



New Tools and Approaches for Crop Protection

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IRISH TILLAGE AND LAND USE SOCIETY

WINTER CONFERENCE

5TH DECEMBER 2019



Introducing
Corteva
Agriscience™

- A brand new agriculture company for a brand new world.

Rooted in Excellence

- Corteva Agriscience™ draws upon the combined strengths of three agricultural leaders.





CORTEVA[™]
agriscience

Our Purpose

To enrich the lives of those who produce and those who consume, ensuring progress for generations to come.

The Challenges We Take On



Future of Farming: Integrated Solutions focused on Sustainability

Crop Protection & Nitrogen Management Solutions

Natural Products & Biologicals

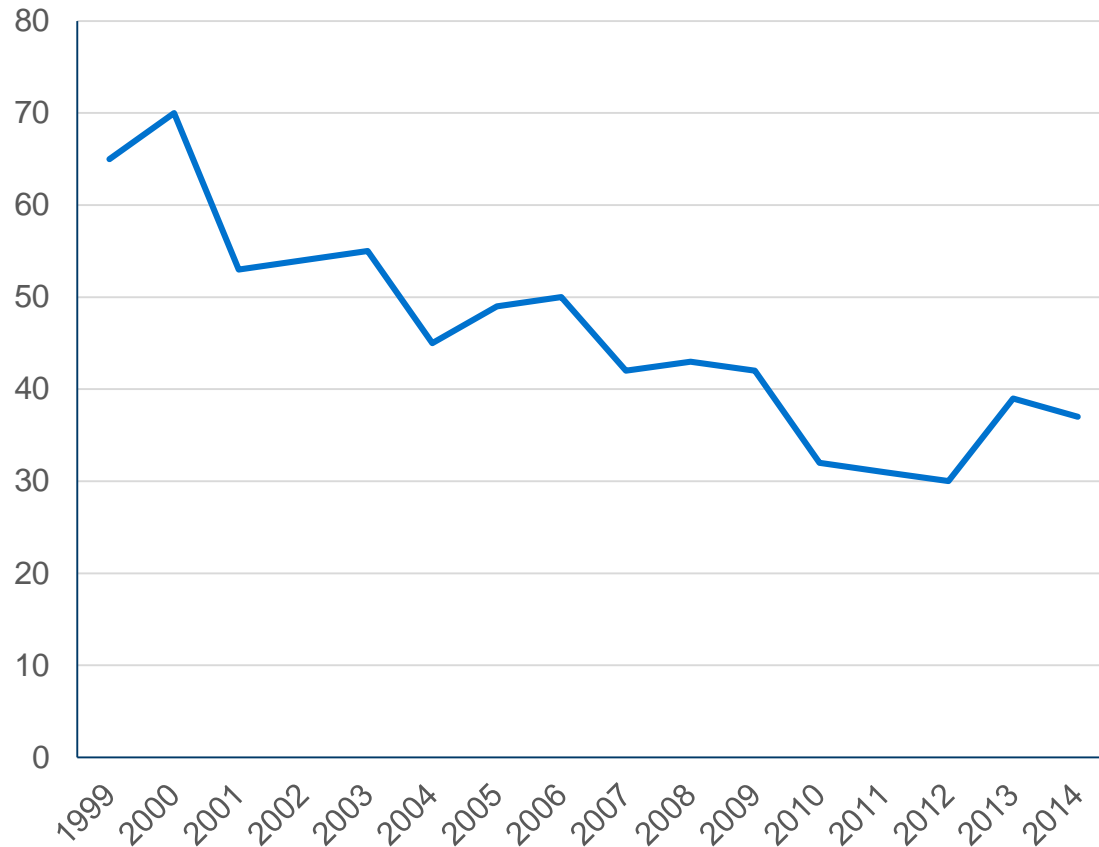
Germplasm, Traits, and Seed Applied Technology

