Lessons learnt from a transAtlantic comparison

Jack Heinemann
Professor, School of Biological Sciences and Director, Centre for Integrated Research in Biosafety
University of Canterbury

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Goals

= More *nutritious and tasty* food

= From less land

= Fewer exotic pesticide and fertilizer inputs

= Less water input

= Less carbon output

How do we do it?

Has GM already done it?

Nina Fedoroff: "The science is quite clear" on the benefits of GM crops.

"The reason farmers turn to genetically modified crops is simple: yields increase and costs decrease."

Comparative analysis of North America vs. Western Europe

= Same hemisphere

= Same latitudes

= Equal access to advance biotechnologies

= Elite germplams

= Mechanised and educated sector


International Journal of Agricultural Sustainability

Sustainability and innovation in staple crop production in the US Midwest

DOI: 10.1080/14735903.2013.806408

Jack A. Heinemann[ab*], Melanie Massaro[bc], Dorien S. Coray[ab], Sarah Zanon Agapito-Tenfen[bd] & Jiajun Dale Wen[e]

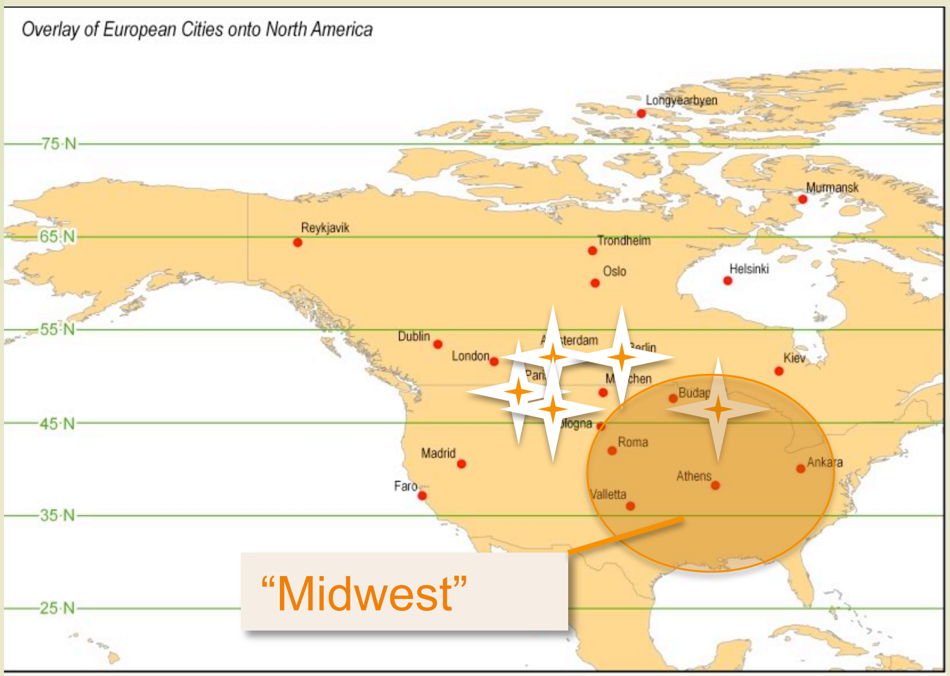
Preview

View full text

Download full text

Open access

Publishing models and article dates explained
Published online: 14 Jun 2013



Country vs field scale

Country comparisons	Meta analysis
Potentially benefits from long term big scale measures providing statistical strength	Potentially assembles strong statistical power from robust side by side comparisons
Lacks replication because only one Earth	Tend to be short term, small scale studies of variable input data (eg, farmer surveys mixed with measures of yield)
	In practice, have excluded most robust individual studies that contradict conclusions

