EUROPEAN
NETWORK OF
SCIENTISTS
FOR SOCIAL AND
ENVIRONMENTAL
RESPONSIBILITY

Genetic engineering for sustainable food systems?

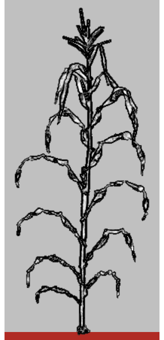
Dr. Angelika Hilbeck, ENSSER co-founder and board member

So-called ‘gene editing’ tools are powerful and cutting edge new genetic engineering tools with no history of safe use.

Recognized as human-made, non-natural invention/intervention they are patented and give rise to patentable (private property) genetically engineered (modified) organisms.

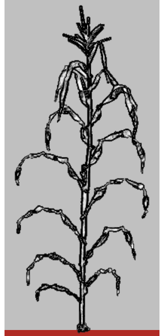
ENSSER’s position: As a tool they have **potential to yield both**: **wanted benign and unwanted adverse effects**. Both benign and adverse effects have to studied in targeted, well-designed experiments. When these techniques are applied to living organisms released into the environment, their subsequent ecological and evolutionary behavior is beyond human control. Consequently, **they must be regulated at least as stringently as products of other genetic engineering techniques, or more.**

“… the Court considers that the **risks linked to the use of these new mutagenesis techniques might prove to be similar to those that result from the production and release of a GMO through transgenesis**, since the direct modification of the genetic material of an organism through mutagenesis makes it possible to obtain the same effects as the introduction of a foreign gene into the organism (transgenesis) and those new **techniques make it possible to produce genetically modified varieties at a rate out of all proportion to those resulting from the application of conventional methods of mutagenesis**.”



New genetic engineering techniques:

- alter/delete many identical DNA sequences simultaneously
- alter/delete many different DNA sequences simultaneously (multiplexing)
- alter/delete DNA sequences in specifically protected regions of the genome