Digital Solutions

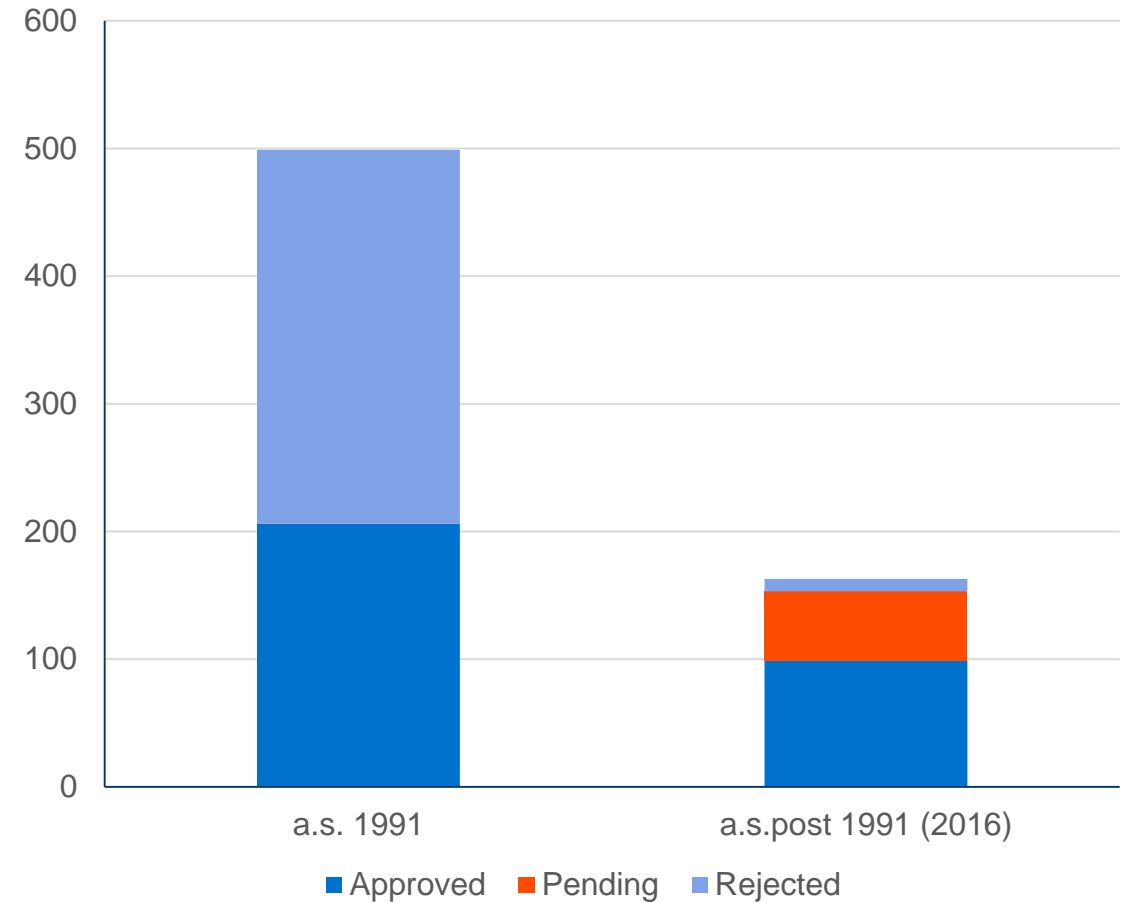
Targeted Breeding -
CRISPR

Trends in active substance registrations

Agrochemical active substance in development : Global



EU active Substances registrations



Important Elements of EU Regulation (EC) No 1107/2009



Source: CropLife International

Important Elements of EU Regulation (EC) No 1107/2009

