Access and Benefit Sharing

Key Points for Policy-Makers

AGRICULTURE

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THE ABS CAPACITY DEVELOPMENT INITIATIVE

People and Plants international

University of Cape Town • iYunivesithi yaseKapa • Universiteit van Kaapstad

SUMMARY OF KEY POINTS

USE OF GENETIC RESOURCES IN AGRICULTURE

- ABS is relevant in different ways in this sector due to the variety of actors, the different company sizes, the array of markets, the range of technologies, the diversity and scope of genetic resources used, and the different laws and regulations involved.
- Genetic resources used comprise plants, animals or microbes collected in the wild, including wild relatives of domesticated species, as well as landraces, genetic stocks, breeding lines, mutants and commercial or elite varieties.
- Research activities might include improving yield; improving tolerance to drought, heat or cold; improving quality through taste, colour, odour, shelf-life or nutrition; or protecting against diseases, insects, and weeds.
- Many actors are involved in the collection and maintenance of agricultural genetic resources, their research and development (R&D), regulation, multiplication, distribution and sale.

MARKETS, COMPANIES AND PRODUCTS

- There has been massive transformation of this sector leading to increased market concentration by fewer companies through a series of 'mega-mergers'. Six companies have collective sales of over $65 billion per annum and control 75% of the global agrochemical market; 63% of the commercial seed market; and account for more than 75% of all private sector research in seeds and chemicals.
- The growth of the commercial seed market has almost tripled since 2000 and has been accompanied by greater use of genetically modified (GM) seeds with about 10% of arable land – 181.5 million hectares - now planted to GM crops. In Europe, the adoption of GM crops is static or declining, largely due to consumer resistance and stringent regulatory requirements.
- The global market for agrochemicals stood at US$ 56.6 billion in 2014, more than doubling since 2000. The global South is emerging as the fastest growing market for pesticides, with Brazil, China, India and Argentina now among the top 10 country markets.
- Biopesticides include microbes, plant extracts, fermentation products, and biochemicals. Their use is growing due to environmental concerns regarding the use of synthetic pesticides but still comprises only a tiny fraction of the global agrochemical market. There is also increasing interest in screening and analysing plant-associated microbes.

TRENDS IN RESEARCH AND DEVELOPMENT

- Private sector interest in agricultural research has escalated with an associated decline in public sector research. Nearly all R&D by the private sector is conducted on a handful of crops and traits.
- There is growing interest and investment in crop wild relatives, mainly because they contain important genes for stress resistance, adaptability, and improved productivity.
- Although herbicide tolerant and stacked traits remain a central focus, there is also interest in developing new insect control traits, particularly to manage resistance. Microbes and insects are a major focus and ABS questions are highly significant.
- Partly in response to climate change, companies are now investing in 'climate-smart' and 'precision' agriculture, involving Big Data, robotics, drones to deliver fertiliser, pesticides and other inputs and farm and weather surveillance technologies. The knowledge and genetic resources of farmers play a minor role in new developments.

ACCESS TO GENETIC RESOURCES AND FARMERS' RIGHTS

- Most genetic resources used in the plant breeding industry today are elite, modern varieties that already incorporate desired characteristics.
- Considerable effort is required to develop landraces or wild relatives into modern varieties or to find useful traits. New technologies are however making this process easier. There is increased interest in developing neglected and under-utilised crops as high-value niche products and for changing climates.
- Ex-situ collections are the most commercially significant source of genetic material. A substantial source resides with large companies, mainly to increase self-reliance and to avoid any risks of reduced access. Smaller companies and developing country institutions continue to be dependent on public sector collections and thus may be more affected by ABS measures.
- The horticulture industry has low reliance on wild genetic resources but requires access to such material for the development of new horticultural species, new traits, colours, and characteristics.
- The importance of farmers as custodians and developers of genetic diversity for food and agriculture is recognised in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) through provisions on Farmers' Rights.

POLICY CONTEXT

- Key agreements which govern the use of agricultural genetic resources include the Convention on Biological Diversity (CBD), its Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation; and the ITPGRFA.