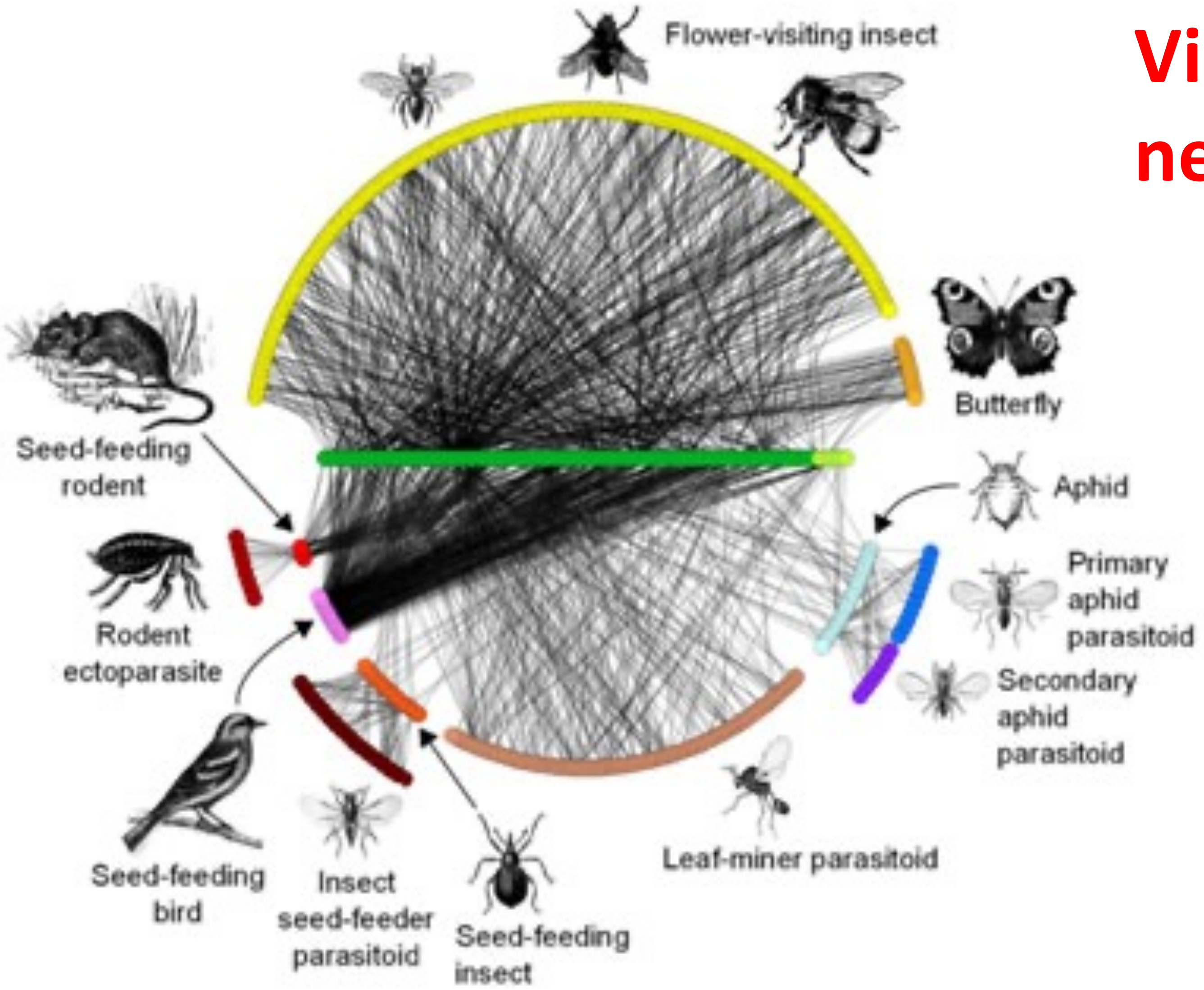


“Safety” narrative in genetic engineer circles builds entirely on a ‘precision = control’ narrative which is limited to and solely applies to the known, target DNA sequences

Problem: Precision of knowledge about genomic context (gene functioning in relation to environmental and epigenetic regulatory networks) is marginal (or non-existent) and considered an unnecessary prerequisite for ‘safe’ interventions.

➡ Scientific Uncertainty is a non-issue

Vibrant interaction networks rule!

