

# *Agricultural seeds towards future sustainability*

Johannes Kotschi

## *Setting the scene*

### *Agriculture at a crossroads - main challenges*

- Sustainable use of resources (energy, nutrients)
- Maintaining landscapes and their ecosystem services
- Production increase for growing populations
- Agricultural adaptation to climate change



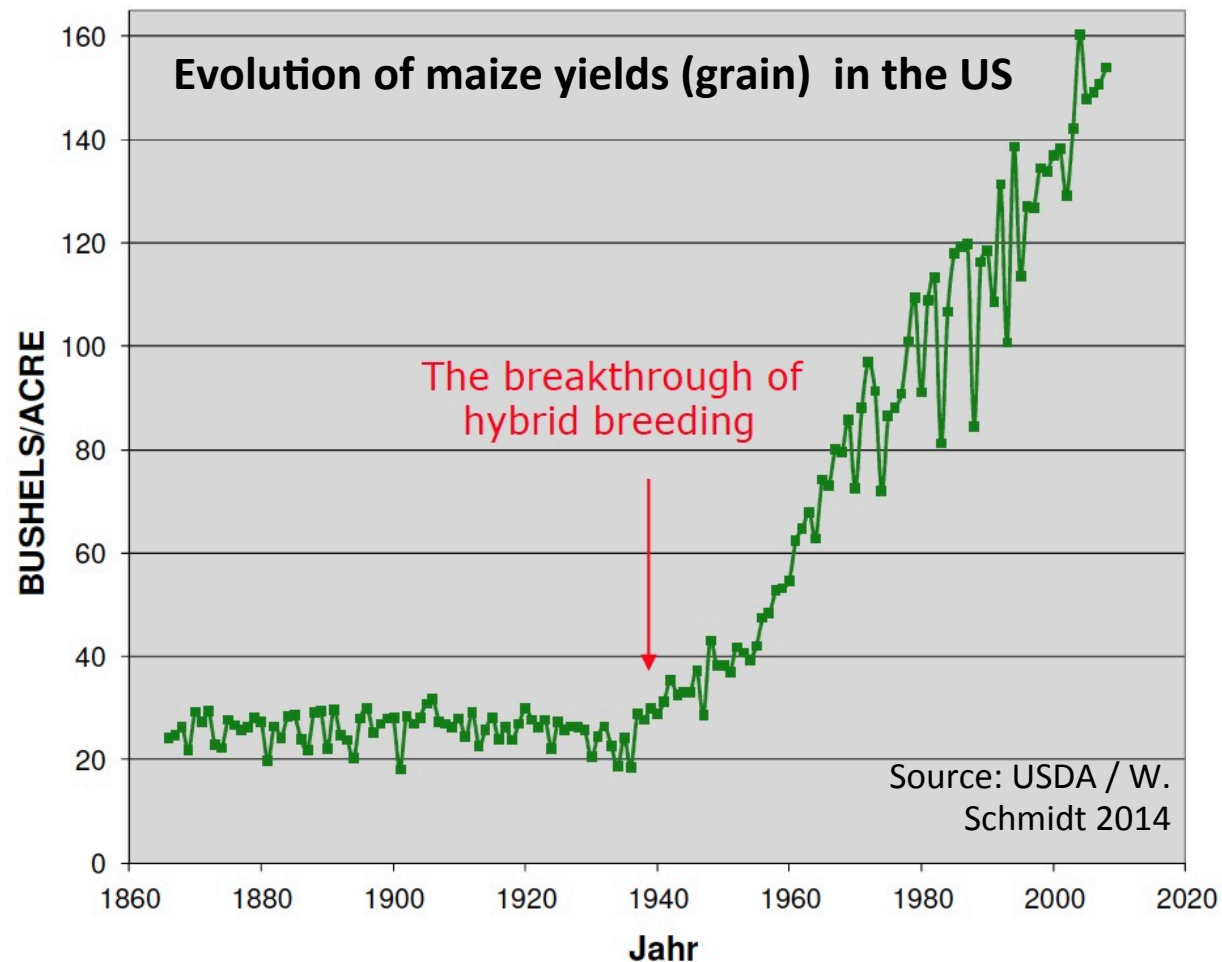
Sustainable and Intensified production  
Ecological agriculture



Implications for seeds?