Number of pages in Guidance Document 1992 vs 2019

250

1500

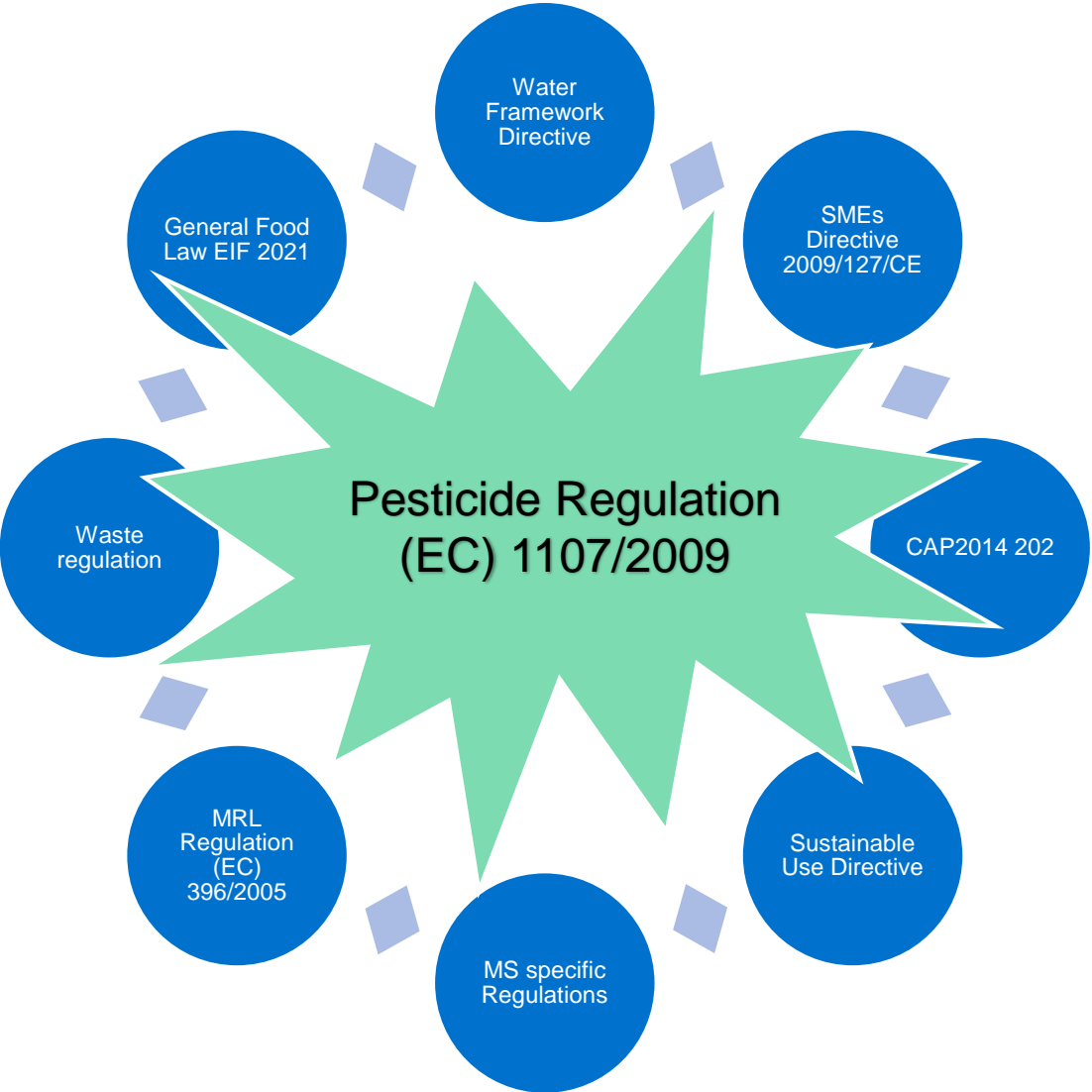
Endocrine Disruptors

Honey Bee Risk Assessment

Co- formulants

Public access to data

Other Influences on Crop Protection Regulation

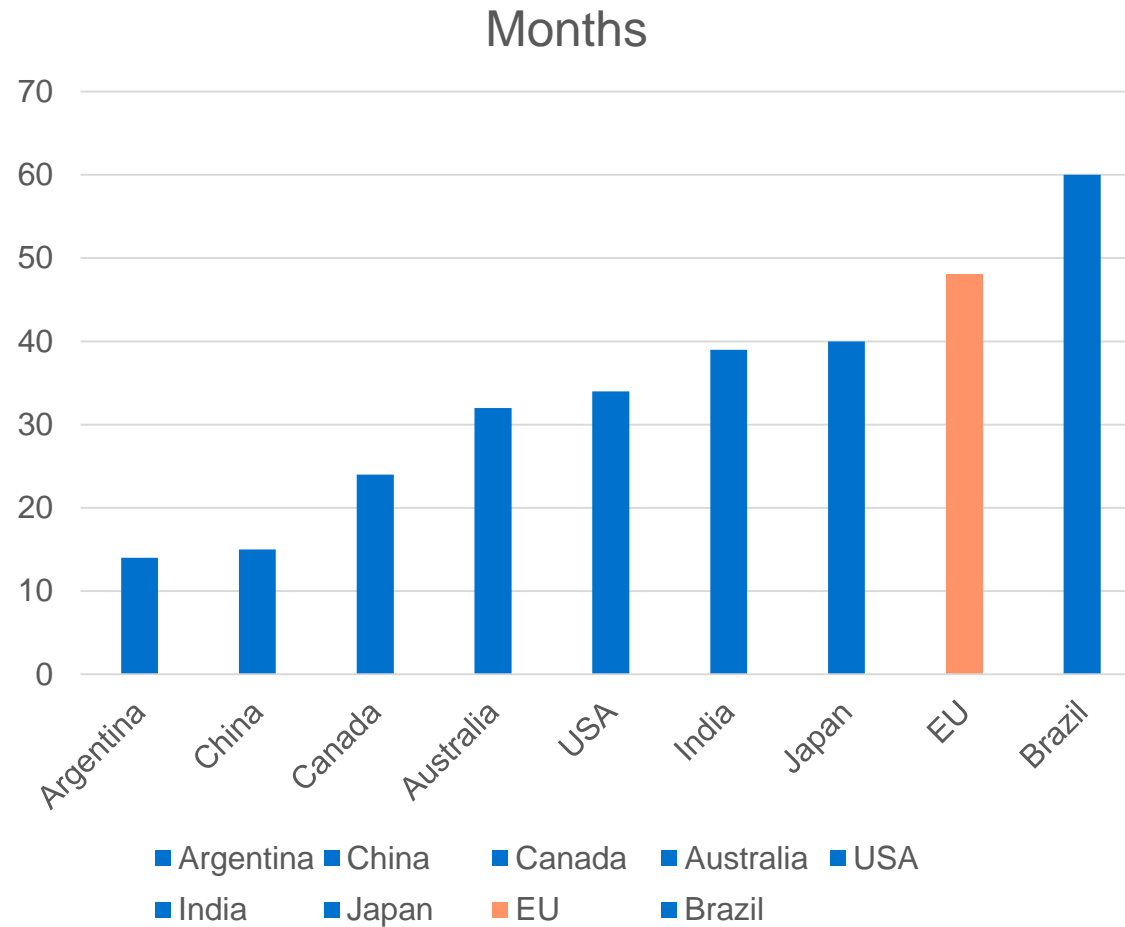


Trend in active substance registrations

Number of products investigated leading to a successful product launch				