INDUSTRY AND ABS

- Access to genetic resources is highly variable depending on the materials sought, company size and use. There is growing interest in wild species and landraces for breeding, crop protection and, to a lesser extent, for horticulture. This raises the importance of benefit sharing and Farmers' Rights.
- Fast-moving technological changes mean that those implementing ABS must have familiarity with bioinformatics and an understanding of how informational resources are shared and used.
- This sector has engaged actively in ABS due to its involvement in the ITPGRFA. Despite slow progress on benefit sharing and implementation of the ITPGRFA, important strides have been made to facilitate genetic resource exchange for food security and the public good. Implementation of the Nagoya Protocol should build on past achievements.

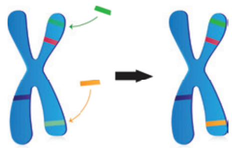
USE OF GENETIC RESOURCES IN AGRICULTURE

Main uses of genetic resources in commercial agriculture

Conventional breeding

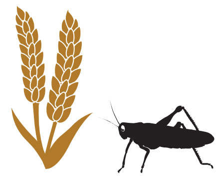
Selection and development of germplasm, including use of molecular markers

Genetic modification and marker assisted breeding



Incorporation of transgenic traits into germplasm to develop selected characteristics

Crop protection



R&D of active ingredients, biocontrol agents, and genes that confer pest, disease and herbicide resistance

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Research activities might include improving yield; improving tolerance to drought, heat or cold; improving quality through taste, colour, odour, shelf-life or nutrition; or protecting against diseases, insects, and weeds.

Many actors are involved in the collection and maintenance of agricultural genetic resources, their R&D, regulation, multiplication, distribution and sale.

Actors in the agriculture sector

Seed companies

Biotechnology companies

Horticulture companies

Chemical companies

Universities

Genebanks

Farmers

Government

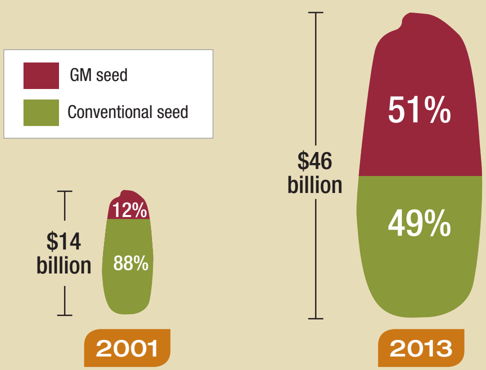
NGOs

MARKETS, COMPANIES AND PRODUCTS

CONSOLIDATION AND INTEGRATION

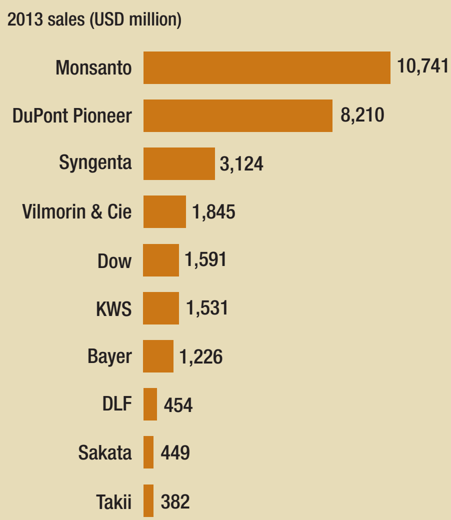
There has been massive transformation of this sector leading to increased market concentration by fewer companies through a series of 'mega-mergers'. Six companies have collective sales of over $65 billion per annum and control 75% of the global agrochemical market; 63% of the commercial seed market; and account for more than 75% of all private sector research in seeds and chemicals.

