## Slide 1

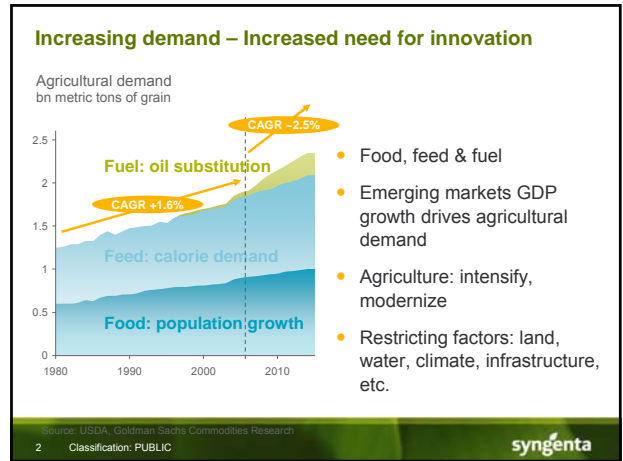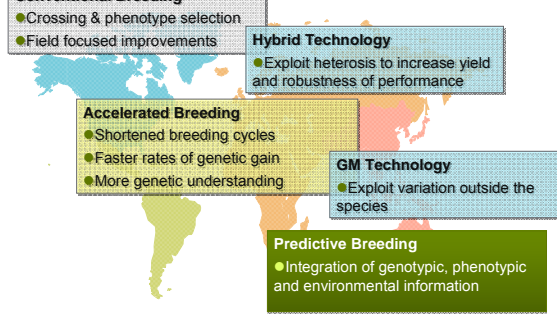**Variety traits for the future**

David Nevill
Symposium on Plant Breeding for the Future
UPOV, Geneva, Oct. 21, 2011

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## Slide 2

**Increasing demand – Increased need for innovation**

Agricultural demand
bn metric tons of grain

CAGR ~2.5%

Fuel: oil substitution

CAGR +1.6%

Feed: calorie demand

Food: population growth

- Food, feed & fuel
- Emerging markets GDP growth drives agricultural demand
- Agriculture: intensify, modernize
- Restricting factors: land, water, climate, infrastructure, etc.

2    Classification: PUBLIC

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## Slide 3

**Technologies in plant breeding**

**Conventional Breeding**
- Crossing & phenotype selection
- Field focused improvements

**Hybrid Technology**
- Exploit heterosis to increase yield and robustness of performance

**Accelerated Breeding**
- Shortened breeding cycles
- Faster rates of genetic gain
- More genetic understanding

**GM Technology**
- Exploit variation outside the species

**Predictive Breeding**
- Integration of genotypic, phenotypic and environmental information

3    Classification: PUBLIC

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## Slide 4

**New hybrid barley system: step-change in farm profitability**

Convential barley system    Hybrid barley system

**UK hybrid barley solution**
- Unique seed technology innovation
- Higher yield potential, better consistency / stress tolerance
- Requires change in agricultural practices: "Grow barley like wheat", tailored inputs
- Tailored ag input protocols, leveraging Syngenta technology breadth/expertise
- On-farm education, leveraging Syngenta sales force reach

| | | | |
|---|---|---|---|
| Farmer pays: | £750/ha | +£40/ha | £790/ha |
| Barley yields: | 7.5 t/ha | +1.5 t/ha | 9 t/ha |
| Farm profit: | £113/ha | +£132/ha | £245/ha |

ROI of 3.3 : 1

1.  Feed barley price: £115/t
2.  Variable and fixed costs included; no price / forex changes included

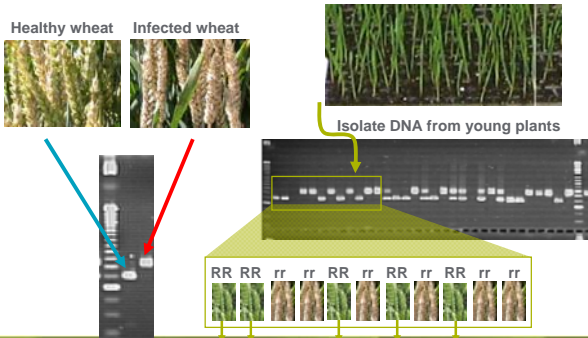4    Classification: PUBLIC

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## Slide 5

**Result**

Volume winter barley gives you exceptional yields
**Your only problem is where to put it all!**

- Highest yielding winter barley on the HGCA Recommended List 2009/10*
- 111% UK treated yield (116% in the north)
- Impressive grain quality – low screenings and high specific weight (68.5 kg/hl)
- Excellent resistance to Rhynchosporium (8) and net blotch (8) coupled with resistance to BaYMV
- Early maturity

**VOLUME**

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## Slide 6

**Marker assisted trait selection: an example in wheat**

Healthy wheat    Infected wheat

Isolate DNA from young plants

RR  RR  rr  rr  RR  rr  RR  rr  RR  rr  rr

**Selected plants**

6    Classification: PUBLIC

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## Benefits of double haploid breeding

