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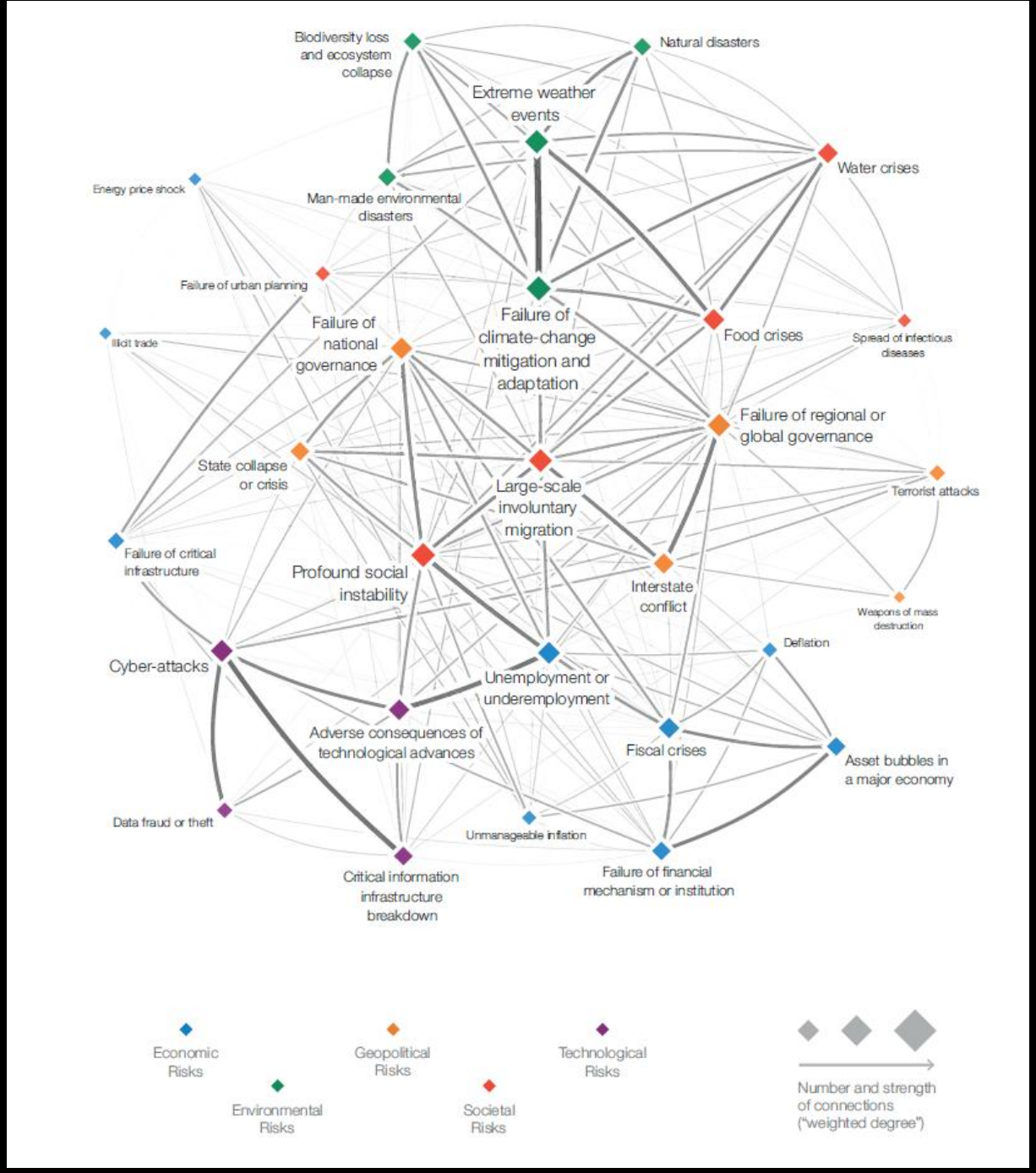
GMOs (& food security): an environmental perspective for South Africa