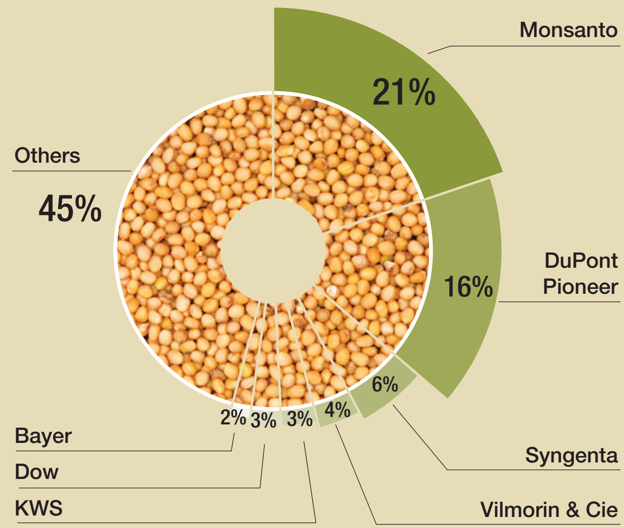
World market for commercial seeds (including vegetable and field crop seeds)



SEED

Top 10 seed companies



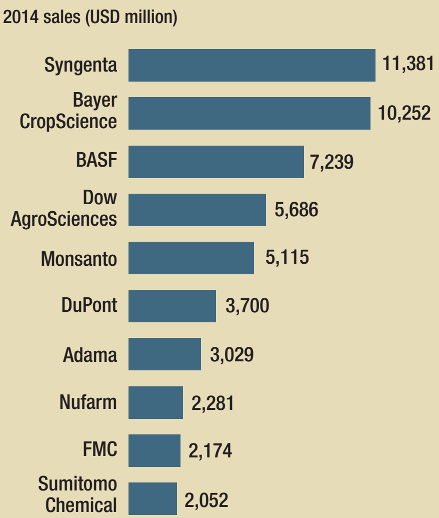


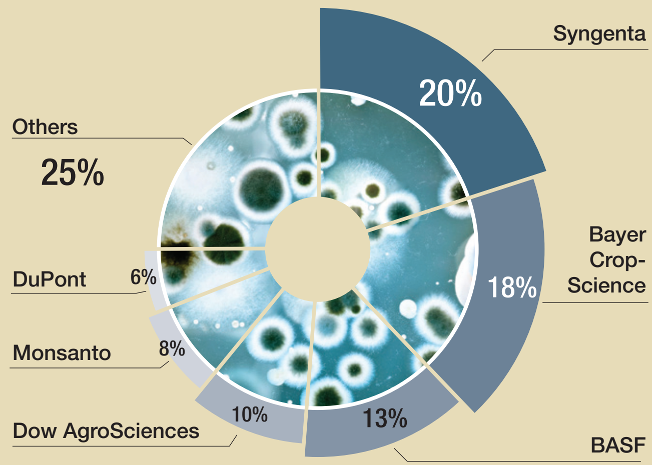
The growth of the commercial seed market has almost tripled since 2000 and has been accompanied by greater use of genetically modified (GM) seeds with about 10% of arable land – 181.5 million hectares - now planted to GM crops. In Europe, the adoption of GM crops is static or declining, largely due to consumer resistance and stringent regulatory requirements.

AGROCHEMICALS AND CROP PROTECTION

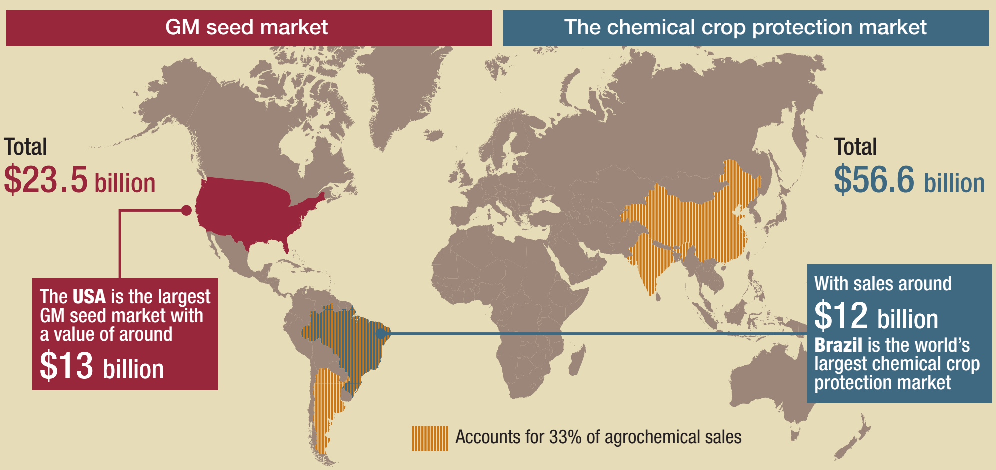
The global market for agrochemicals stood at US$ 56.6 billion in 2014, more than doubling since 2000. The global South is emerging as the fastest growing market for pesticides, with Brazil, China, India and Argentina now among the top 10 country markets. Soybean alone attracts crop protection sales of $9.6 billion.