http://rightbiotech.tumblr.com/post/103665842150/correlation-is-not-causation

http://www.inbi.canterbury.ac.nz

The story of maize

Low germplasm biodiversity

Depleted soils requiring high external inputs

Reduced farmer contribution/power

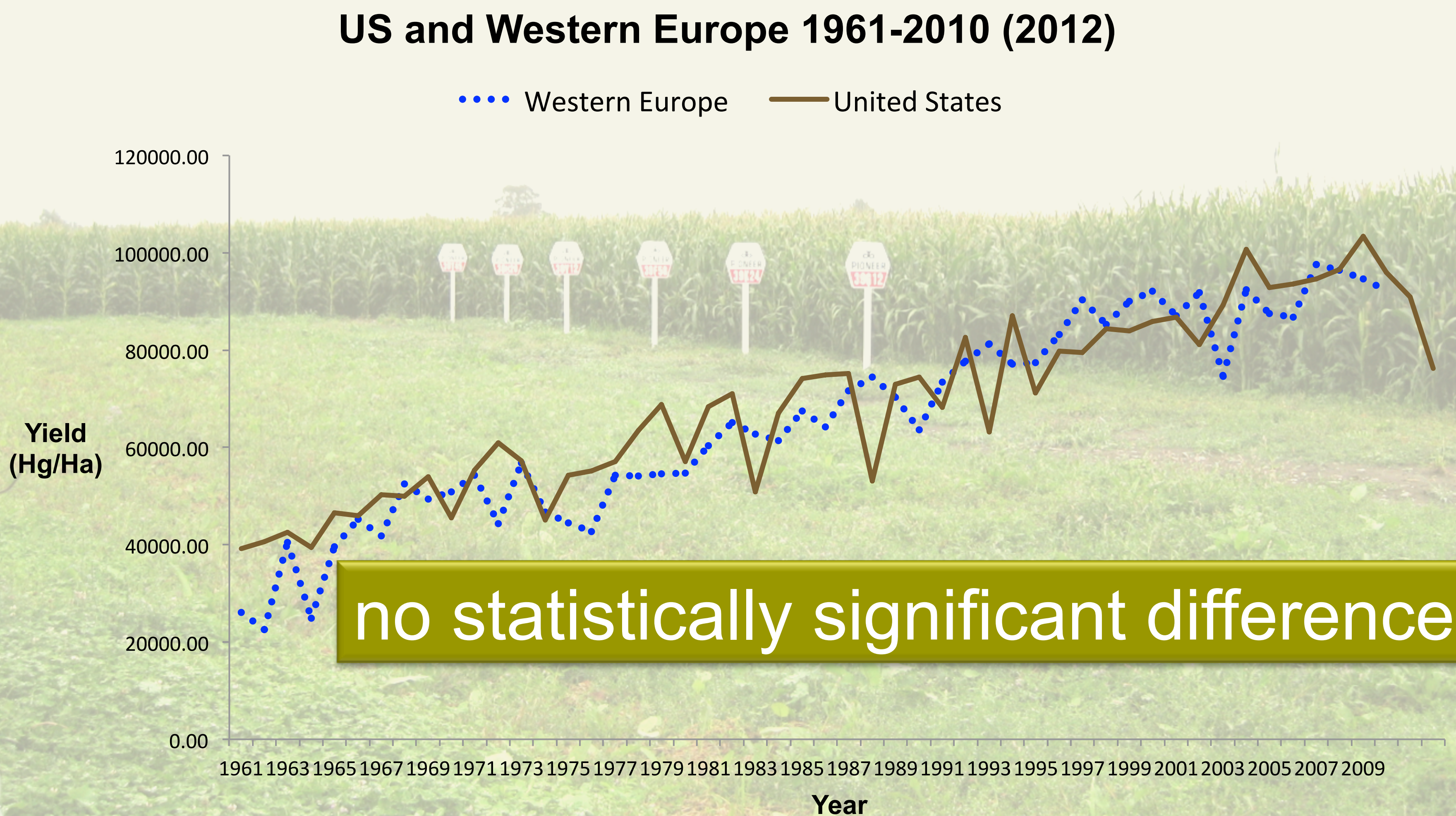
Reducing farmer choice

High pesticide use

Concentration of breeder power

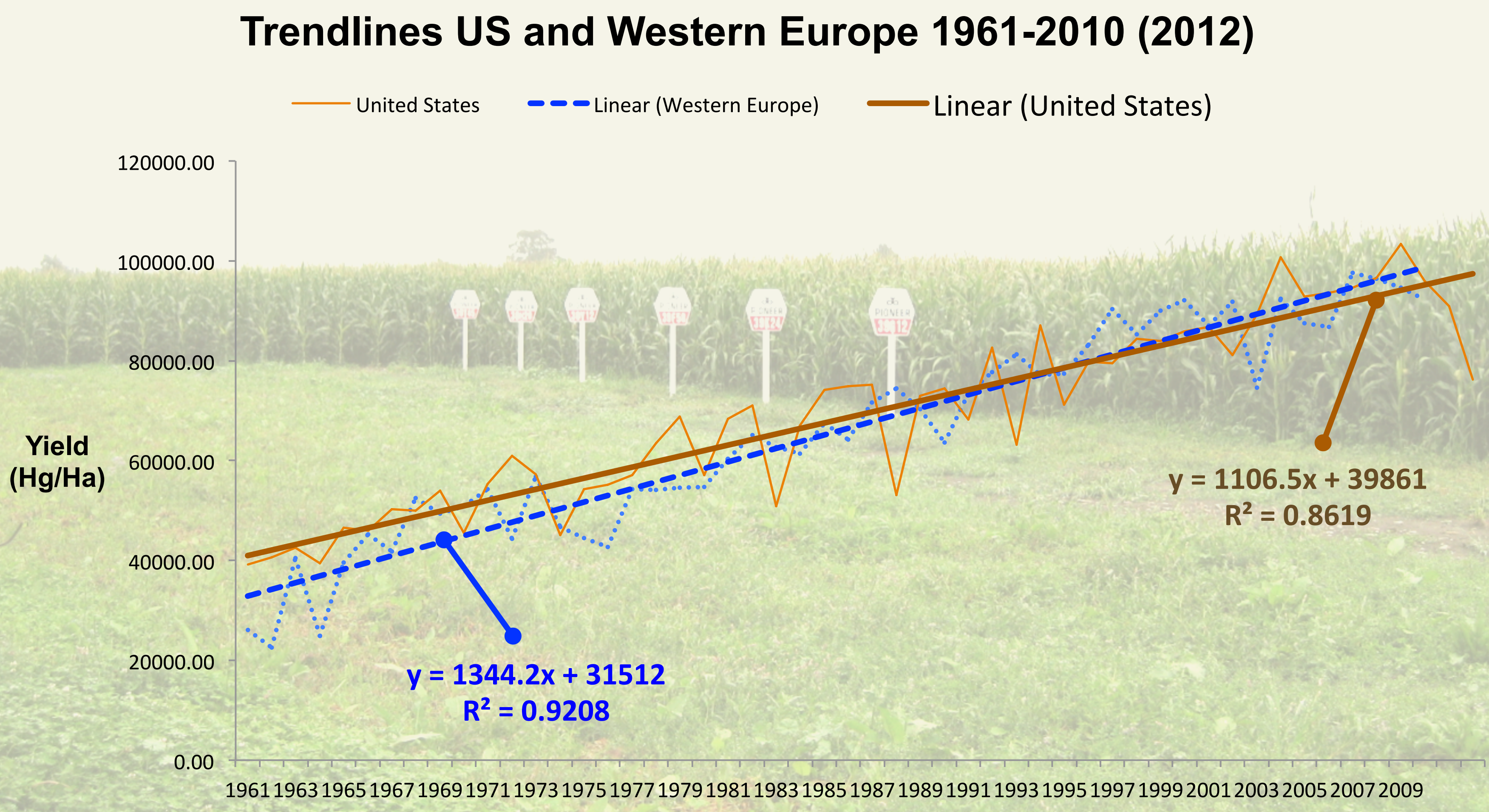
How did we get here?