Tlou Masehela

Round Table Discussion – Catholic Parliament; 12/03/2019



World Economic Forum Global Risks Perception Survey: 2018 - 2019

CONTRIBUTION OF BIOTECH CROPS TO FOOD SECURITY, SUSTAINABILITY, AND CLIMATE CHANGE

INCREASING CROP PRODUCTIVITY

US$186.1 BILLION

FARM INCOME GAINS IN 1996-2016 GENERATED GLOBALLY BY **BIOTECH CROPS**

CONSERVING BIODIVERSITY

IN 1996-2016, PRODUCTIVITY GAINED THROUGH BIOTECHNOLOGY SAVED

183 MILLION HECTARES

OF LAND FROM PLOWING AND CULTIVATION

PROVIDING A BETTER ENVIRONMENT

LESS PESTICIDE APPLICATIONS

DECREASED ENVIRONMENTAL IMPACT FROM HERBICIDE & INSECTICIDE USE BY **18.4% IN 1996-2016**

REDUCING CO2 EMISSIONS

SAVED 27.1 BILLION KGS CO2 EQUIVALENT TO REMOVING

16.7 MILLION CARS

OFF THE ROAD FOR 1 YEAR

HELPING ALLEVIATE POVERTY & HUNGER

BIOTECH CROPS UPLIFTED THE LIVES OF

16-17 MILLION SMALL FARMERS

AND THEIR FAMILIES TOTALING

>65 MILLION PEOPLE

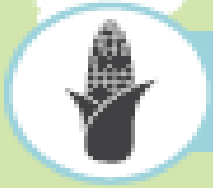
Source: Brookes and Barfoot, 2018

STATUS OF GM PRODUCTS IN SOUTH AFRICA

OVER THE PAST FIVE YEARS ON AVERAGE

In addition, many GM-derived medicines, including anti cancer agents, vaccines, insulin, cytokines and growth factors are on the South African market.

2.7 million hectares of GM crops were planted in South Africa.



90% of maize is GM (HT and/or IR)

95% of soybean is GM (HT)

100% of cotton is GM (HT and/or IR)

Since 1999, **393** permits for confined field trials on 10 different crops have been issued.