## Setting the scene

### Focus on plant breeding



- Scientific plant breeding of the past 100 years has been very successful in intensifying agriculture

At the same time

- Enormous losses of genetic diversity – interspecific and intraspecific
- Limited access to seeds due to privatisation and market concentration

## *Constraints*

### *Privatization*

#### **Technological barriers**

- Hybrid breeding / Cytoplasmatic Male Sterility

#### **Legal regulations**

- Patents
- Plant Variety Protection



# 2012 MONSANTO TECHNOLOGY/STEWARDSHIP AGREEMENT

(Limited Use License)

Form Number  
120234296

PLEASE MAIL THE SIGNED 2012 MONSANTO TECHNOLOGY/STEWARDSHIP AGREEMENT TO: Grower Licensing, Monsanto, 622 Emerson Road, Suite 150, St. Louis, MO 63141

## GROWER INFORMATION (please print)

Please complete this section with your business information. To sign this Monsanto Technology/Stewardship Agreement ("Agreement") you must be the **operator/grower** for all fields that will grow plants from Seed (as defined below). You represent that you have full authority to and do hereby bind to this Agreement yourself, all entities for which you obtain Seed, all individuals and entities having an ownership interest in any entities for which you obtain Seed, and that

Monsanto Company has not barred any of those individuals or entities from obtaining this limited-use license. Your name must be filled in and must match the signature below. This Agreement becomes effective if and when Monsanto issues the Grower a license number from Monsanto's headquarters in St. Louis, Missouri. Monsanto does not authorize seed dealers or seed retailers to issue a license of any kind for Monsanto Technologies.

Please check one of the following:

NEW LICENSE ☐

RENEWAL ☐

Grower's Full Legal Name (First/Middle/Last) ☐ Dr. ☐ Mr. ☐ Mrs. ☐ Ms. ☐ Suffix (Sr, Jr, II, III) ☐

Grower's Mailing Address (no P.O. Boxes) ☐

Grower's City ☐

State ☐

Zip ☐

Area Code ☐

Home Phone ☐

Fax ☐

Area Code ☐

Cell Phone ☐

Email ☐

Farm Business Name ☐

Farm Physical Address (as listed with the FSA) ☐

Farm City ☐

State ☐

Zip ☐

Last Four of Social Security # ☐

Role ☐

☐ Operator

☐ Owner/Operator

☐ Farm Manager

☐ Other

If the above information changes, Grower agrees promptly to notify Monsanto of the changes by calling the Grower Licensing Team at 1-800-768-6387, Option #3.

## SEED SUPPLIER

Business Name ☐

Area Code ☐

Phone ☐

City ☐

State ☐

Zip ☐

THIS SPACE FOR MONSANTO OFFICE USE ONLY, PLEASE LEAVE THIS SECTION BLANK:

Lic. #: ☐

Batch #: ☐

Date: ☐

This Monsanto Technology/Stewardship Agreement is entered into between you ("Grower") and Monsanto Company ("Monsanto") and consists of the terms on this page and on the reverse side of this page.

This Monsanto Technology/Stewardship Agreement grants Grower a limited license to use Genuity® Bollgard II® cotton, Genuity® Bollgard II® with Roundup Ready® cotton, Genuity® Bollgard II® with Roundup Ready® Flex cotton, Genuity® Roundup Ready 2 Yield® soybeans, Genuity® Roundup Ready® Canola, Genuity® Roundup Ready® Alfalfa, Roundup Ready® Corn 2 corn, Roundup Ready® Cotton, Genuity® Roundup Ready® Flex cotton, Roundup Ready® Soybeans, Genuity®

• To implement an Insect Resistance Management ("IRM") program as specified in the applicable Genuity® Bollgard II® cotton, Genuity® corn and YieldGard® corn sections of the most recent IRM Grower Guide and to cooperate and comply with these IRM programs.

• To acquire Seed containing these Monsanto Technologies only from a seed company with technology license(s) from Monsanto for the applicable Monsanto Technology(ies) or from a licensed company's dealer authorized to sell such licensed Seed.

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"...limited license to use..."

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Grower's Full Legal Name (First/Middle/Last) ☐ Dr.