	1995	2000	2005-8	2010-14
Research Synthesis	52,500	139,429	140,000	159,574
Development	4	2	1.3	1.5
Registration	1	1	1	1

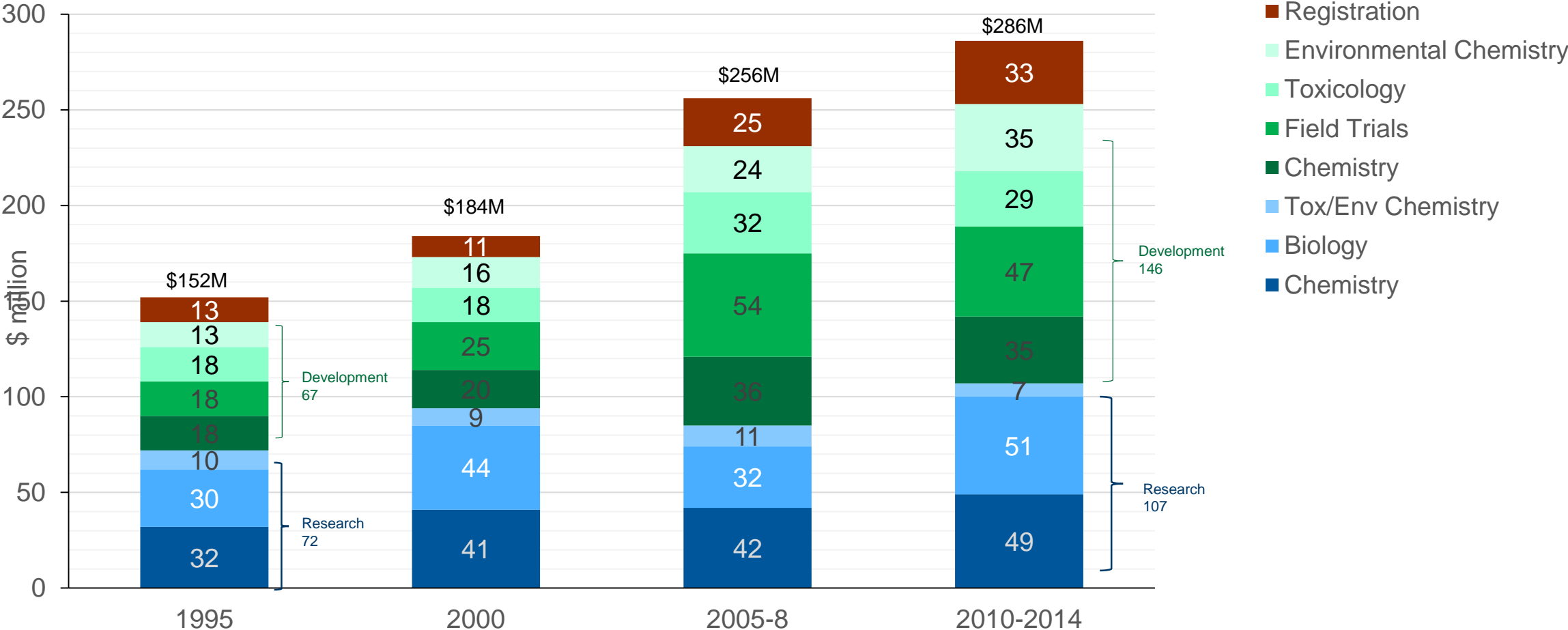
Crop Protection Discovery and Development Lead Time				
	1995	2000	2005-8	2010-14
Number of years between first synthesis and the first sale of product	8.3	9.1	9.8	11.3