IR – Insect resistant HT – Herbicide tolerant

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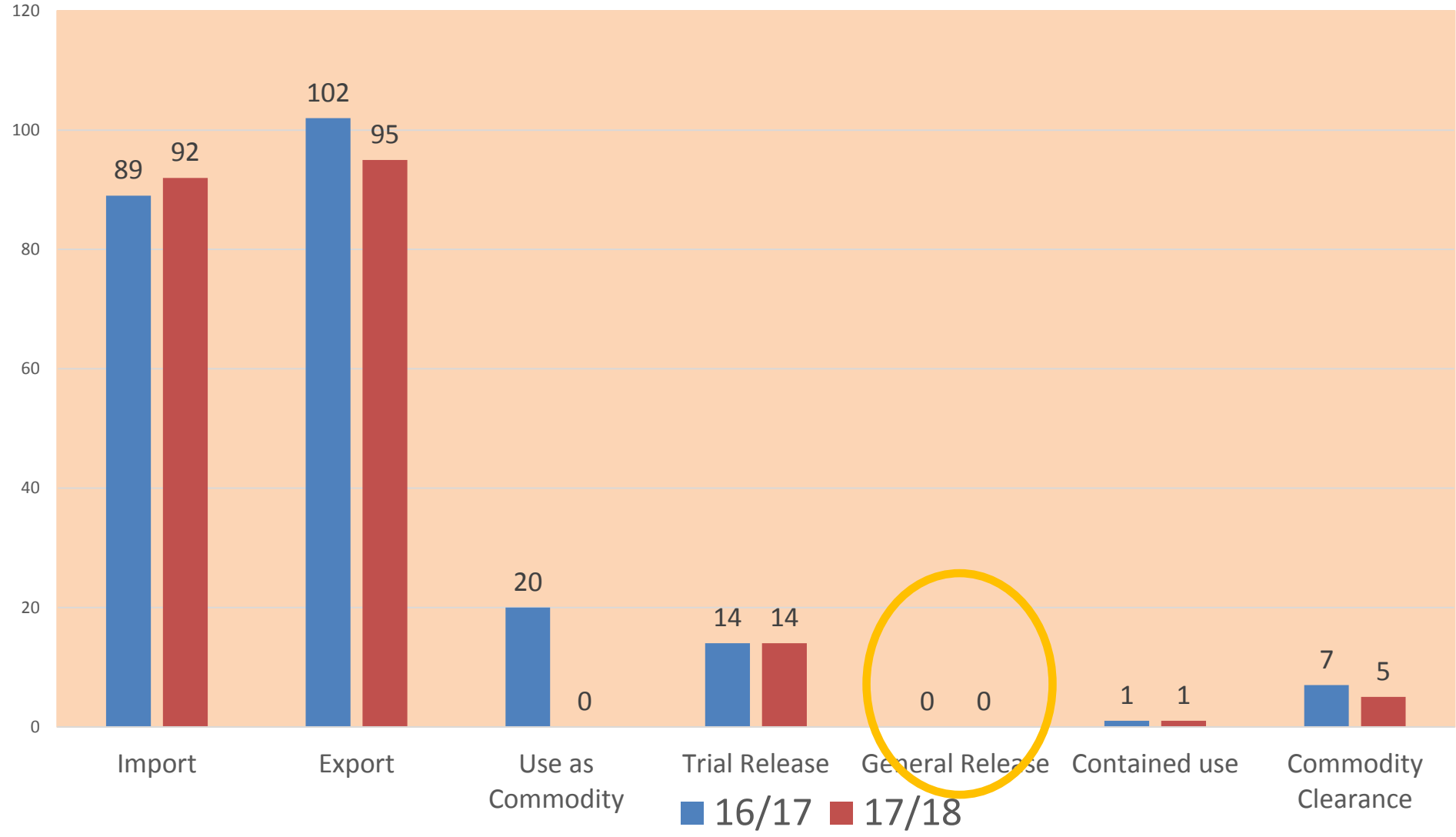
ISAAA BRIEF 53, Global Status of commercialised biotech/GM crops in 2017

Summary of number of GMO applications per activity level (2016/17 - 2017/18 financial years)



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DAFF 2019

GMO legislative framework in SA

POTENTIAL IMPACT	LEGISLATION		HOW THE LEGISLATION IS APPLIED
Human and animal health and safety	Genetically Modified Organisms (GMO) Act Provides for measures to promote the responsible development, production, use and application of genetically modified organisms	Foodstuffs, Cosmetics and Disinfectants Act	Defines labelling requirements for GM containing foods (Regulation 25, 2004).
		Occupational Health and Safety Act	Safeguards the health and safety of the workers, cleaning personnel and any other person, involved with activities with GMOs.
Environmental safety		National Environmental Management Biodiversity Act	Regulates possible impacts of GMOs on biodiversity and introduces minimum monitoring requirements, implemented through SANBI (South African National Biodiversity Institute).
		National Environmental Management Act	Provides general guidance with regards to the criteria that may trigger an EIA for GMOs, the objectives of such an EIA and the administrative procedure to follow
Socio-economic viability		Consumer Protection Act	Introduced mandatory labeling requirements for all GM goods (Regulation 293, 2008).

SANBI's Mandate on GMOs
(NEMBA Act No 10 of 2004; currently under review)

Must monitor and report regularly to the Minister on the impact of any genetically modified organism that has been released into the environment including the impact on non-target organisms and ecological processes, indigenous biological resources and the biological diversity of species used for agriculture;

All categories of genetically modified organisms, post commercial release, based on research that identifies and evaluates risk.