Top 10 agrochemical companies



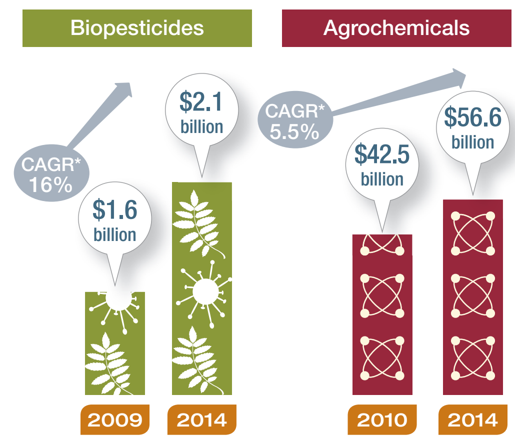


Global leaders in the GM seed and chemical crop protection markets



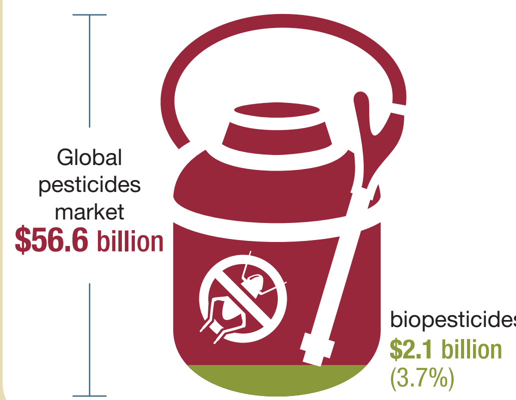
Biopesticides include microbes, plant extracts, fermentation products, and biochemicals. Their use is growing due to environmental concerns regarding the use of synthetic pesticides but still comprises only a tiny fraction of the global agrochemical market. There is also increasing interest in screening and analysing plant-associated microbes.

Growth of the biopesticides market



*CAGR (Compound Annual Growth Rate)