Grower's Mailing Address (no P.O. Boxes)

Grower's City

Area Code Home Phone

Area Code Cell Phone

If the above information changes

Business Name

City

THIS SPACE

Lic. #:

- no saving the seed
- no re-planting the seed
- no sharing the seed
- no breeding with the seed
- no research on the seed
- one time use solely for planting
- grower permits access to land
- grower permits access to records
- grower permits access internet records

Source: Kloppenburg 2015

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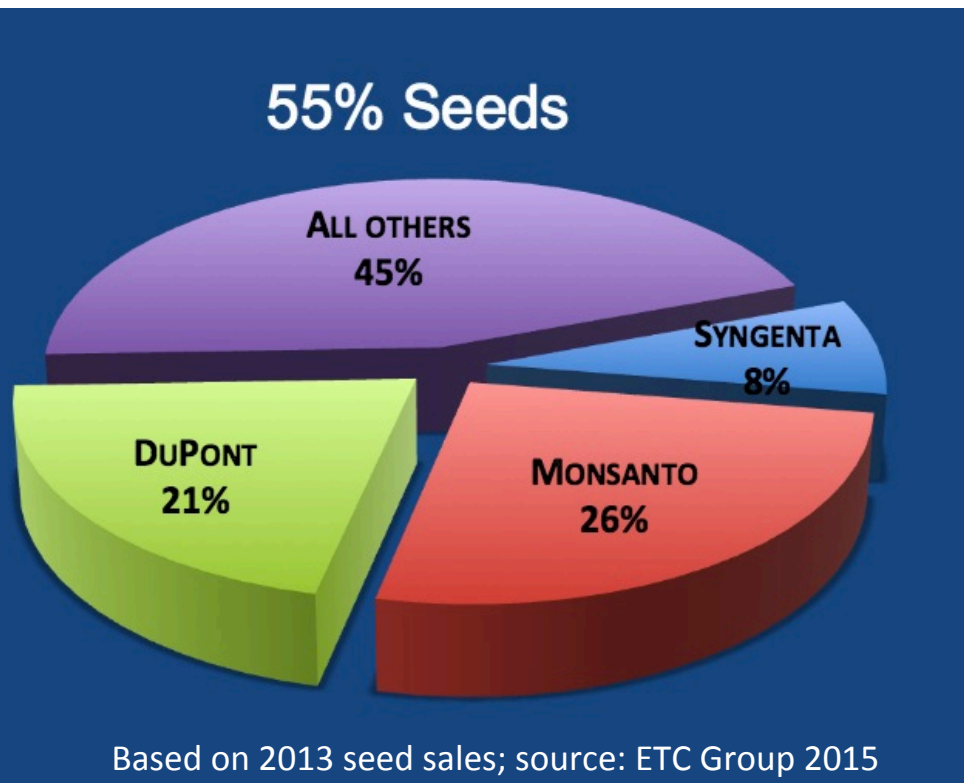
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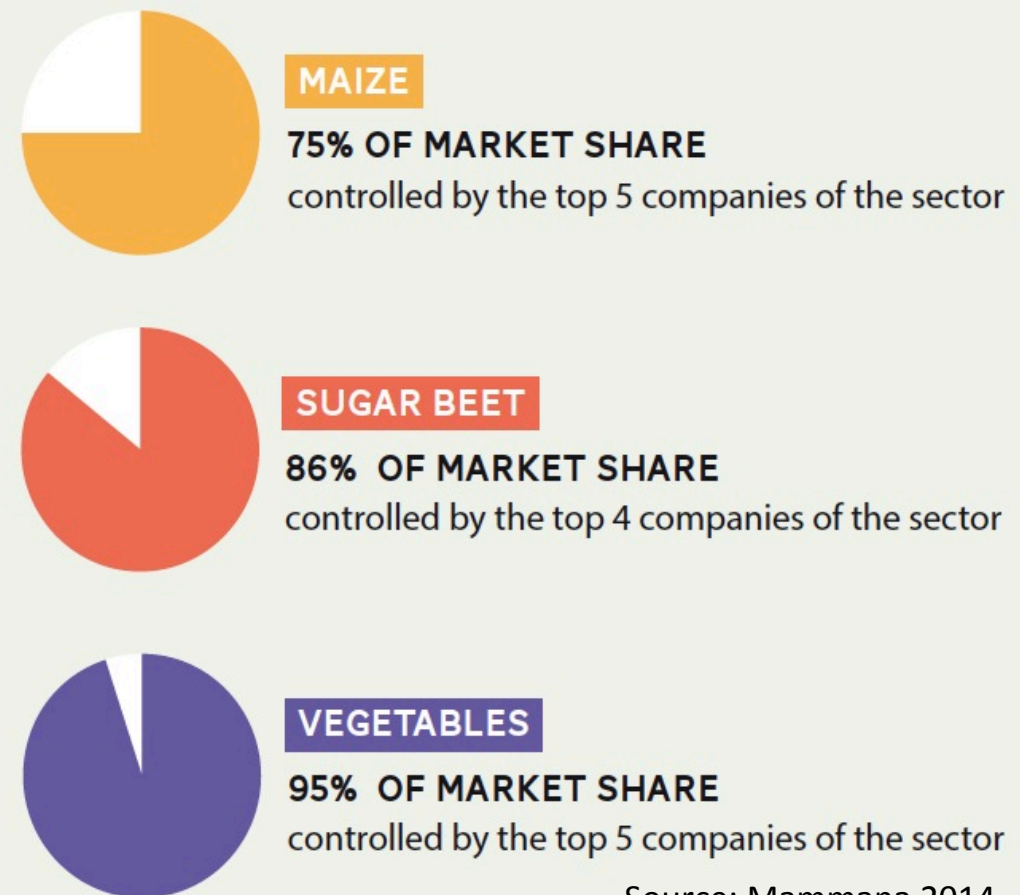
## Constraints