Maize yield comparisons



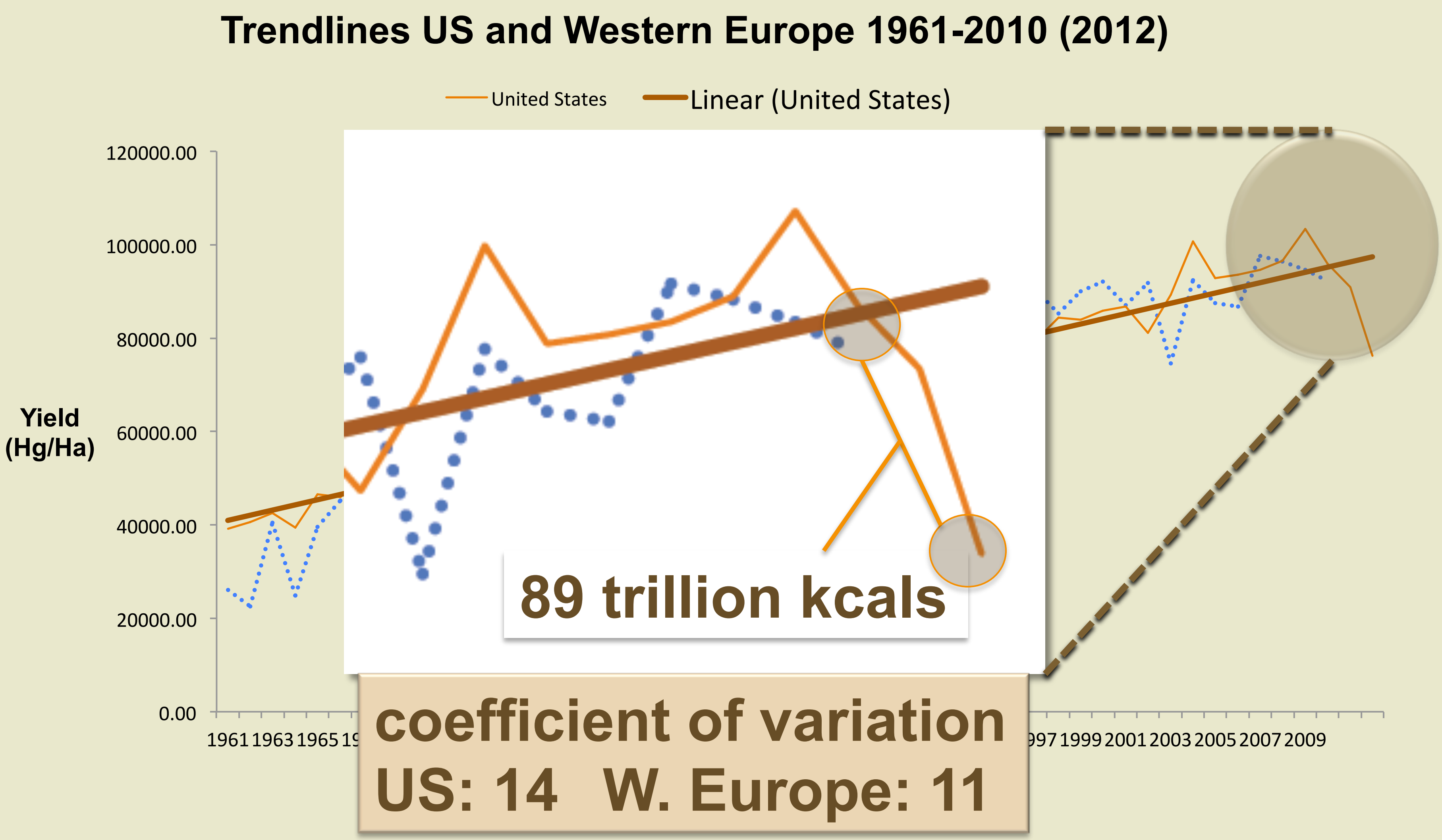
no statistically significant difference

Projected maize yield increases