Global pesticides market 2014

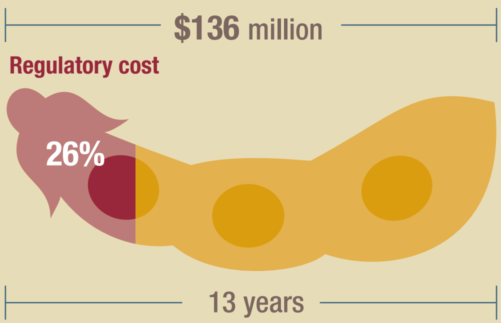


TRENDS IN RESEARCH AND DEVELOPMENT

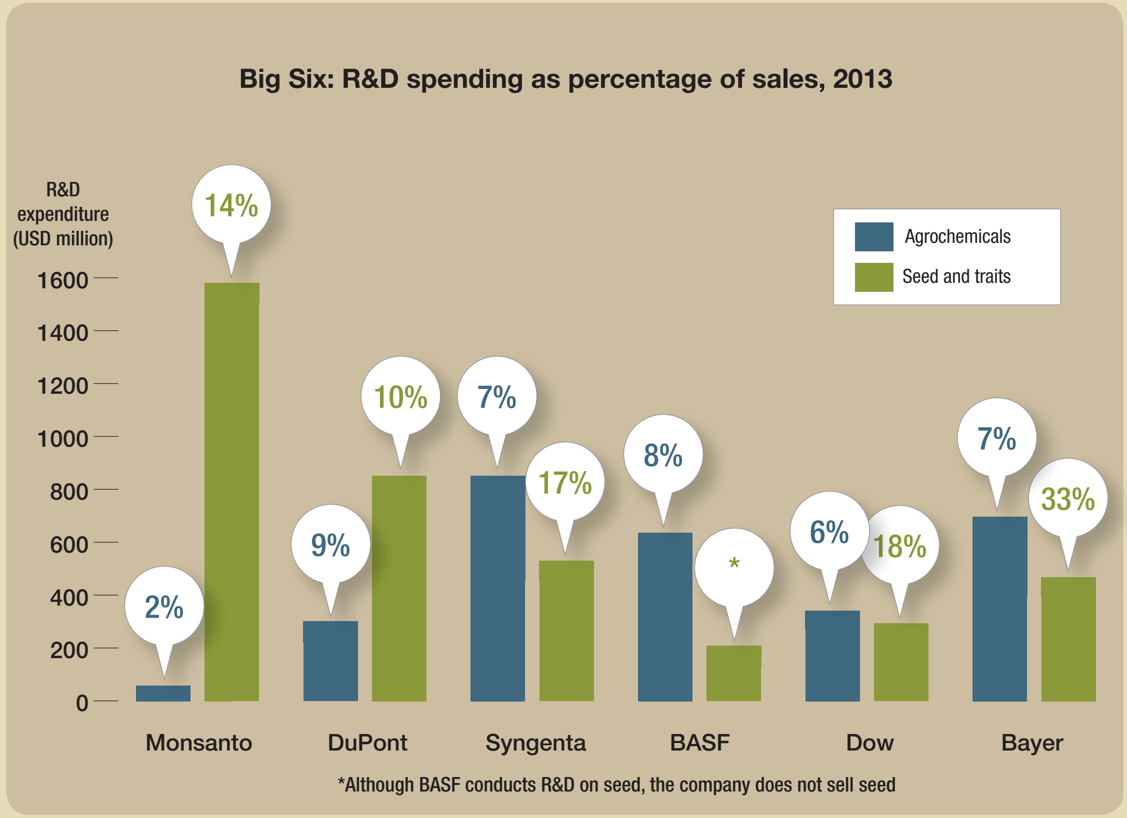
BREEDING

Private sector interest in agricultural research has escalated with an associated decline in public sector research. Nearly all R&D by the private sector is conducted on a handful of crops and traits.

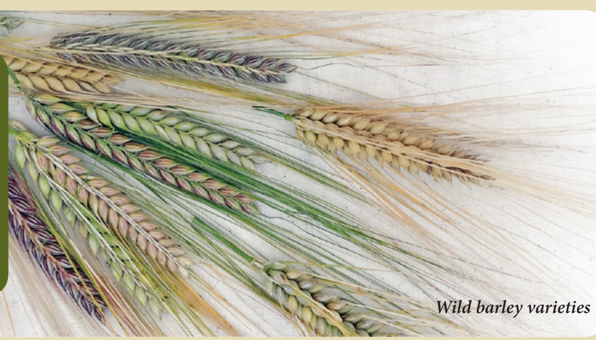
Developing a new GM crop



$4.5 billion spent on seed R&D in 2014 – more than double that of 2007.



There is growing interest and investment in crop wild relatives, mainly because they contain important genes for stress resistance, adaptability, and improved productivity.



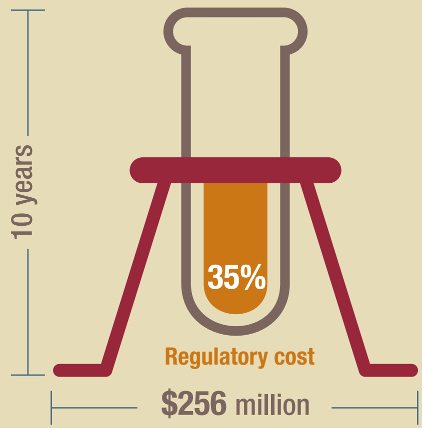
Wild barley varieties

> *Breeding is quickly becoming an information science, where the performance of a hybrid variety in a farmer's field may soon be predicted to a large extent just by looking at its DNA sequence.*
>
> – Syngenta

CROP PROTECTION

Although herbicide tolerant and stacked traits remain a central focus, there is also interest in developing new insect control traits, particularly to manage resistance. This involves searching for interesting compounds, screening these for active ingredients, developing those with potential and commercialising the few that are viable. Microbes and insects are a major focus and ABS questions are highly significant.