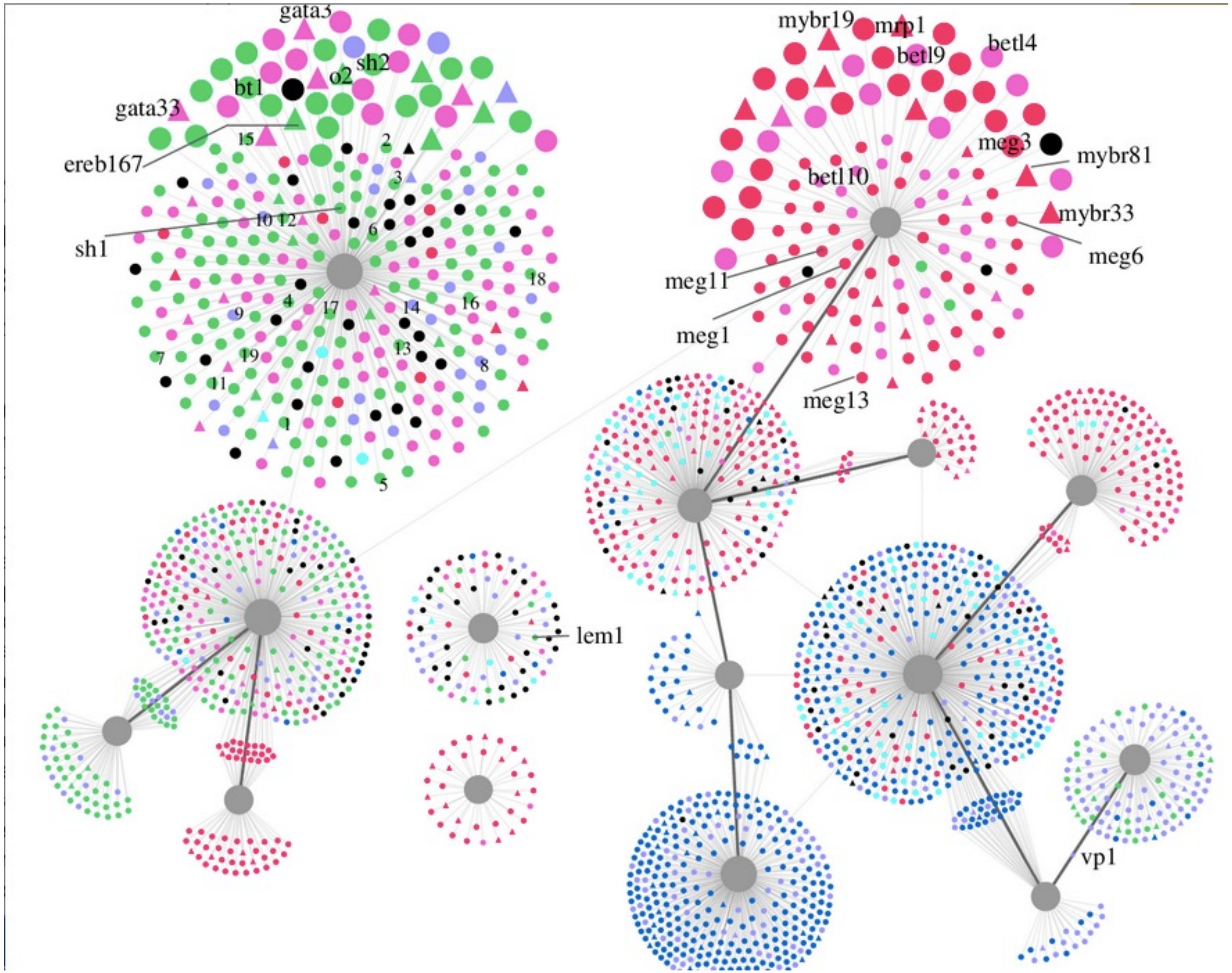


Species' **interaction** networks at Norwood Farm (125 ha), Somerset, UK

Our networks comprised **1501 quantified unique interactions between a total of 560 taxa**, comprising plants and 11 groups of animals…

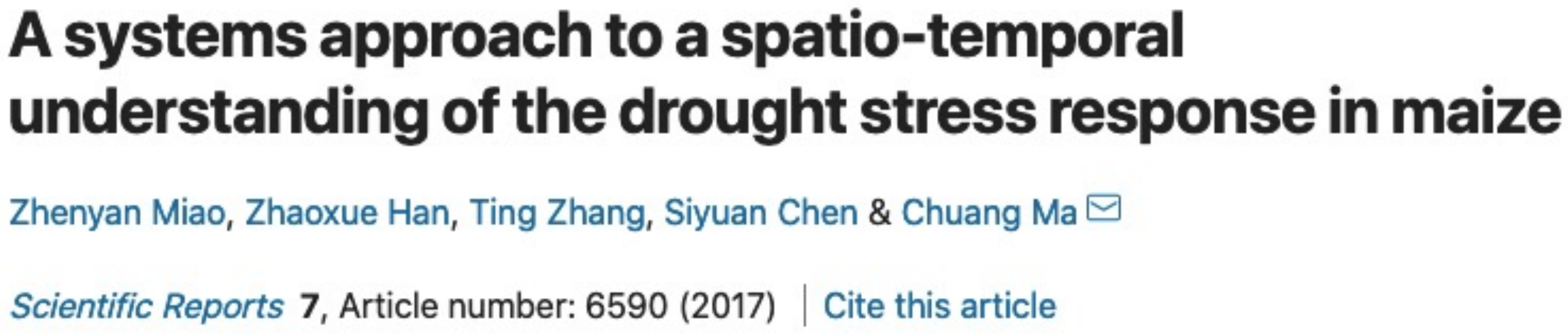
Pocock et al. 2012. The robustness and restoration of a network of ecological network. Science 335: 973-977.

