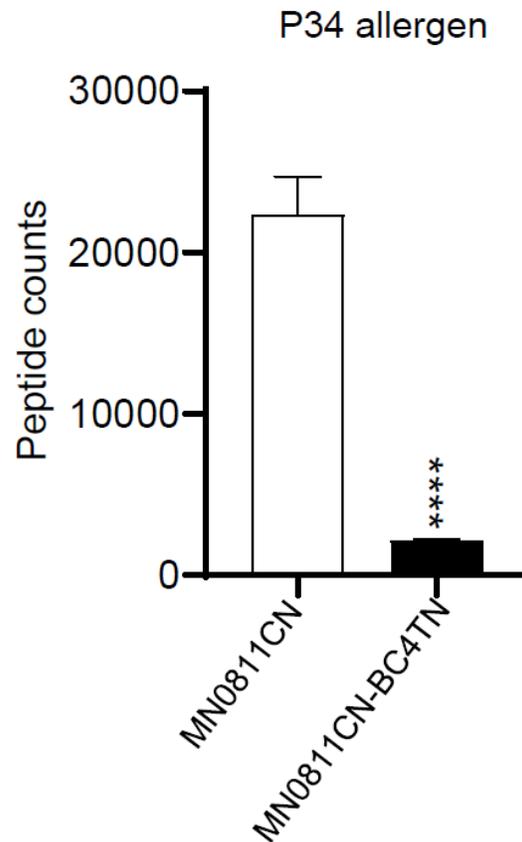


Combination of Gene Editing & Traditional Plant Breeding

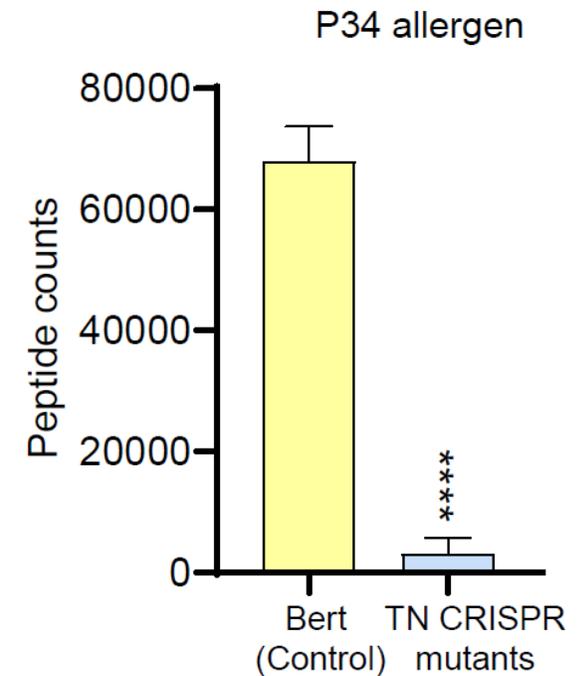
Gene editing and plant breeding can modify seed protein composition

Stupar and Lorenz UMN Labs successfully reduced Kunitz3 trypsin inhibitor and P34 allergen protein using both conventional breeding and gene editing approaches.

These applications are being used to further knock down overall trypsin inhibitor to near-zero levels.