Active Approval Timelines Global Trend



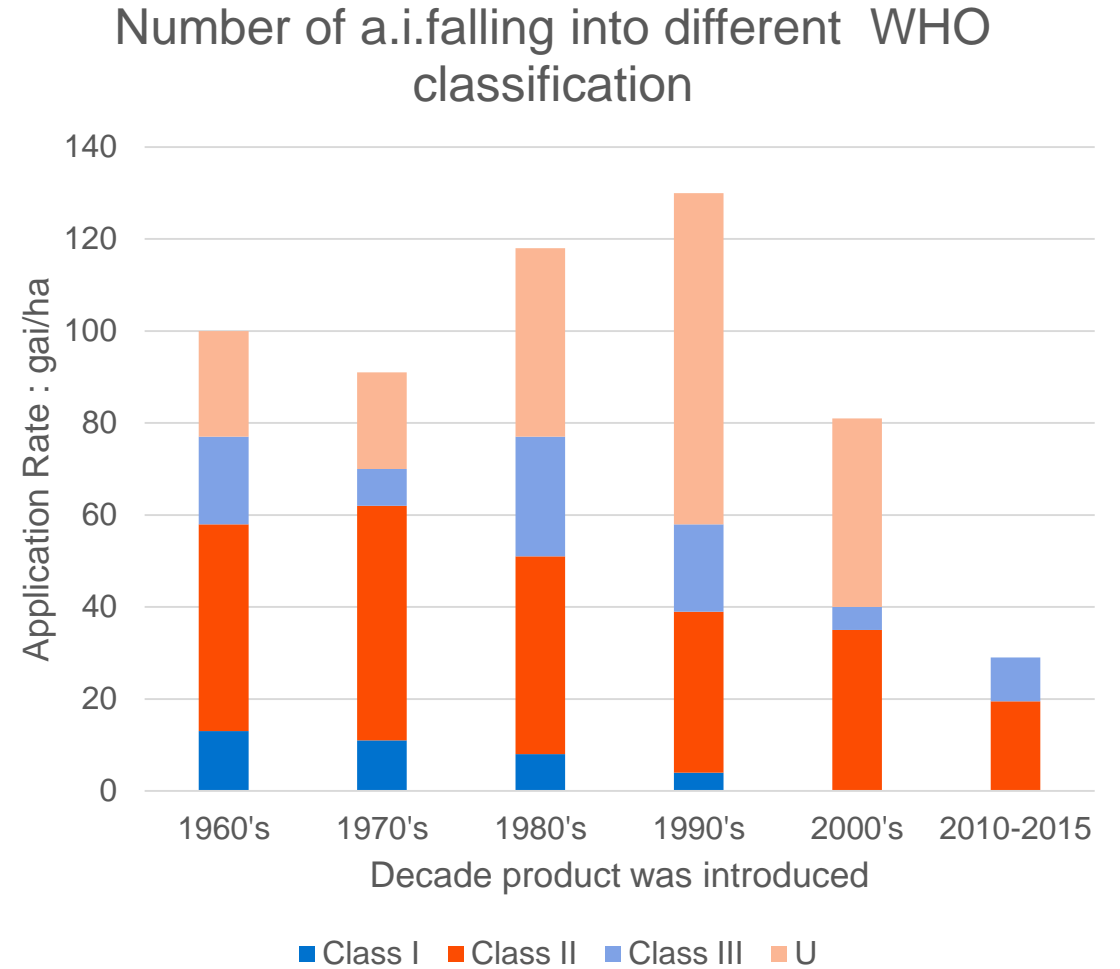