Highly interwoven communities of a gene **regulatory network** unveil topologically important genes for maize seed development



Wenwei Xiong, et al.
The Plant Journal,
(2017), 92, 1143–1156

Figure 1. Interwoven network communities … of gene regulatory network in maize seed development. Topological analysis uncovered **15 network communities … genes are almost fully connected with each other.**



A systems approach to a spatio-temporal understanding of the drought stress response in maize

Zhenyan Miao, Zhaoxue Han, Ting Zhang, Siyuan Chen & Chuang Ma

Scientific Reports **7**, Article number: 6590 (2017) | Cite this article

“…**drought tolerance is a complex quantitative trait that is potentially correlated with other developmental trait**s, such as plant height, leaf area, stem diameter, and plant biomass.

These traits are generally quantitative, and each is controlled by multiple quantitative trait loci (QTLs) with relatively small individual effects on the corresponding traits, thus making them difficult to dissect by classical genetics approaches

RESULTS

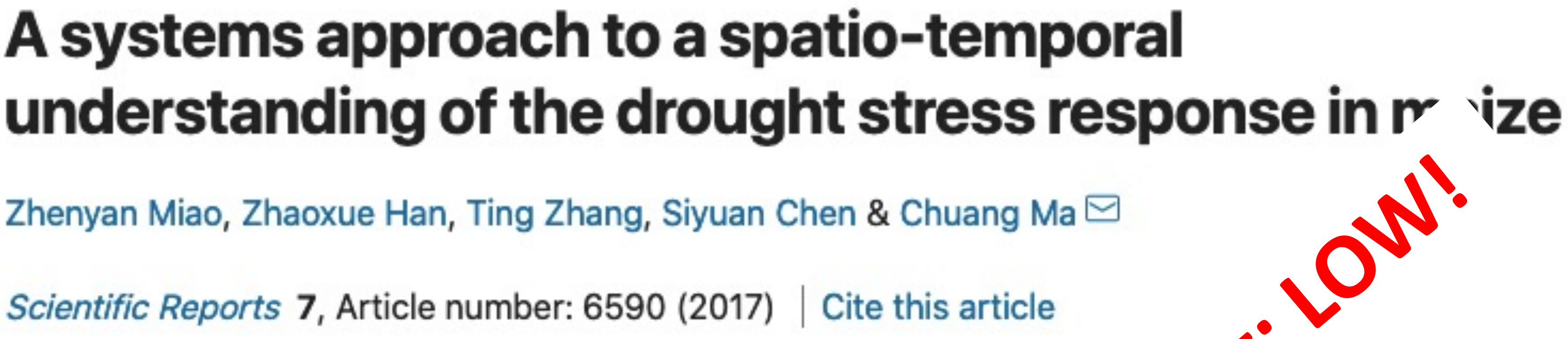
Co-expression analysis grouped drought-response genes into ten modules**, covering 844 highly connected genes** (hub genes).

'New' GE techniques remain limited:

Short DNA sequences, limited to monogenic (simple) traits

→(many) point mutations

→a technique where the 'delete' button works best



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Potential for genetic engineering: LOW!