### Market concentration

#### Global commercial seed sales



#### Market share on commercial seeds in the European Union



Source: Mammana 2014

## *Crop variety supply*

### **Present variety supply neglects important farming potential**

- Varieties for cropping under optimal growing conditions with high input
- Large scale propagation (economies of scale)

### **More crop varieties are required**

- to enable farming under difficult or even marginal environmental conditions.
- to intensify smallholder agriculture in rural areas
  - contributing substantially to food security and food supply (an estimated 40 – 50%).
  - providing a livelihood for approximately 40% of the global population



## *Implications*

- Region-specific adapted varieties instead of mass-products
- Breeding of a larger number of crop-species
- Manifold breeding objectives that meet the various challenges to sustainability
- This results in a broad, diverse and small-scale variety development

## *Ideas for innovation*

- Breeding objectives
- Technology
- Finance
- Organisation
- Legal Aspects



## Objectives

# *Plant breeding for new cropping systems and of neglected crops (examples)*

Maize /Beans  
Suitability for intercropping



Photo: W. Schmidt



Minor Millets  
(Setaria Italica)  
Drought tolerance

Protein rich minor crops  
yield improvement



Amaranthus caudatus



## Objectives

### *Breeding for resistance against fungal disease - example wheat -*

Yellow rust (*Puccinia striiformis*)



Common bunt, (*tilletia caries*)