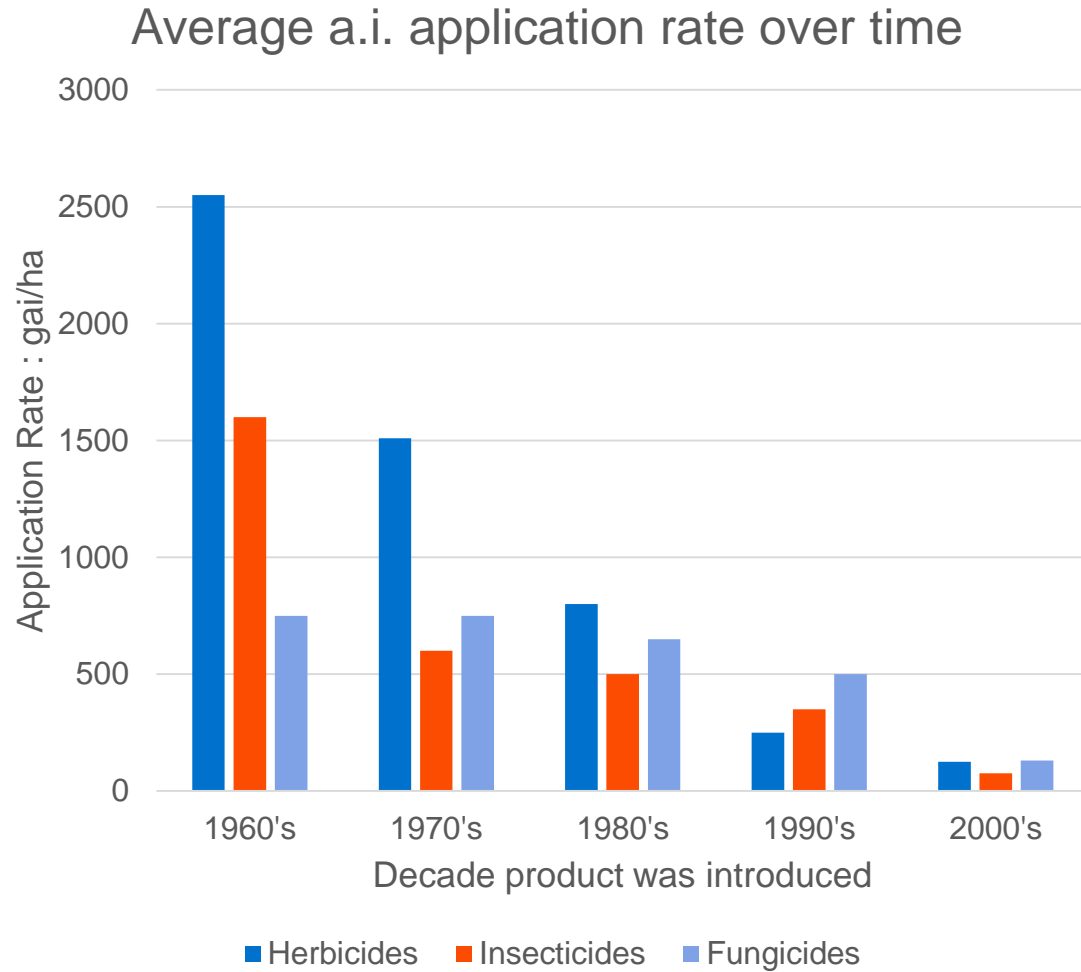
Discovery, development and registration costs