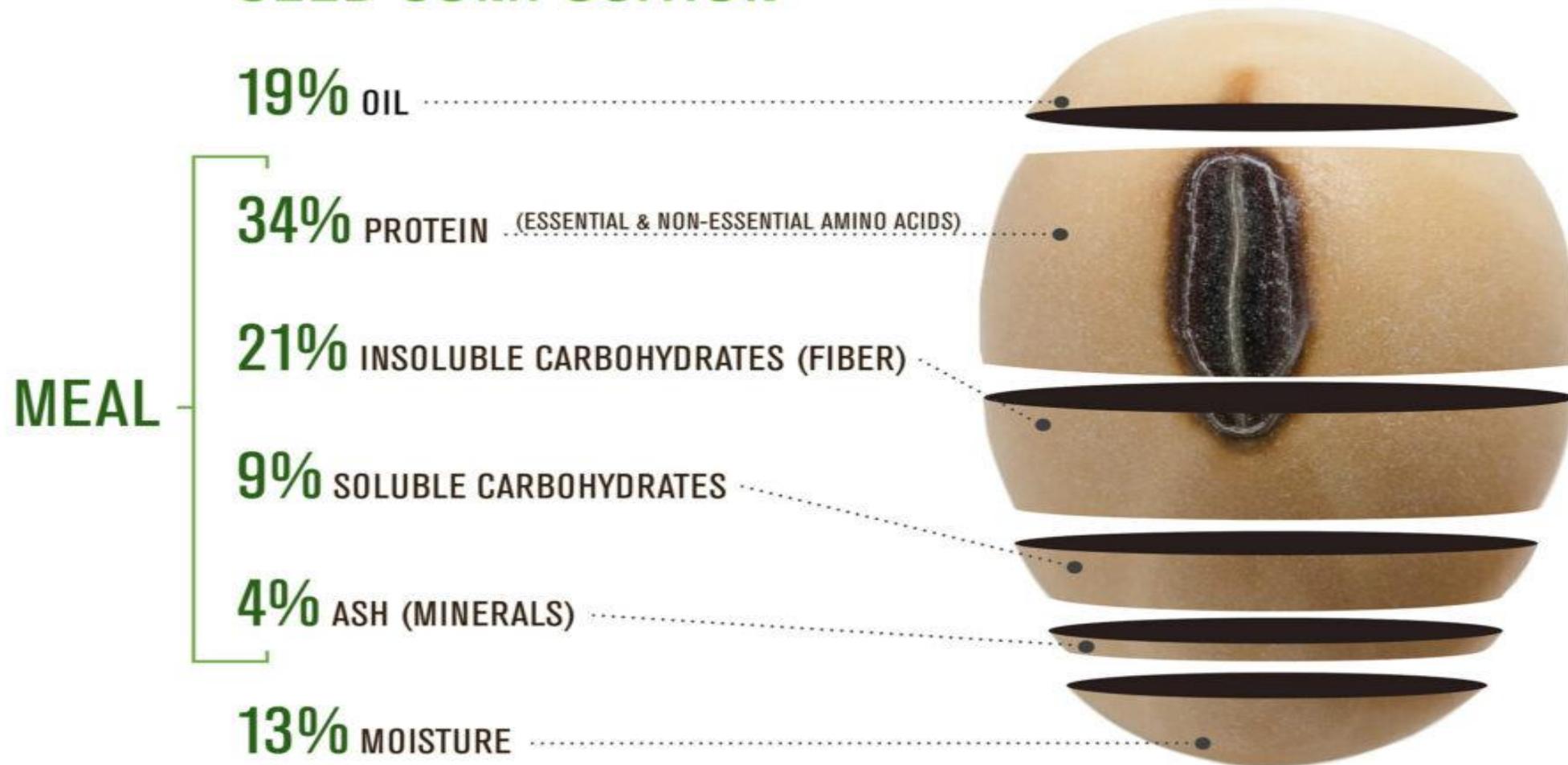
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AVERAGE SOYBEAN SEED COMPOSITION



Data as of October 2015

Novel composition materials available or under development

Trait	Stage
High oleic, low linolenic	Commercial stage
High oleic, high linolenic	Commercial stage + Pre-commercial stage
Natto- Miso-Tofu-Soymilk	Traditional plant breeding/breeder's seed/foundation seed development
Low saponins Better meat substitutions	Research / gene editing Progeny seed developed
Elevated oil	Preliminary breeding phase
Reduced P34 allergen protein	Advanced breeding stages



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Upcoming soybean varieties fulfill IP soy customer needs

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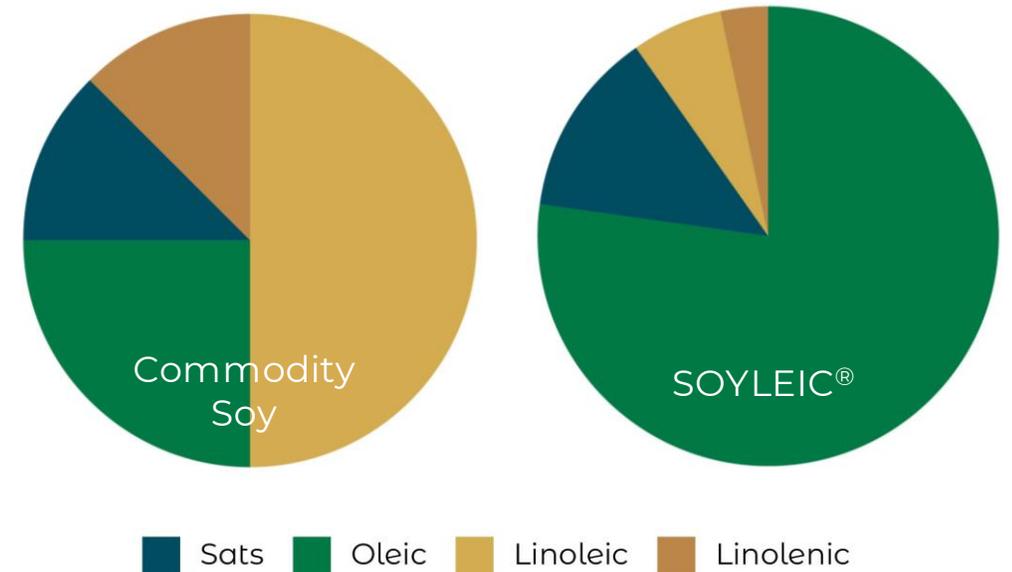
Upcoming value-added soybeans enables customers to manufacture:

- Tofu possessing extra-hard texture.
- Protein-containing sport drinks in which the protein does not settle-out.
- Tofu that can bear a “healthy” label in Japan known as FOSHU (“Food of Special Health Use”).
- Better tasting plant-based meat products (burgers).
- Multi-ingredient food products that can bear a HEALTHY label in U.S.
- Petfoods that avoid causing gas in pets.
- Foods /lozenges that reduce risk of certain cancers.
- Artificial “cheese” made from soy.
- Feed that causes swine to grow faster and produce lean meat.



SOYLEIC[®] — High Oleic Low Linolenic Non-GM Soy

- Low in saturated fat content
- 0 grams trans fat
- Superior high – heat stability
- 2.5 X Fryer Lifetime*
**Less Buildup Of “Gunk” On Fryer Surfaces*
- Neutral flavor profile
- Lower oil pick up, by items which are fried
- Extended shelf life for baked goods and snack foods
- Excellent blending oil for hard – stock oils (e.g., to make bakery shortening products)



Not all Soybean Oil is Created Equal

 **TruSoya**TM

NON-GMO HIGH OLEIC SOYBEANS

- **TruSoya**TM is the soybean oil that brings the food industry great flavor, product stability and full traceability. All while delivering a non-GMO, trans fat free solution lower in saturated fat than traditional soybean oil with higher Omega-3s than ordinary high oleic soybean oils.
- **TruSoya**TM – based tempeh is preferred by taste testers over tempeh manufactured from commodity soybeans.
- Variety Study at National Institutes of Health (NIH)
 - Elevated oleic acid and linolenic at a one-to-one ratio
 - Reducing atherosclerosis and cardiovascular disease



Developing New Industrial Uses for Soybean Products

PAINTS & STAINS



ROADS



FARM EQUIPMENT



LUBRICANTS



FLOORING



TIRES



AUTOMOTIVE



CLEANERS



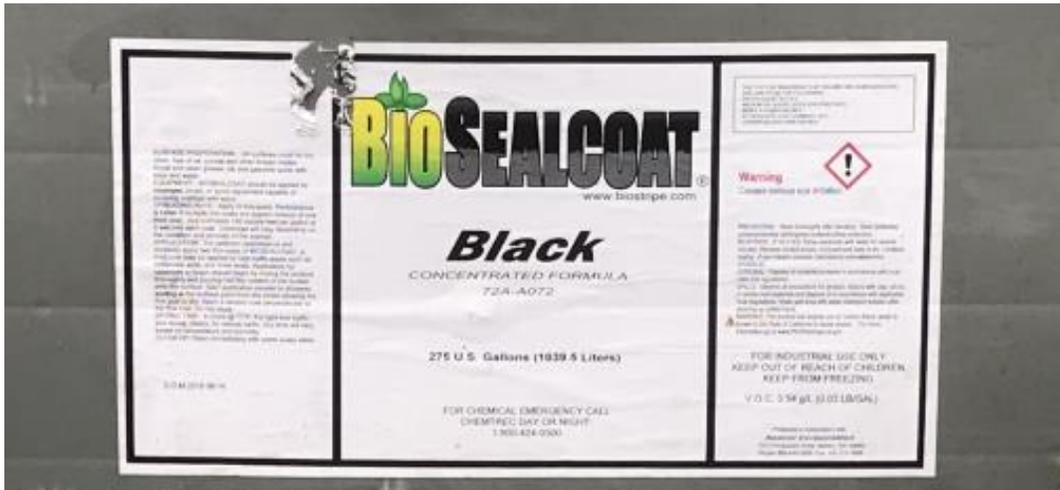
Asphalt Rejuvenates



Concrete Sealants



Asphalt Sealcoats



BioStripe



Biodiesel, Renewable Diesel and Synthetic Aviation Fuels



Biobased Artificial Turf

SYNLawn's exclusive EnviroLoc+™ Backing System is an environmentally friendly, multi-layer component system that "locks" in durable turf fibers, extending the product's life cycle. The EnviroLoc+ Backing System replaces a portion of petroleum-based polymers with biobased polymers created from sustainable resources including soybean oil. In addition to SYNLawn's iconic green soy backing, the back of every SYNLawn product with EnviroLoc+ contains a certification number and the SYNLawn logo.