Our Environment and Biodiversity

South Africa is the 3rd most biodiverse country in the world

7% of the world's reptiles, birds and mammals

10% of the world's plants

2% of the world's land area

15% of the world's coastal marine species

OUR research activities

Weed profiling and herbicide use in GM maize (with HT traits): Mthatha, Eastern Cape (4 sites; 24 fields)

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GRAIN SA
GRAAN SA

Areas of interest for the project:

- Weed diversity, prevalence, potential of herbicide resistance & invasive traits;
- Different spectrums of herbicides used and the effectiveness thereof;
  - Comparisons of sites for different planting seasons

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Maize events (yellow maize)

NK603xMON810
2017/18

MON 89034
2018/19

Herbicide application 2017 – 2019 (GrainSA protocol)

Year	Pre-emergence (3-7 days after planting)	Post-emergence (4-6 weeks after planting)
2017/18	Primagram Gold (2.5L/ha)	2-4-D (250ml/ha)
	Judo 50 EC (150ml/ha)	Halo (sachet) (50g/ha)
		Roundup (3L/ha)
		Judo 50 EC (50ml/ha)
		Sorgomil (1.5L/ha)
2018/19	Alpha-thrin 100 SC (100ml/ha)	Alpha-thrin 100 SC (100ml/ha)
	Metolachlor 915 EC (1L/ha)	Halo (sachet) (50g/ha)
	Cantrol 480 SC (250ml/ha)	Metolachlor 915 EC (1L/ha)
		Terbuweed 600 WDG (1kg/ha)
		Villa 51 (100ml/ha)
		2-4-D (250ml/ha)
		Roundup (2L/ha)

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Weed profiling and herbicide use in Soybean cultivars, Gauteng Province

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AFRICABIO

Areas of interest for the project:

- Weed diversity, prevalence, potential of herbicide resistance & invasive traits;
- Different spectrums of herbicides used and the effectiveness thereof;
  - Comparisons of sites for different planting seasons
- Cultivar performance (AfricaBio)

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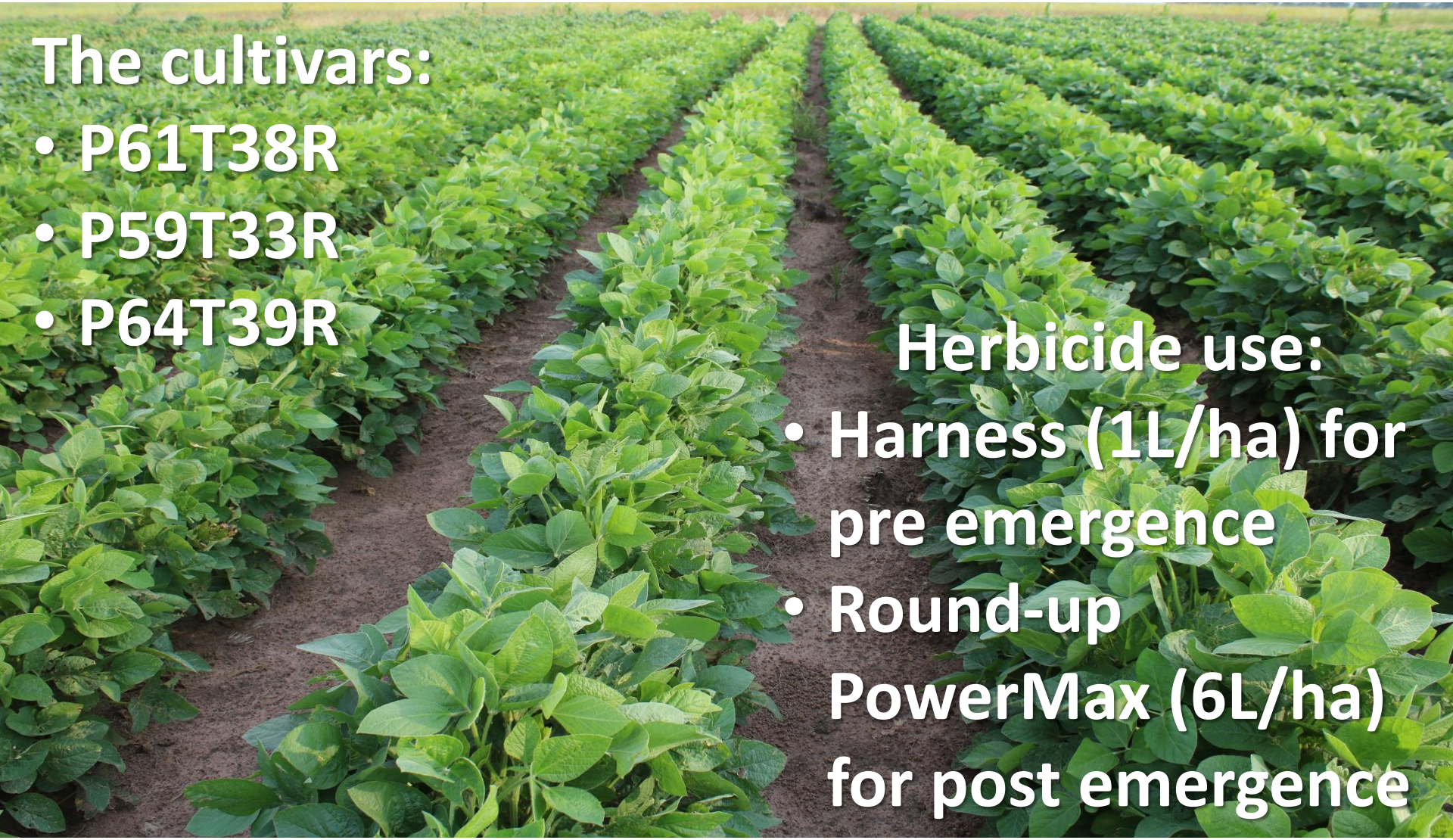
The project: 6 x 2ha farms in GP (2018/19)