Developing a new pesticide



Discovery and development of a crop protection product

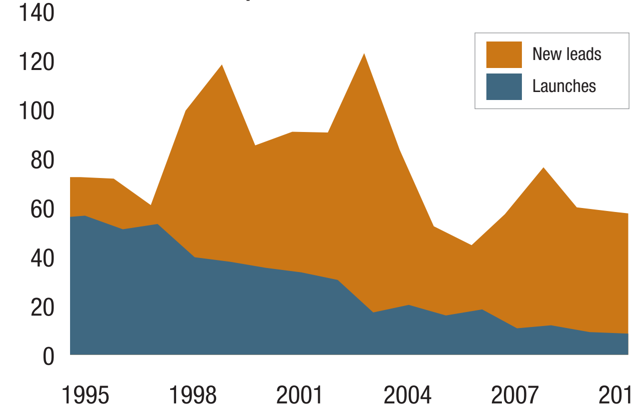
Research optimisation (years 0–3) · Early development (years 4–7) · Late development (years 8–9)

Year	0	1	2	3	4	5	6	7	8	9	Estimated cost* (USD million)
Chemistry – synthesis – formulation of product											≈ $80
Biology – research – trials – field development											≈ $85
Toxicology											≈ $70
Environment											
Registration											≈ $25
Compounds	140,000	5,000	30	1-3	1	1	1	1	1	1	≈ $260

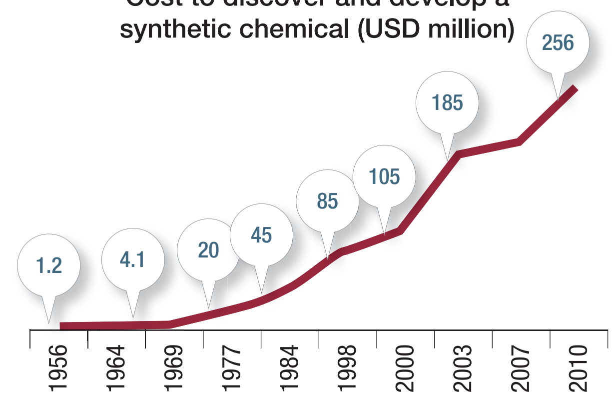
*Estimated cost excludes cost of failures

FEWER CHEMICALS – HIGHER COST

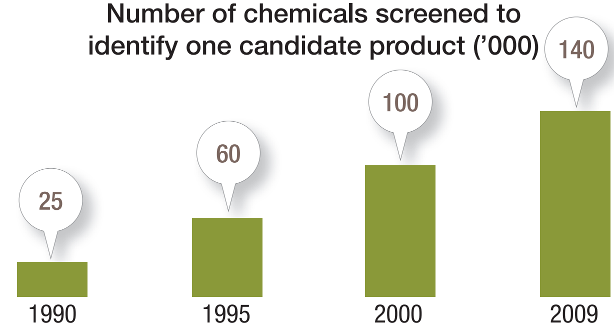
Number of new chemical leads vs. product launches



Cost to discover and develop a synthetic chemical (USD million)