- Double Haploid technology creates true-breeding lines in a single step
- Combined DH & molecular marker technologies result in increased rates of genetic gain.
- Facilitates multiple trait stacking/pyramiding
- Increases efficiency & probability of succesful product development
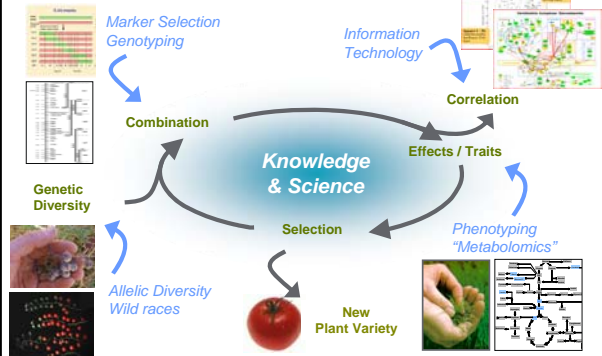- Reduces time to market
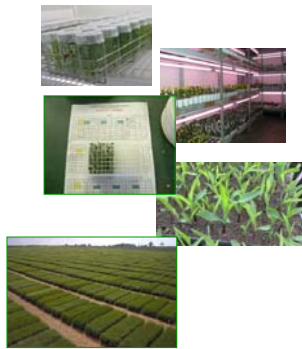
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## Modern Breeding Research
Technology integration for improved, faster product development



*Marker Selection Genotyping*

*Information Technology*

**Combination**

**Correlation**

*Knowledge & Science*

**Genetic Diversity**

**Effects / Traits**

**Selection**

*Phenotyping "Metabolomics"*

*Allelic Diversity Wild races*

**New Plant Variety**

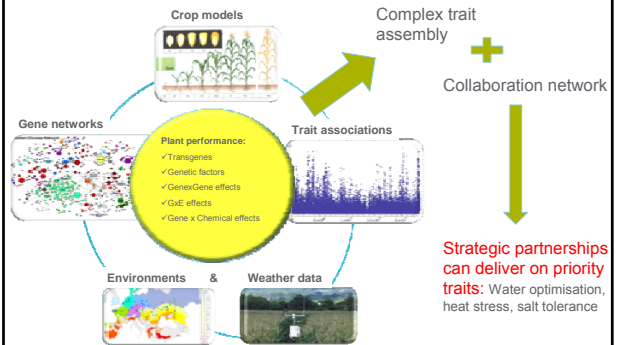syngenta

## Example : tomato fruit quality

- 300 diverse lines for candidate gene selection
- "genome-wide" genotyping
- 100 agronomic traits and metabolites scored
- Genetic analysis to find markers/genes associated to the main traits (taste, colour, texture...)
- Integration of knowledge into ongoing breeding strategies

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## Integrate complex technologies to deliver increase in crop performance – move towards predictive breeding



Crop models

Complex trait assembly

Collaboration network

Gene networks

Trait associations

Plant performance:
✓Transgenes
✓Genetic factors
✓GenexGene effects
✓GxE effects
✓Gene x Chemical effects

Environments    &    Weather data

Strategic partnerships can deliver on priority traits: Water optimisation, heat stress, salt tolerance

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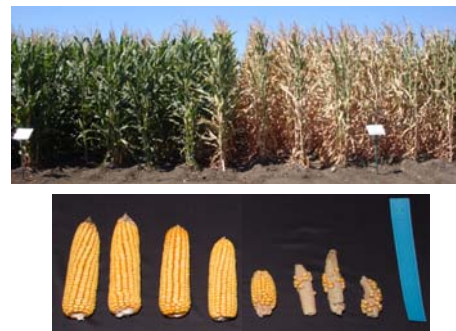## Example:  Drought - The Agrisure Artesian™ solution

- Using state of the art biotechnology and breeding capabilities...
- To deliver an innovative solution...
- Developed from the natural diversity of corn...
- That is on track to be the first to market drought tolerance product for farmers

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## Benefits of Agrisure Artesian™ technology

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## Example: Insect Management - Agrisure Viptera™



Agrisure Viptera
trait stack
N77P-3111 Brand

Agrisure® GT
N78B-GT Brand

Agrisure 3000GT
N77P-3000GT Brand

PHI-33M57
Herculex®

DKL 68-05
Genuity™ VT
Triple PRO™

**Location:** Clarkton, NC – Bob Milholland – Board Level Agrisure Viptera Experience

Herculex® is a trademark of Dow AgroSciences, LLC.
Genuity™ and VT Triple PRO™ are trademarks of Monsanto Technology LLC.

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## Example Biofuels:  Enogen Benefits In Corn Ethanol

Enogen corn contains a bacterial amylase gene which results in:
- Higher ethanol output (gal/mo)
- Reduced water and energy use
- Increased process flexibility
- Reduced maintenance cost
- Reduced environmental footprint
- Chemical savings

*Greater productivity and sustainability*

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## Example: Delicious Melons

Understand plant production

Understand the fruit

Understand flavor

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## Example: Healthy and Colorful Lifestyle

Salads that are fresh and nutritious when they reach your home

Flowers with new deeper colors that last longer and survive better

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## Summary

- The Plant breeder has novel tools which enhance his/her ability to deliver novel products

**HOWEVER**

- The demands of the world population not only increase but there is a paradigm shift to quality and sustainability

**THEREFORE**

- We need two levels of integration:
  - A focus on production systems, where agronomy leverages the benefits of plant genetics and crop protection
  - Open collaboration where knowledge networks ensure that we share and build our capabilities through public private partnerships

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## Thank you very much !

*Bringing plant potential to life*