Discovery and development costs of a new crop protection product



Source: Philips MacDougal 2016

Trends in active substance approvals : Efficacy and toxicology improvements

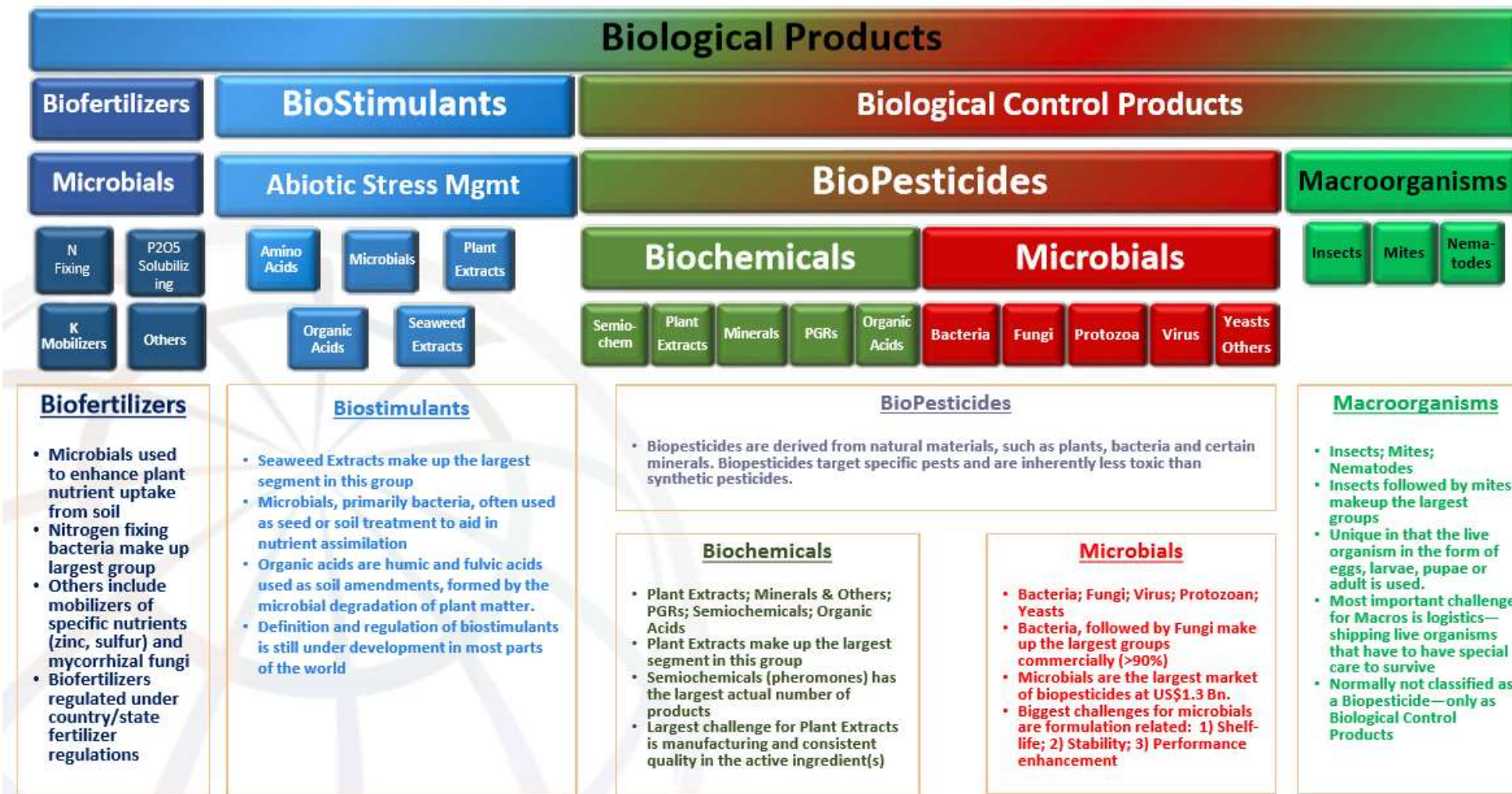


Trends in active substance registrations

No. chemical groups	
1960	2016
15	40

BIOLOGICAL MARKET OVERVIEW

--INTRODUCTION--PRODUCT TYPES



Biofertilizers

- Microbials used to enhance plant nutrient uptake from soil
- Nitrogen fixing bacteria make up largest group
- Others include mobilizers of specific nutrients (zinc, sulfur) and mycorrhizal fungi
- Biofertilizers regulated under country/state fertilizer regulations

BioStimulants

- Seaweed Extracts make up the largest segment in this group
- Microbials, primarily bacteria, often used as seed or soil treatment to aid in nutrient assimilation
- Organic acids are humic and fulvic acids used as soil amendments, formed by the microbial degradation of plant matter.
- Definition and regulation of biostimulants is still under development in most parts of the world

BioPesticides

- Biopesticides are derived from natural materials, such as plants, bacteria and certain minerals. Biopesticides target specific pests and are inherently less toxic than synthetic pesticides.