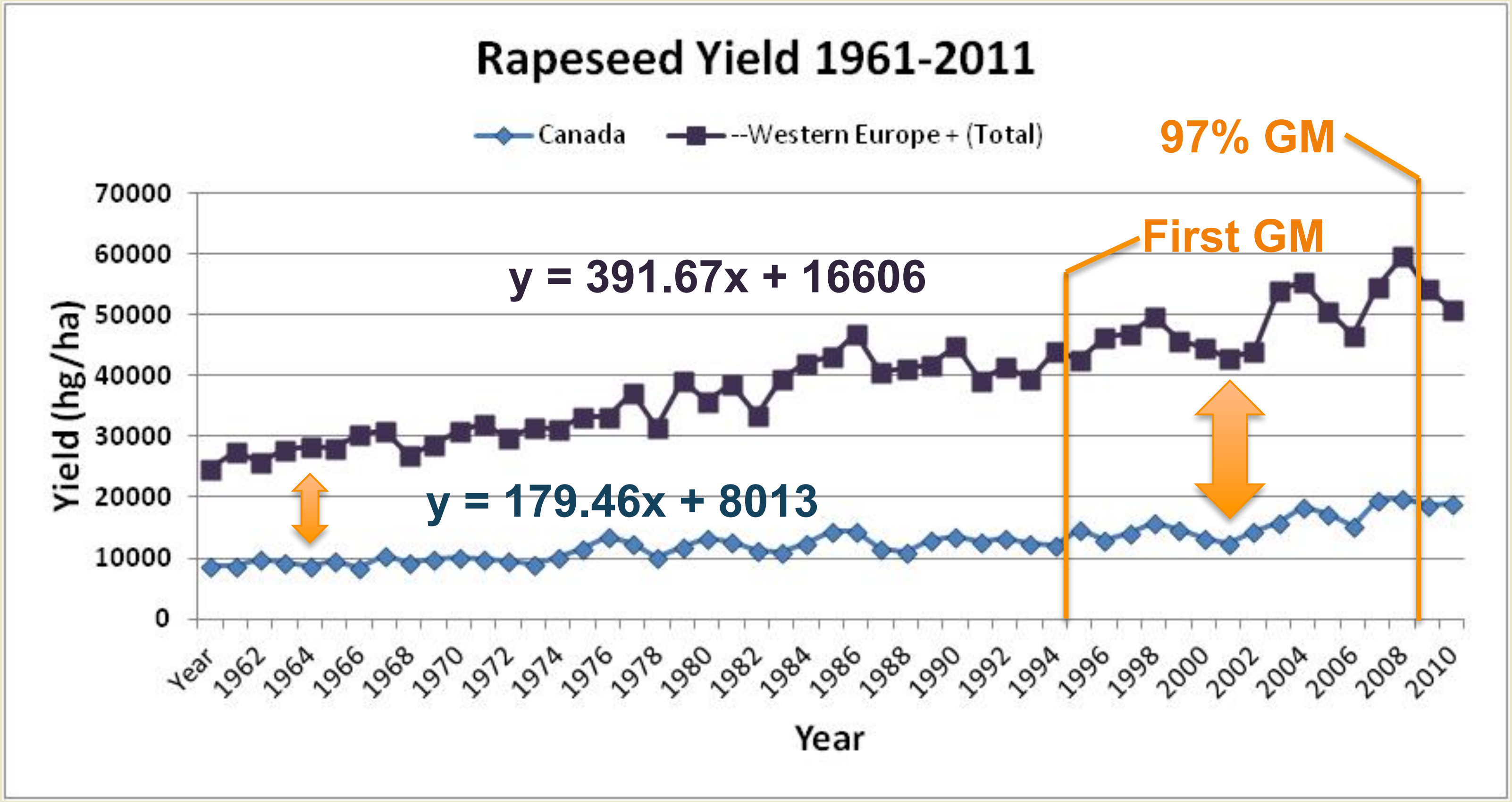


Europe outpacing US on projections

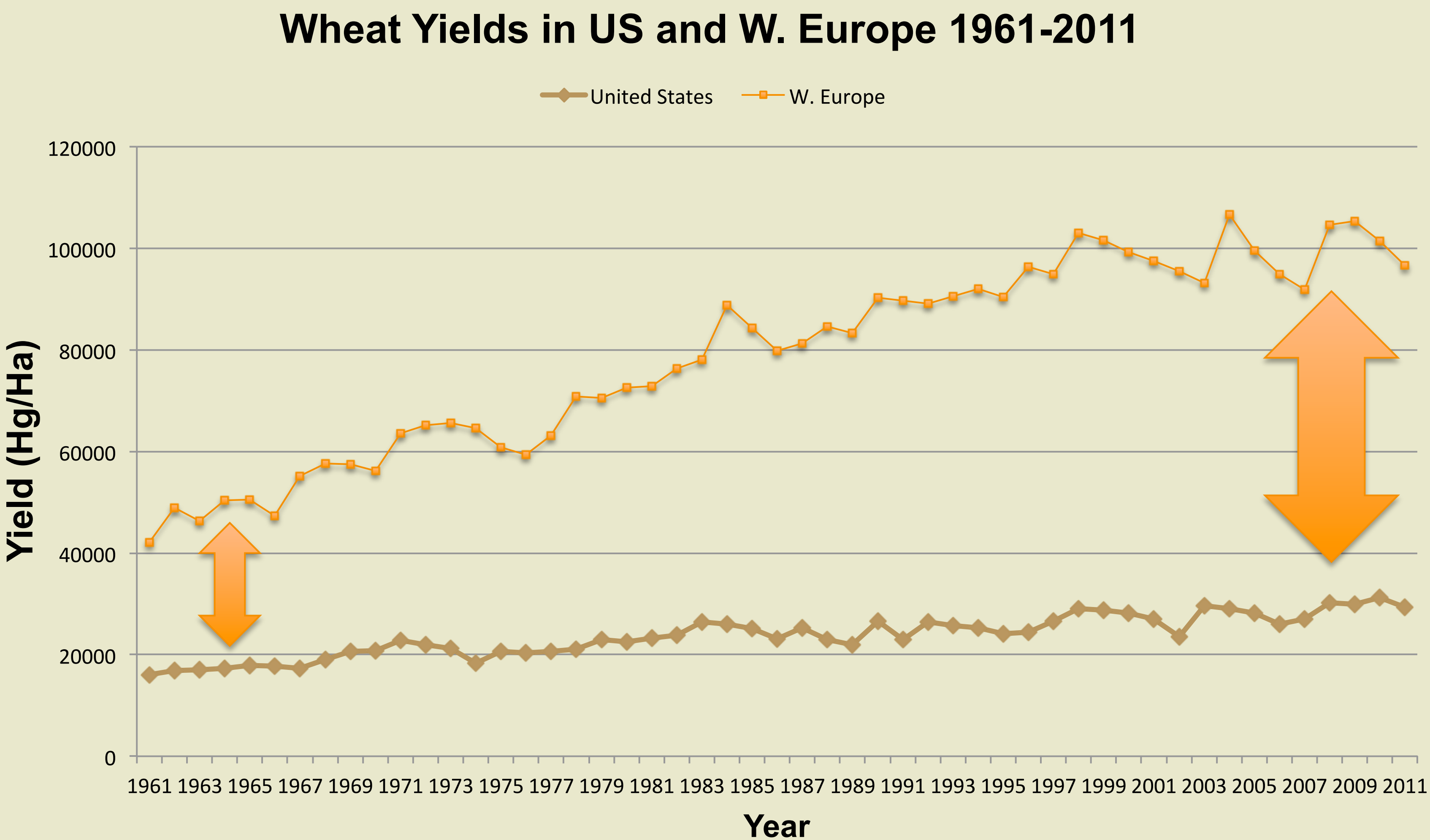
Resilience (maize)