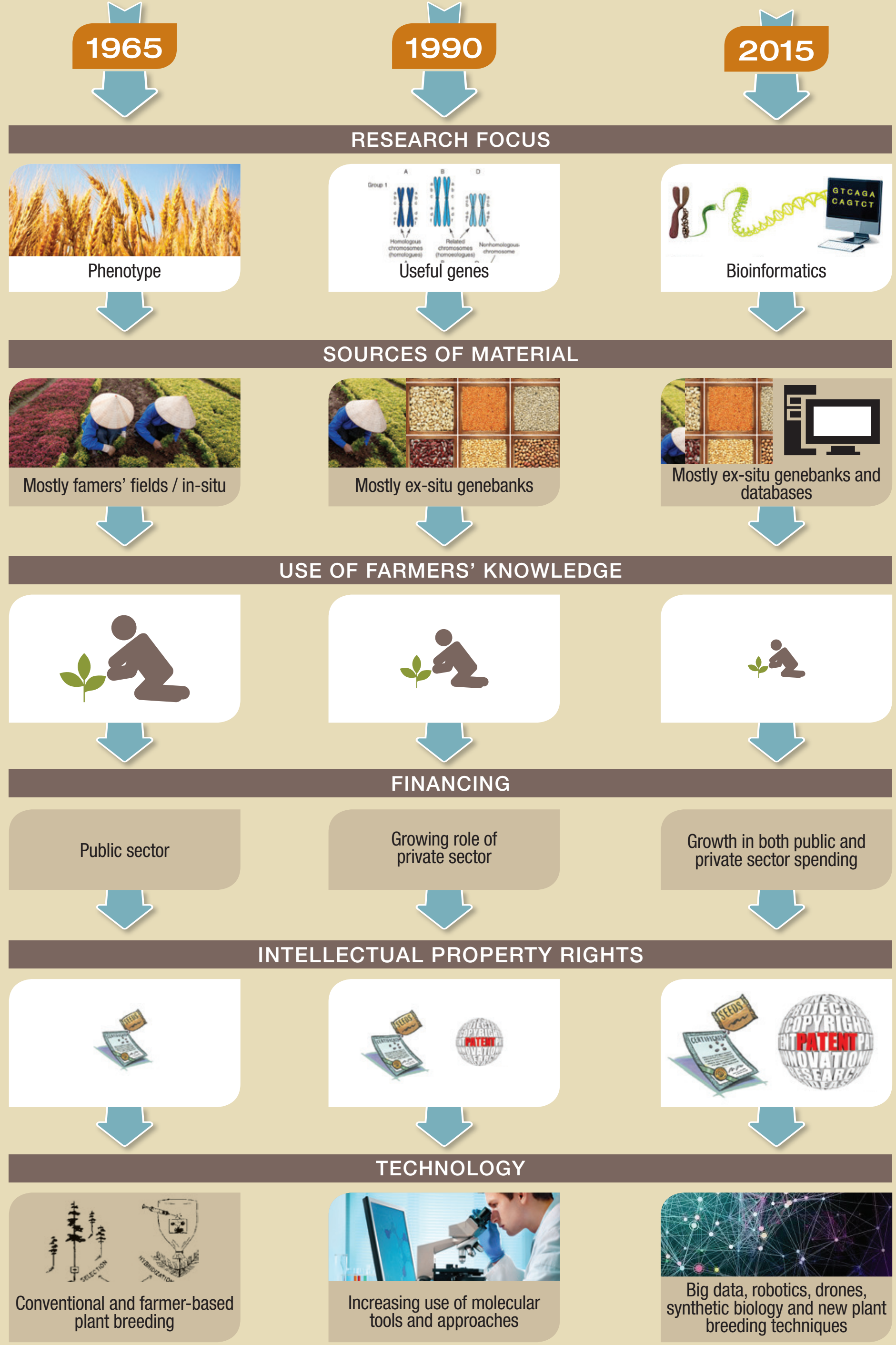


Number of chemicals screened to identify one candidate product ('000)

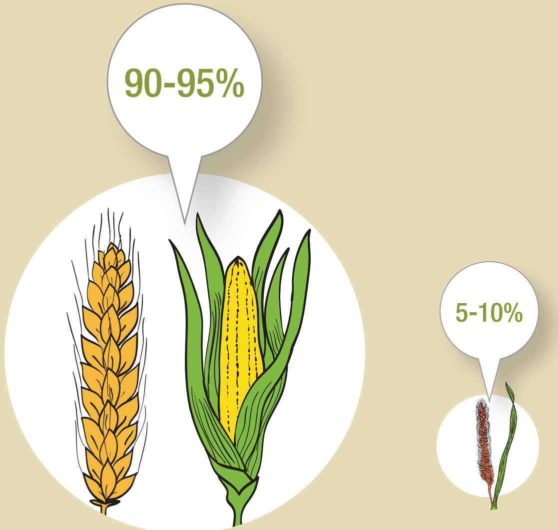


TRENDS IN AGRICULTURAL RESEARCH

Partly in response to climate change, companies are now investing in 'climate-smart' and 'precision' agriculture, involving Big Data, robotics, drones to deliver fertiliser, pesticides and other inputs and farm and weather surveillance technologies. The knowledge and genetic resources of farmers play a very minor role in new developments.