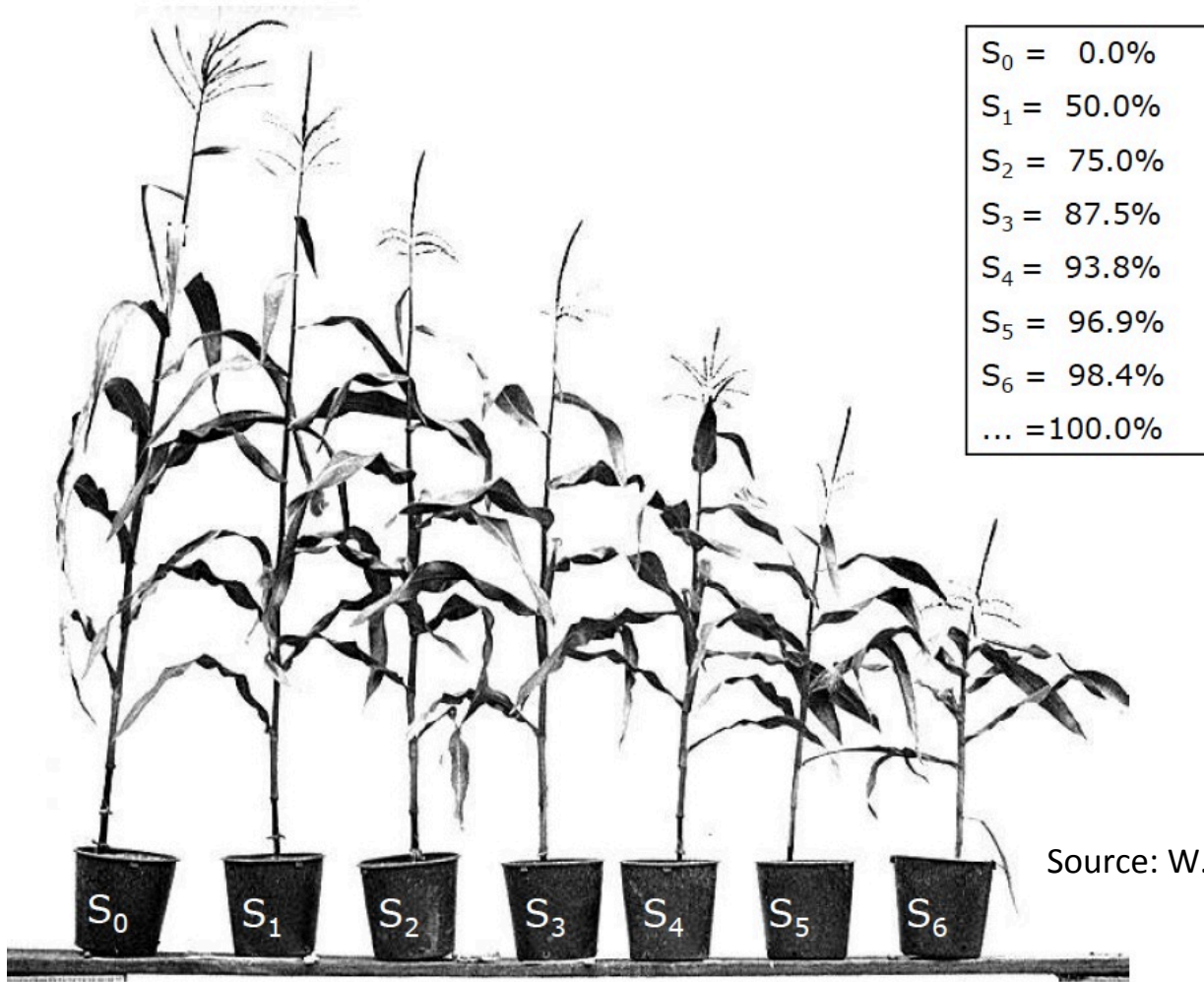




## Technology

# Hybrid breeding for maize has been very successful

Homozygosity increases with continued inbreeding



Source: W. Schmidt 2014

Ears of a Hybrid and its inbred parents





## Technology

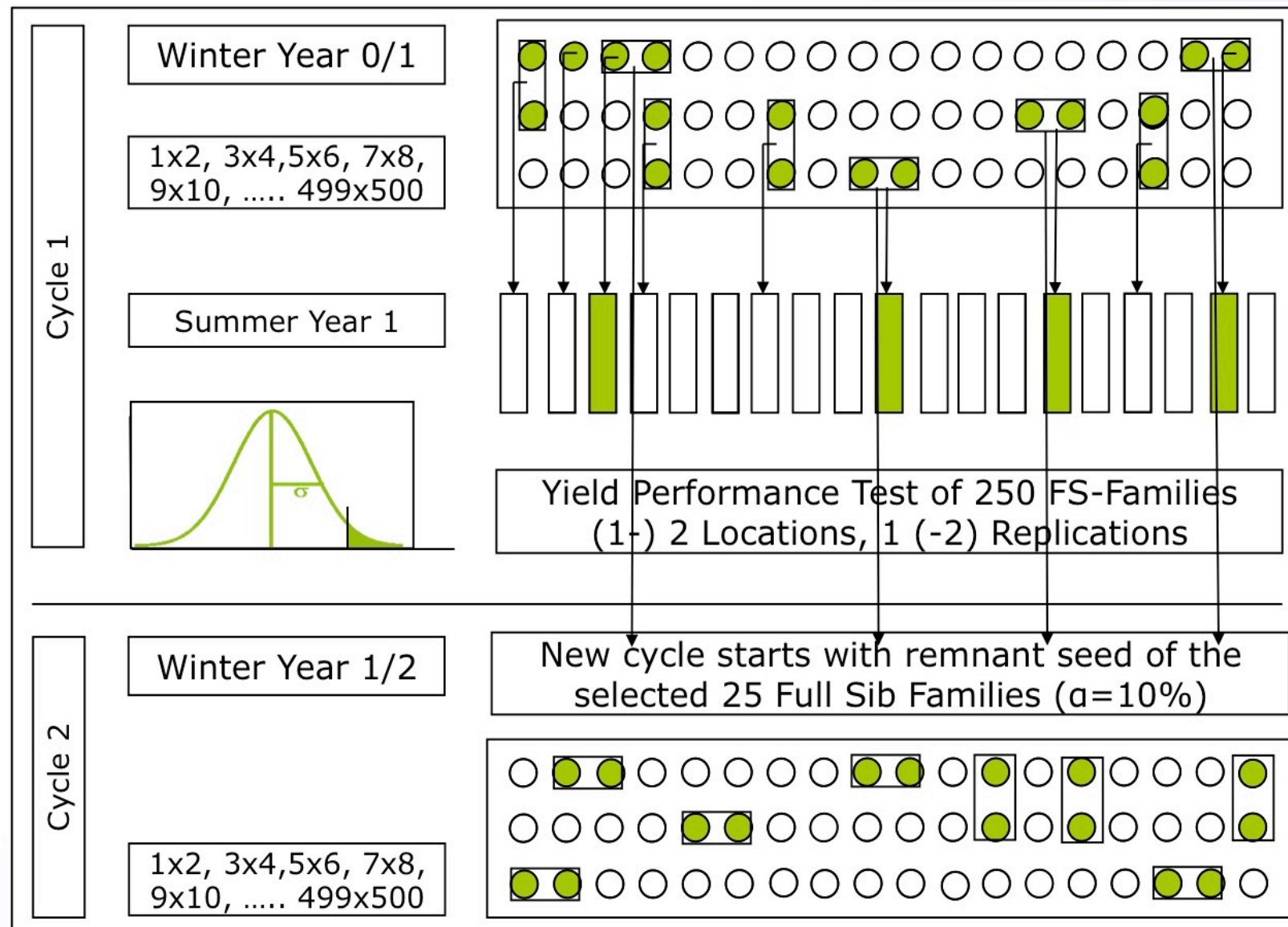
### Maize hybrid variety – plants are genetically identical