Rapeseed yield

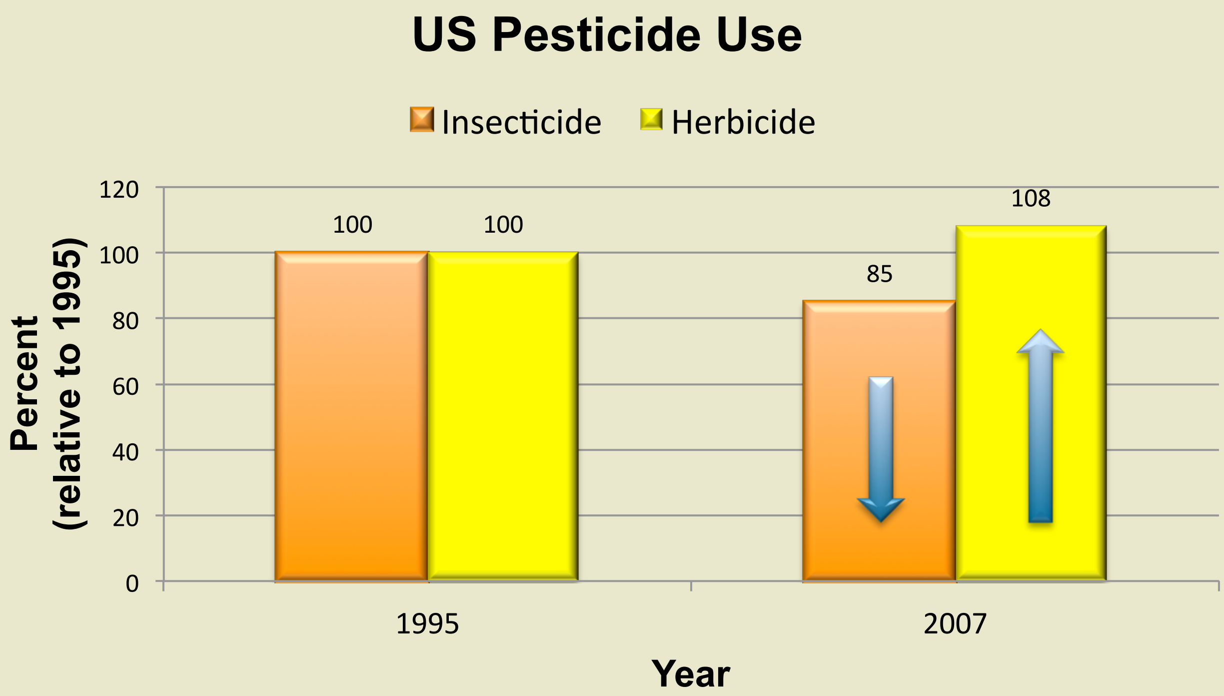


Projected yield increases



European yields increasing faster

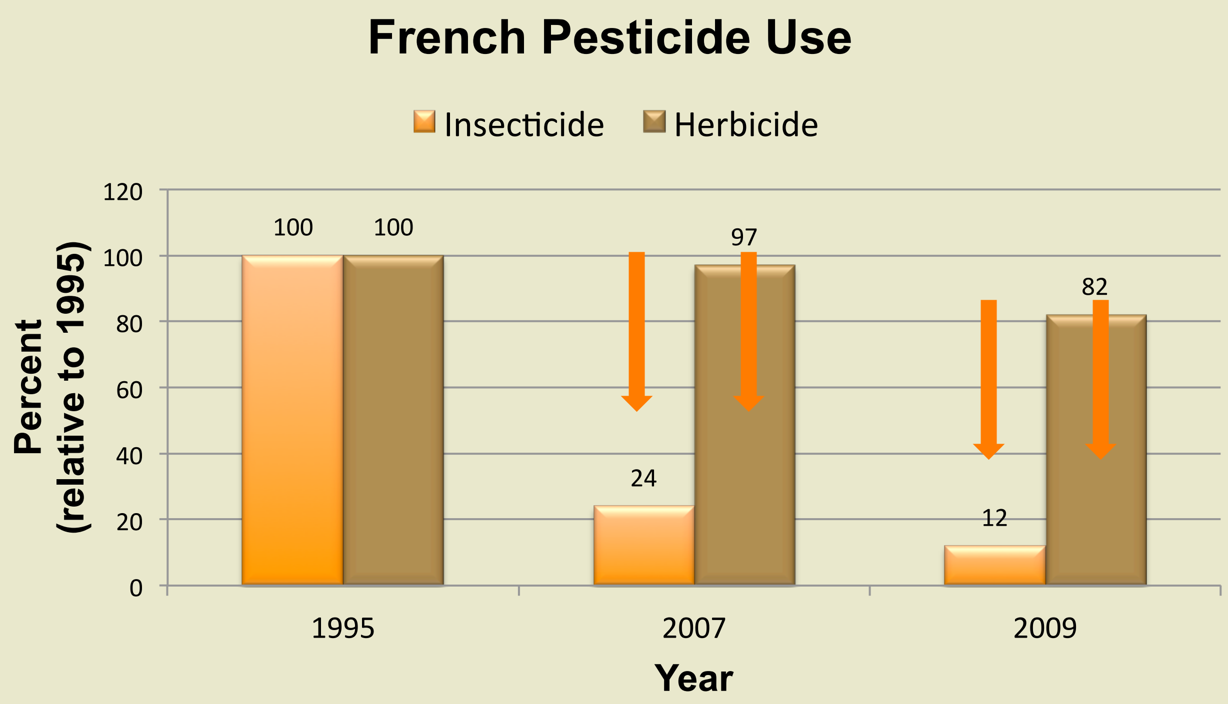
Sustainability: external inputs



insecticide down
herbicide up

Source: Heinemann et al International Journal of Agricultural Sustainability

Sustainability: external inputs



No GM crops
insecticide DOWN
herbicide DOWN

Source: Heinemann et al International Journal of Agricultural Sustainability

Lessons from the history of innovation in US Agriculture

Relatively low yields

High pesticide use

Concentration of breeder power

- Low germplasm biodiversity
- Reduced farmer contribution/power
- Reducing farmer choice