ACCESS TO GENETIC RESOURCES AND FARMERS' RIGHTS



Elite, modern varieties

Landraces or wild relatives

Most genetic resources used in the plant breeding industry today are elite, modern varieties that already incorporate desired characteristics.

Considerable effort is required to develop landraces or wild relatives into modern varieties or to find useful traits. New technologies are however making this process easier. There is increased interest in developing neglected and under-utilised crops as high-value niche products and for changing climates.

FARMERS' RIGHTS

The importance of farmers as custodians and developers of genetic diversity for food and agriculture is recognised in the ITPGRFA through provisions of Article 9 on Farmers' Rights. Such rights include:

- the protection of traditional knowledge relevant to PGRFA;
- the right of farmers to receive an equitable share of benefits resulting from use of their resources;
- their right to participate in making decisions at the national level on matters related to the conservation and sustainable use of PGRFA;
- their right to save, use, exchange and sell farm-saved seed or propagating material, subject to national law.

Such rights are subject to the decision and control of individual states.

Ex-situ collections are the most commercially significant source of genetic material. A substantial source resides with large companies, mainly to increase self-reliance and to avoid any risks of reduced access. Smaller companies and developing country institutions continue to be dependent on public sector collections and thus may be more affected by ABS measures.

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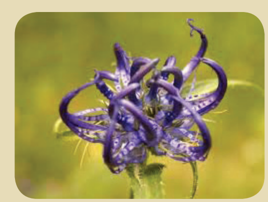

POLICY CONTEXT

Key agreements which govern the use of agricultural genetic resources include the Convention on Biological Diversity (CBD); its Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation; and the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA).

INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Establishes a multilateral ABS system for 64 important food security and forage crops (Annex 1).

These crops are accessible to everyone and share a set of rules of facilitated access and benefit sharing.

A Standard Material Transfer Agreement sets agreed terms and conditions for the transfer and use of Annex 1 crops for research, training and breeding.

The same terms govern ex-situ collections of PGRFA held by the Centres of the Consultative Group on International Agricultural Research (CGIAR).

NAGOYA PROTOCOL

Includes all other genetic resources not included in Annex 1 of the ITPGRFA or CGIAR collections, including many food and agricultural crops, all ornamentals and associated traditional knowledge.

Also includes Annex 1 crops used outside the scope of the ITPGRFA, for example for pharmaceutical purposes.

ABS is negotiated on a bilateral basis with variable terms.

Recognises the importance of genetic resources for food and agriculture and their special role for food security in relation to ABS measures.

Envisages implementation in a mutually supportive manner with other international agreements.

INDUSTRY AND ABS

Access to genetic resources is highly variable depending on the materials sought, company size and use. There is growing interest in wild species and landraces for breeding, crop protection and, to a lesser extent, for horticulture. This raises the importance of benefit sharing and Farmers' Rights.

Fast-moving technological changes mean that those implementing ABS must have familiarity with bioinformatics and an understanding of how informational resources are shared and used.

This sector has engaged actively in ABS due to its involvement in the ITPGRFA. Despite slow progress on benefit sharing and implementation of the ITPGRFA, important strides have been made to facilitate genetic resource exchange for food security and the public good. Implementation of the Nagoya Protocol should build on past achievements.

SOURCES

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The International Treaty on Plant Genetic Resources for Food and Agriculture; The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity.

www.abs-initiative.info

www.bio-economy.org.za

www.peopleandplants.org

The Access and Benefit-Sharing Key Points for Policy-Makers series has been produced to provide governments, companies, researchers, communities and others with background information to assist with the development of access and benefit-sharing measures to implement the Nagoya Protocol. The briefs are organised around central, key points on trends and practices in markets, research and development, and ABS. More detailed information on these sectors can be found at: www.bio-economy.org.za; www.abs-initiative.info; www.peopleandplants.org; CBD Bioscience at a Crossroads policy briefs: https://www.cbd.int/abs/policy-brief/default.shtml/; and in the upcoming book: http://www.routledge.com/books/details/9781138779099/

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