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Crops ranked according to the sum of WHP scores of active ingredients applied to each crop (Total WHP). % WHP is the WHP as a proportion of the sum of the Total WHP scores for all crops. WHP/AI the average WHP score per active ingredient for each crop.

Crop	Total WHP	Crop	WHP/ha
Maize	8.5892	Tomatoes	0.2911
Potatoes	2.5749	Potatoes	0.2348
Citrus	2.0614	Citrus	0.1071
Grapes (wine)	1.6505	Apples	0.0633
Sugar cane	1.1961	Pears	0.0584
Apples	0.6252	Grapes (table)	0.0379
Wheat	0.5892	Grapes (wine)	0.0349
Tomatoes	0.5605	Sugar cane	0.0343
Grapes (table)	0.3971	Maize	0.0330
Soybeans	0.3897	Mangoes	0.0311
Sorghum	0.3483	Sorghum	0.0252
Peaches	0.2756	Plums	0.0234
Potatoes: seed	0.2446	Peaches	0.0221
Pears	0.1958	Groundnuts	0.0219
Sunflower	0.1818	Potatoes: seed	0.0217
Mangoes	0.1746	Sunflower	0.0157
Groundnuts	0.1645	Pineapple	0.0138
Barley	0.1549	Avocados	0.0122
Beans	0.1331	Apricots	0.0121
Avocados	0.0799	Soybeans	0.0117
Pineapple	0.0735	Wheat	0.0099
Plums	0.0594	Cotton	0.0097
Dry-Beans	0.0466	Beans	0.0091
Cotton	0.0450	Dry-beans	0.0046
Apricots	0.0351	Bananas	0.0042
Bananas	0.0172	Barley	0.0032

Dabrowski et al. 2014 *Envr Int* 62: 31-40

Diversity of non-crop plants and arthropods in soybean Agro-ecosystems in South Africa (MSc: 2018-2019)

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NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Project objectives:

- Gather and compare the beta diversity (spatial turnover in species composition) of soybean fields and natural environments in the Grassland biome of South Africa;
- Document and compare patterns of plant and arthropod functional diversity in soybean fields and margins; and
- Investigate possible cases of weed shift in Roundup Ready (RR) and non-RR soybean fields as well as their margins.