Yields > Genes

Europe meets or exceeds US yields with no GM

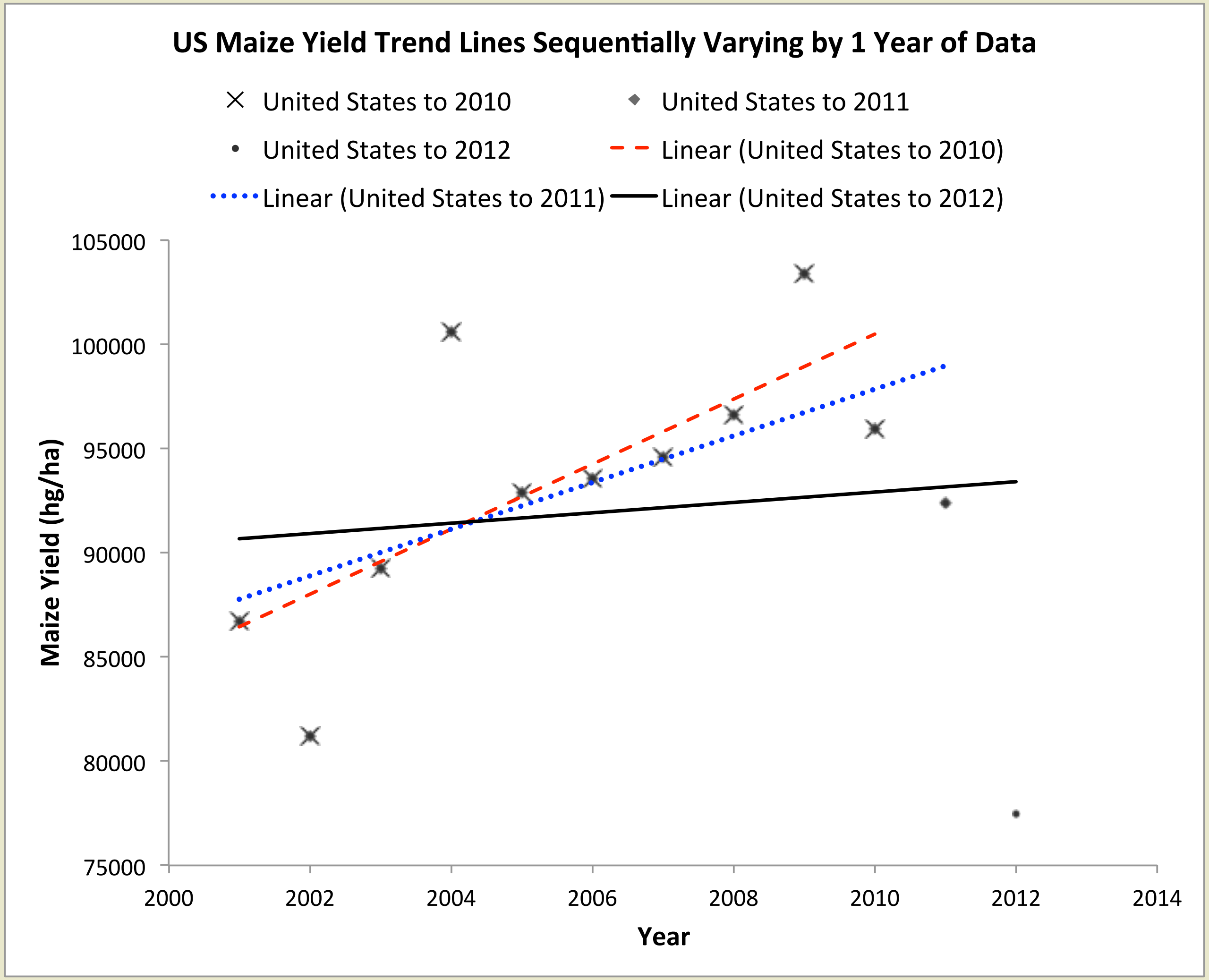
Agriculture is not just genes, it is breeding, management and social good

GM is not the cause:

- of germplasm concentration;
- farm size increases and diversity decreases;
- loss of farmer knowledge and contribution as breeders;
- yield stagnation;
- subsidies.

GM contributes to and accelerates these trends.

Criticism: why measure such a large period?



Period	change in slope
2001-2010	baseline
2001-2011	decreased 28%
2001-2012	decreased another 78%