Donors: BMGF and USAID

The Drought-Tolerant Maize for Africa (DTMA) Initiative demonstrates a joint commitment to protect Africa's maize crop from drought and other threats

Launched in 2006, the Drought Tolerant Maize for Africa (DTMA) project aims to mitigate drought and other constraints to maize production in sub-Saharan Africa, increasing maize yields by at least one ton per hectare under moderate drought and **with a 20 to 30% increase over farmers' current yields**, benefiting 30-40 million people in 13 African countries.

http://www.cgiar.org/enews/april2009/story_05.html

CIMMYT

IITA
Research to Nourish Africa

DTMA
The Drought Tolerant
Maize for Africa Initiative

Reported in 2009:

…… more than **50 new drought-tolerant varieties and hybrids have been developed and released** for dissemination by private seed companies, national agencies and nongovernmental organizations. **African farmers now grow many of those varieties, which yield 20-50% more than others under drought**, on hundreds of thousands of hectares.

http://www.cgiar.org/enews/april2009/story_05.html

Push into corporate seed market, end seed saving and recycling

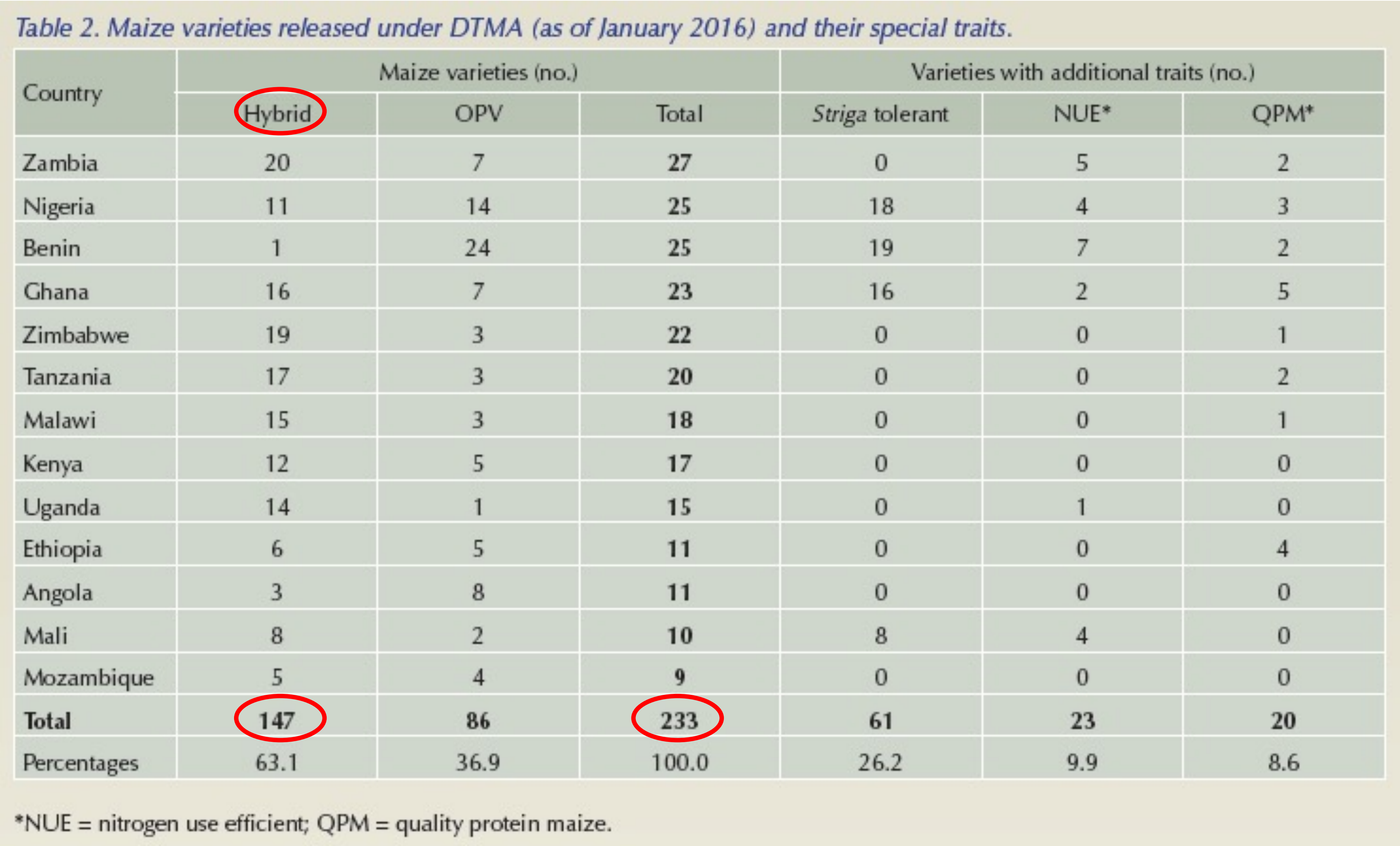

Table 2. Maize varieties released under DTMA (as of January 2016) and their special traits.