International Journal of Pest Management, January – March 2008; 54(1): 77 – 87

Taylor & Francis
Taylor & Francis Group

Diversity and comparative phenology of Lepidoptera on Bt and non-Bt maize in South Africa

ANNEMIE VAN WYK, JOHNNIE VAN DEN BERG, & HUIB VAN HAMBURG

School of Environmental Sciences and Development, North-West University, Potchefstroom Campus, Potchefstroom, South Africa

TRANSGENIC PLANTS AND INSECTS

Comparative Diversity of Arthropods on Bt Maize and Non-Bt Maize in two Different Cropping Systems in South Africa

J. TRUTER,[1,2] H. VAN HAMBURG,[1] AND J. VAN DEN BERG[1,3]

Environ. Entomol. 43(1): 197–208 (2014); DOI: http://dx.doi.org/10.1603/EN12177

Biodivers Conserv (2015) 24:1797–1824
DOI 10.1007/s10531-015-0901-0

CrossMark

ORIGINAL PAPER

Plant and arthropod diversity patterns of maize agro-ecosystems in two grassy biomes of South Africa

M. Botha[1] · S. J. Siebert[1] · J. van den Berg[1] · B. G. Maliba[1,2] · S. M. Ellis[3]

Evaluation of land use impacts of sustaining GM crops in South Africa from 1997 - 2018 (PhD 2019 - 2021)

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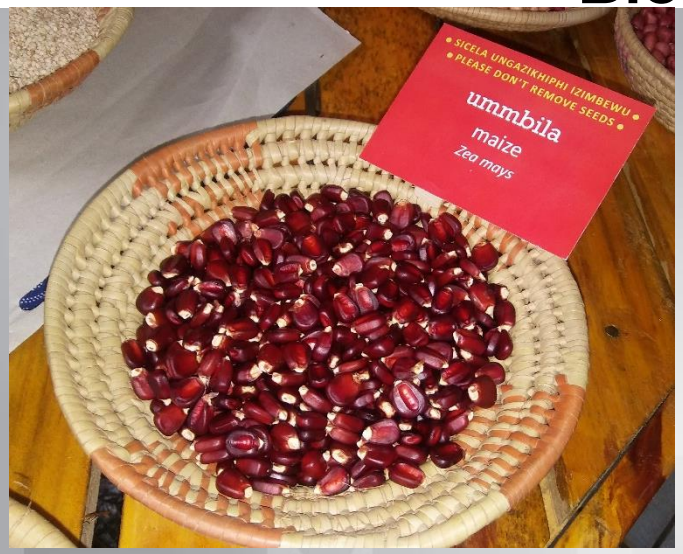
University of Fort Hare
Together in Excellence

Project objectives:

- Remap different land uses and GM crops adopted/ produced in South Africa;
- Predict and forecast underlying trends in land use and production of GM crops;
- Identify the impact of GM crops on natural areas and other crops;
- Evaluate the economic net benefits from both natural resources and GM crops; and
- Identify new pathways, shifts and challenges that are likely to arise with increased cultivation area.

GM maize “contamination”: Mtubatuba, KNZ – Lead by UCT & BiowatchSA (on hold)



- Socio-economic; Cultural & Traditional
- SANBI interest: Landscape aspect (gene flow)