Tires

GOODYEAR



Goodyear Soybean Oil Technology
Wins Environmental Achievement
of the Year Award

Belting



WCCO Belting, Inc.

Footwear



SKECHERS



OKABASHI
..... more than a shoe

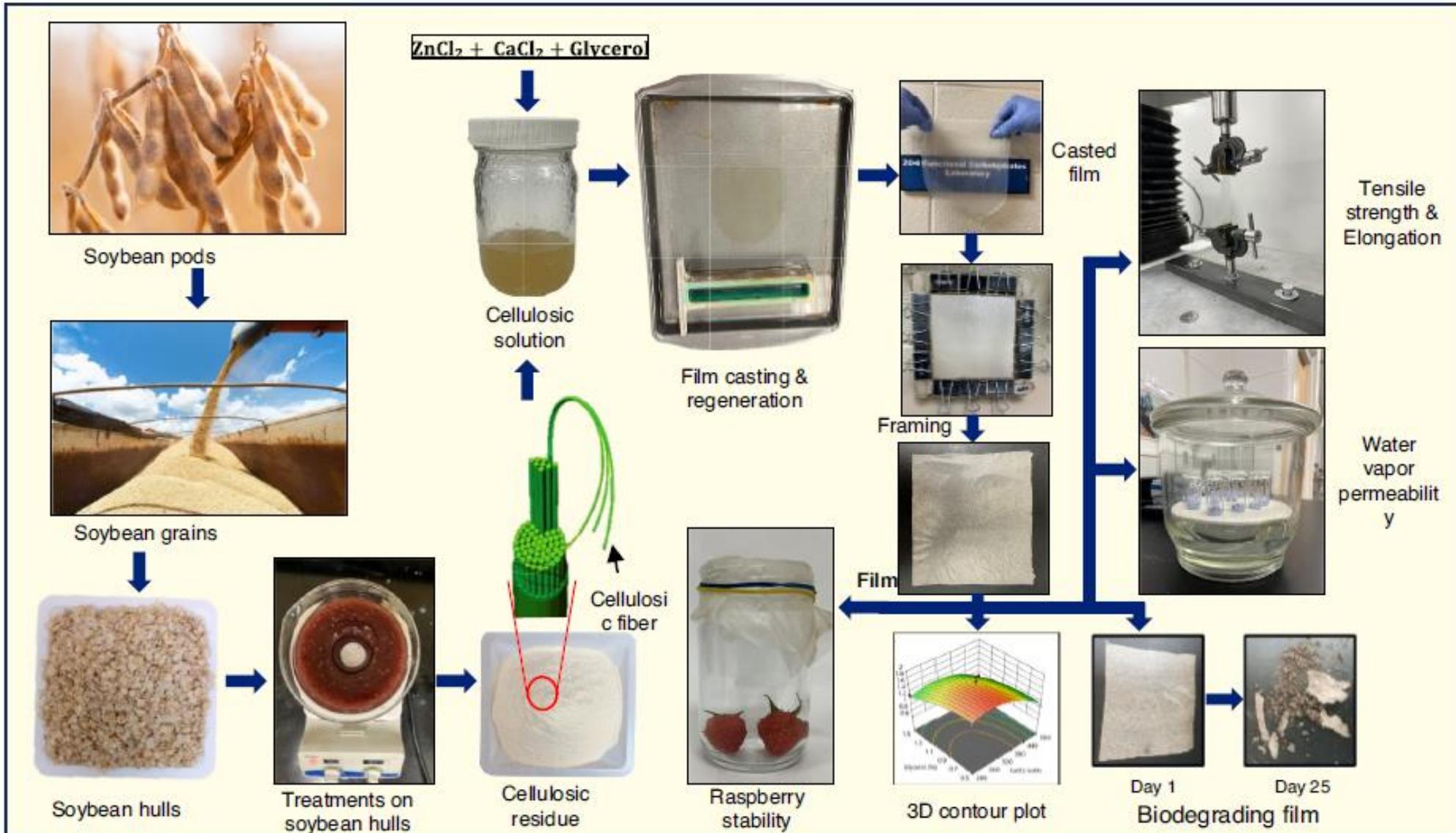
Base Oils



Vulcanized Oils



Turning Soybean Hulls into Biodegrading Films



SoyFoam Firefighting Foam



SoyFoam™ TF-1122

Cross Plains Solutions



OUR MISSION:

To create a safe & environmentally friendly firefighting foam that not only contains no PFAS but also no fluorinated chemicals, made from rapidly renewable and sustainable soybeans grown by U.S. farmers.

Soybean based fertilizers

AMINORGANIX®
SUSTAINABLE SOLUTIONS FOR GROWTH

7-1-7
Organic Fertilizer
No manures, made to FDA feed grade standards
Soybean Meal content 50%

Guaranteed Analysis	Derived from:
Total Nitrogen(N)	7.00%
7.00% Water Insoluble Nitrogen*	Soybean meal, high nitrogen poultry/livestock manure, sulfonated poultry/government/industry manure, potassium chloride, urea in carbonates
Available Phosphate (P ₂ O ₅)	1.00%
Soluble Phosph (P ₂ O ₅)	7.00%
Calcium (Ca)	2.00%
Magnesium (Mg)	3.00%
0.05% Water Soluble Magnesium Sulfate (S)	elemental sulfur, sulfur sulfate, iron sulfate, magnesium oxide, manganese sulfate, zinc sulfate, sodium molybdate
Sulfur (S)	1.00%
1.00% Combined Sulfate(S)	
0.30% Free Sulfate(S)	
Cobalt (Co)	0.0005%
Magnesium (Mg)	3.00%
Iron (Fe)	0.70%
0.30% Water Soluble Iron	17.00% slowly available nitrogen from soybean meal, hydrolyzed poultry/livestock manure, and molasses
Manganese (Mn)	0.25%
0.02% Water Soluble Manganese	
Molybdenum (Mo)	0.0005%
Zinc (Zn)	0.10%
0.10% Water Soluble Zinc	

SATISFACTION GUARANTEED
Manufactured For: Aminorganix®
3880 American Blvd W Ste 1508
Bloomington, MN 55431
800-888-8888
76371473
25 Pounds 11.34 kg
Experimental product, not for resale
Garden and Lawn Starter Fertilizer
Project supported by:
MINNESOTA SOYBEAN PROMOTION AND RESEARCH COUNCIL CHECKOFF

AMINORGANIX®
SUSTAINABLE SOLUTIONS FOR GROWTH

16-0-8
Natural Based Fertilizer
No manures, made to FDA feed grade standards
Soybean Meal content 50%

Guaranteed Analysis	Derived from:
Total Nitrogen(N)	16.00%
12.00% Urea Nitrogen	Urea, ureaformal, hydrolyzed poultry/livestock manure, sulfonated poultry/government/industry manure, potassium chloride, calcium carbonate, elemental sulfur, urea sulfate, iron sulfate
Available Phosphate (P ₂ O ₅)	0.00%
Soluble Phosph (P ₂ O ₅)	0.00%
Calcium (Ca)	8.00%
Magnesium (Mg)	0.30%
0.15% Water Soluble Magnesium Sulfate (S)	
1.00% Combined Sulfate(S)	
0.30% Free Sulfate(S)	
Cobalt (Co)	0.0005%
Iron (Fe)	0.70%
0.15% Water Soluble Iron	17.00% slowly available nitrogen from soybean meal, hydrolyzed poultry/livestock manure, and molasses
Manganese (Mn)	0.25%
0.02% Water Soluble Manganese	
Molybdenum (Mo)	0.0005%
Zinc (Zn)	0.10%
0.10% Water Soluble Zinc	

SATISFACTION GUARANTEED
Manufactured For: Aminorganix®
3880 American Blvd W Ste 1508
Bloomington, MN 55431
800-888-8888
76372473
25 Pounds 11.34 kg
Experimental product, not for resale
Lawn Fertilizer
Project supported by:
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Soybean meal as a soil amendment and fertilizer for lawn & garden applications has proven to be effective alternatives to synthetic fertilizers.

Liquid Soy based fertilizer is now under development for horticulture and controlled environment agricultural use.

**Thank you to our sponsors and cooperators for
advancing soybeans,
and for creating new markets for processed soy.**