Country	Maize varieties (no.)			Varieties with additional traits (no.)		
	Hybrid	OPV	Total	*Striga* tolerant	NUE*	QPM*
Zambia	20	7	**27**	0	5	2
Nigeria	11	14	**25**	18	4	3
Benin	1	24	**25**	19	7	2
Ghana	16	7	**23**	16	2	5
Zimbabwe	19	3	**22**	0	0	1
Tanzania	17	3	**20**	0	0	2
Malawi	15	3	**18**	0	0	1
Kenya	12	5	**17**	0	0	0
Uganda	14	1	**15**	0	1	0
Ethiopia	6	5	**11**	0	0	4
Angola	3	8	**11**	0	0	0
Mali	8	2	**10**	8	4	0
Mozambique	5	4	**9**	0	0	0
Total	**147**	**86**	**233**	**61**	**23**	**20**
Percentages	63.1	36.9	100.0	26.2	9.9	8.6

*NUE = nitrogen use efficient; QPM = quality protein maize.

DTMA ended officially in December 2015…..

‘New’ GE techniques remain risky:

By far **not as precise** as claimed! Many published, scientific reports about:

- **Unintended (on-target)** (side)**effects** caused at the site of the **intended interventions**
- **Unintended (**side)**effects** or mutations in other DNA or RNA sequences/regions (**off-target**) **in addition to the intended interventions at the target site.**

Big problem:

no independent, noteworthy risk or biosafety research programs regarding environmentally relevant consequences of new GMOs

SCIENTIFIC CRITIQUE OF
LEOPOLDINA AND EASAC STATEMENTS ON GENOME EDITED PLANTS IN THE EU

EXECUTIVE SUMMARY OF A
STUDY BY ENSSER AND CSS

April 2021

THE GREENS/EFA
in the European Parliament

EUROPEAN
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SCIENTISTS
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ENVIRONMENTAL
RESPONSIBILITY

ENSSER

CSS
Critical
Scientists
Switzerland

https://www.greens-efa.eu/de/artikel/document/genome-edited-plants-in-the-eu
http://extranet.greens-efa-service.eu/public/media/file/1/6954

A backwards oriented Statement

All narratives and claims stem from the last century and are identical to those for transgenic GMOs

Report is full of **old claims that lack support or rest on cherry-picked and circular (self-)referencing**

- *GMOs – old and new – have increased yields.* Not true. Evidence suggests otherwise
- *GMOs will increase yields and are essential for increasing yields.* Undocumented, pure speculation, biologically highly unlikely
- *GMOs are essential for breeding complex traits for adaptation to adverse environmental conditions* – never worked with old GMOs, pure speculation, biologically highly unlikely to work with new GM techniques
- Ignores successes in conventional and novel real breeding techniques that do deliver the kinds of improved crop plant varieties (example: Drought tolerance)

Superplants never materialized, superweeds and superbugs did

Proposals for future regulation exemption are from the past century

- Proposed de-regulation model is a 40+year old USA model starting in the 1970s with Reagan deregulating GMOs in 1986

  OSTP (Executive Office of the President, Office of Science and Technology Policy). 1986. Coordinated Framework for Regulation of Biotechnology. Federal Register 51:23302.

- It is the total minority model subscribed by exactly 1 country, the USA vis-à-vis 170+ countries worldwide parties to the UN CBD Cartagena Protocol on Biosafety

THANK YOU