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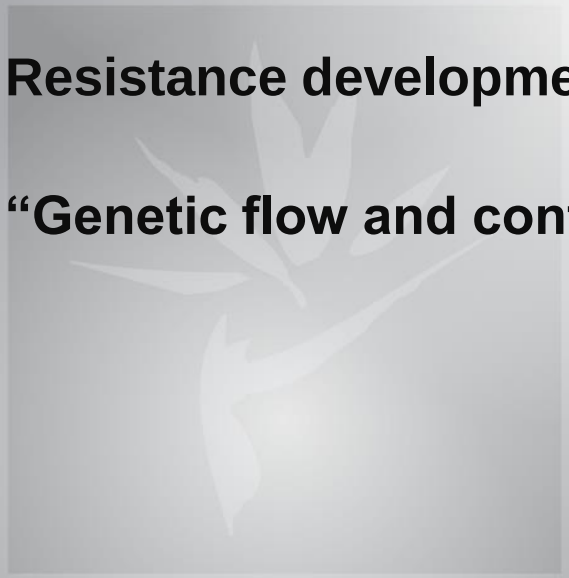
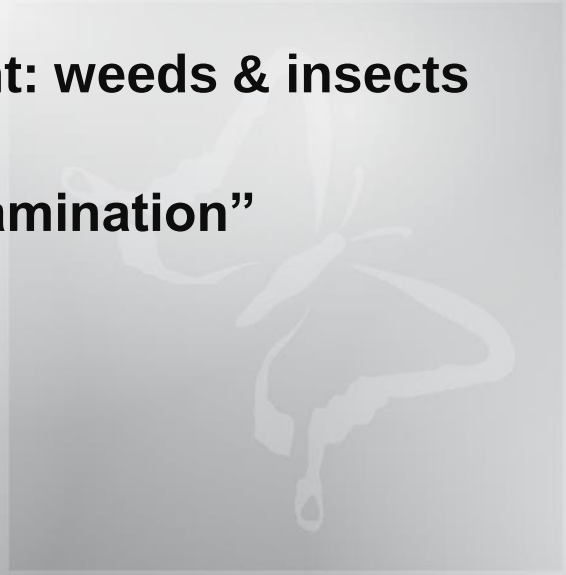
Contributions to reports & studies for DEA

- Pilot project on land use trends for GM crops
  - Soybean and Maize
- Pesticides use trends in GM crops
- Inventories and datasets on GM crops
- Review: environmental section on GM crops general release applications
- Reviews: Industry Monitoring reports/protocols (for compliance)

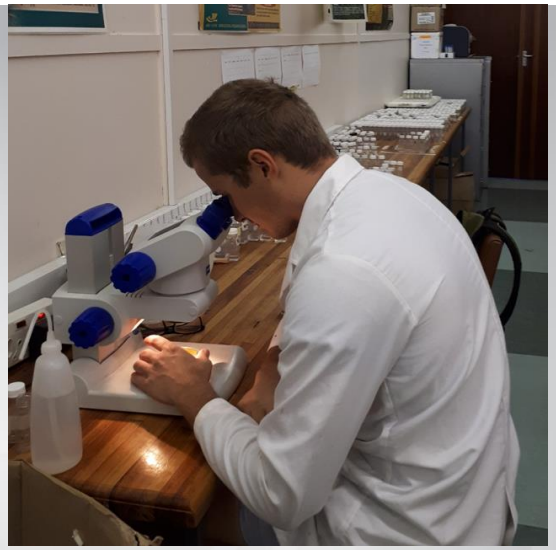
Data, Knowledge and Research Gaps

- GM crops and water bodies
- GM crops and soil microbes
- GM crops: pesticides bioaccumulation & indirect impacts
- Resistance development: weeds & insects
- “Genetic flow and contamination”


The “team”

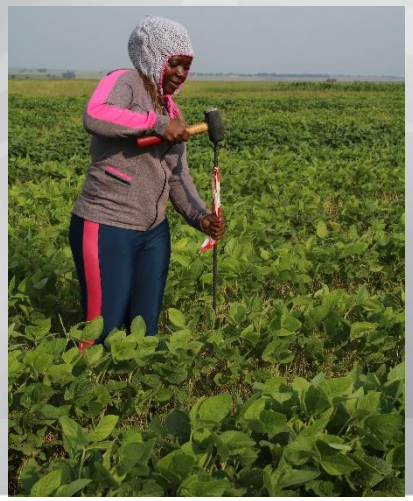
Jacob Rossouw: Intern 2017/18



Paul Janse van Rensburg: MSc 2018

Asandile Gana: Volunteer 2017/18

Murendeni Kwinda
Intern 2018/19
MSc to start April 2019



Siphokazi Ncginela
Phd 2019

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Thank You!

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