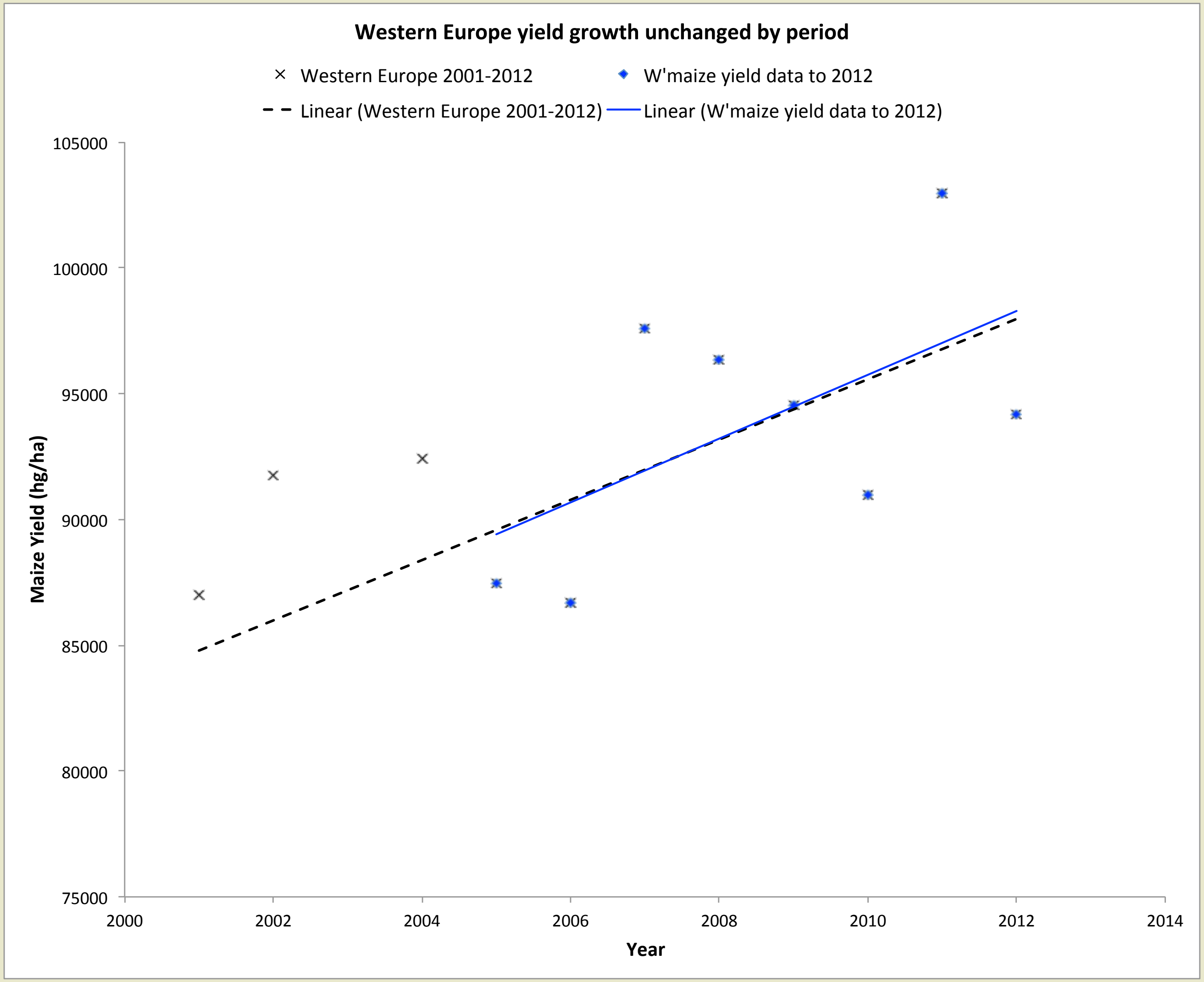
Yields flat during 90% of GM period

Period	slope (m)
2001-2012 US	~flat m=250
2001-2012 Western Europe	positive m=1200

Yields *decline* during 75% of GM period

Period	slope (m)
2005-2012 US	negative m=-1230
2005-2012 Western Europe	positive m=2520

In contrast, Europe consistent



Industrial European Ag not the answer either

Box 4. Agricultural productivity performance of organic and near organic agriculture in Africa

Region	Number of countries represented	Number of projects analysed	Number of farmers in projects (million)	Number of hectares under organic and near-organic agriculture (million ha)	Average change in crop yields compared with beginning of projects (per cent)
Africa (all countries with data)	24	114	1,900,000	2.0	+116
East Africa	7 (Kenya, Malawi, Tanzania, Ethiopia, Uganda, Zambia)	71	1,600,000	1.4	+128
East Africa (countries focused upon within this study)	3 (Kenya, Tanzania and Uganda)	44	1,300,000	1.2	+120
Kenya	1	18	1,000,000	0.5	+179
Tanzania	1	9	27,000	0.06	+67
[illegible]	1	17	241,000	0.68	+54

...elds do not necessarily mean that organic agriculture is more or less inherently ... increases vary depending on the type of project and the crops/livestock

United Nations Conference on Trade and Development
United Nations Environment Programme
UNITED NATIONS UNCTAD
UNEP
UNEP-UNCTAD Capacity-building Task Force on Trade, Environment and Development

Future directions

1. technological innovation and improvements in technologies that support agroecological and compatible methods should be the priority
2. these technologies must be customised as necessary to the adopting agroecosystem and societies (e.g., sub-Saharan Africa vs. Argentina's pampas)
3. the main incentive should be sustainable societies rather than pursuit of intellectual property, or the invention of intellectual property instruments that deliver sustainable outcomes rather than counter-productive biotechnologies such as GM

Acknowledgments

Co-authors: Melanie Massaro (Charles Sturt University, Australia), Dorien Coray (University of Canterbury), Sara Agapito (Universidade Federal de Santa Catarina in Brazil) and J. Dale Wen (Third World Network)

Brigitta Kurenbach and Jason Tylianakis, University of Canterbury

Thank you to the organisers, ENSSER and TWN, for inviting me to the conference and to you, for your attention.