Source: W. Schmidt 2014

## Technology

### *Full sibling selection - superior to hybrids?* (one cycle completed within one year)



Source:  
W. Schmidt 2014



## Technology

### *Advantages of population breeding to classical hybrid breeding*

#### Farmer's sources of seeds in 6 African countries

| Seed-source*                   | % of seed |
|--------------------------------|-----------|
| Own Stock                      | 29.9      |
| Friend, neighbour,<br>relative | 8.6       |
| Local market                   | 50.9      |
| Agro-dealer                    | 2,4       |
| Other (NGO, Gov.<br>etc.)      | 8.2       |

- Three key crops.  
Survey 2009-2012; Sperling and McGuire 2013

- Same or even higher breeding progress with same input
- The seed is „open-source“; farm-saved seed can be used at any stage
- A high degree of genetic diversity (heterogeneity) is maintained

## Finance

### *How can it be financed?*

- Region-specific adapted varieties instead of mass-products
- Breeding of a larger number of crop-species
- Manifold breeding objectives that meet the various challenges to sustainability
- This results in a broad, diverse and small-scale variety development

## Finance

### *New financing concepts are necessary*

#### **Who pays for seeds?** Thoughts on financing organic plant breeding

Johannes Kotschi  
Johannes Wirz

Marburg / Dornach  
May 2015



- Royalties are insufficient
- Plant breeding – a public task

#### **Options:**

- Include whole value chain in funding
- Engage governments and civil society
- Create financial platforms to coordinate funds (e.g. the Seed Fund in Germany)
- Crowd-funding



## *Organisation*

### *Public and non-profit breeding – complementary to the private sector*

- Return to public breeding
- Organize breeding in CSO - in associations, foundations and informal networks (non-profit oriented)
- Seek close collaboration between breeders and farmers (participatory plant breeding)

## Legal Innovation

### *Open-Source Licensing – more than a legal alternative*

- Protect genetic resources against privatisation with copyleft,
- Create a pool of seeds commons as a second pillar next to the private seed pool,
- Stimulate plant breeding by numerous initiatives beyond the monopolized private sector



*Thank You!*

**Further Reading:**

ETC Group. 2015. Mega Mergers in the Global Agricultural Inputs Sector.

Kotschi and Wirz., 2015. Who pays for seeds?

Kotschi and Minkmar. 2015. Liberating seeds with open source licenses.

Schmidt. 2014. Maiszüchtung.

Mammana. 2014. Concentration of market power in the EU seed market.

Sperling and McGuire 2013. Integrating Seed Systems

Kotschi. 2010. Reconciling Agriculture with Biodiversity and Innovations in Plant Breeding.

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