Biochemicals

- Plant Extracts; Minerals & Others; PGRs; Semiochemicals; Organic Acids
- Plant Extracts make up the largest segment in this group
- Semiochemicals (pheromones) has the largest actual number of products
- Largest challenge for Plant Extracts is manufacturing and consistent quality in the active ingredient(s)

Microbials

- Bacteria; Fungi; Virus; Protozoan; Yeasts
- Bacteria, followed by Fungi make up the largest groups commercially (>90%)
- Microbials are the largest market of biopesticides at US\$1.3 Bn.
- Biggest challenges for microbials are formulation related: 1) Shelf-life; 2) Stability; 3) Performance enhancement

Macroorganisms

- Insects; Mites; Nematodes
- Insects followed by mites makeup the largest groups
- Unique in that the live organism in the form of eggs, larvae, pupae or adult is used.
- Most important challenge for Macros is logistics—shipping live organisms that have to have special care to survive
- Normally not classified as a Biopesticide—only as Biological Control Products

Source: DunhamTrimmer LLC

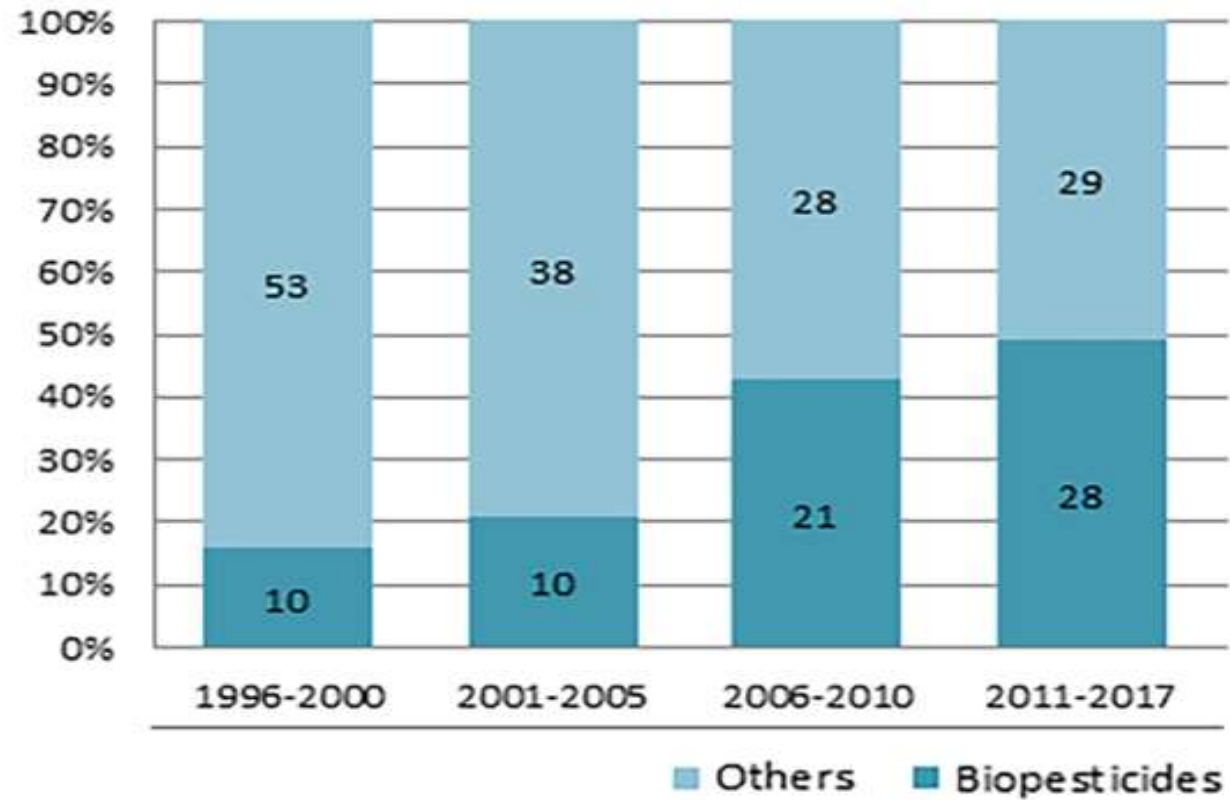
Biologicals

Naturally occurring substances, products derived from fermentation, microbes and pheromones, predatory insects, mites, fungi and nematodes

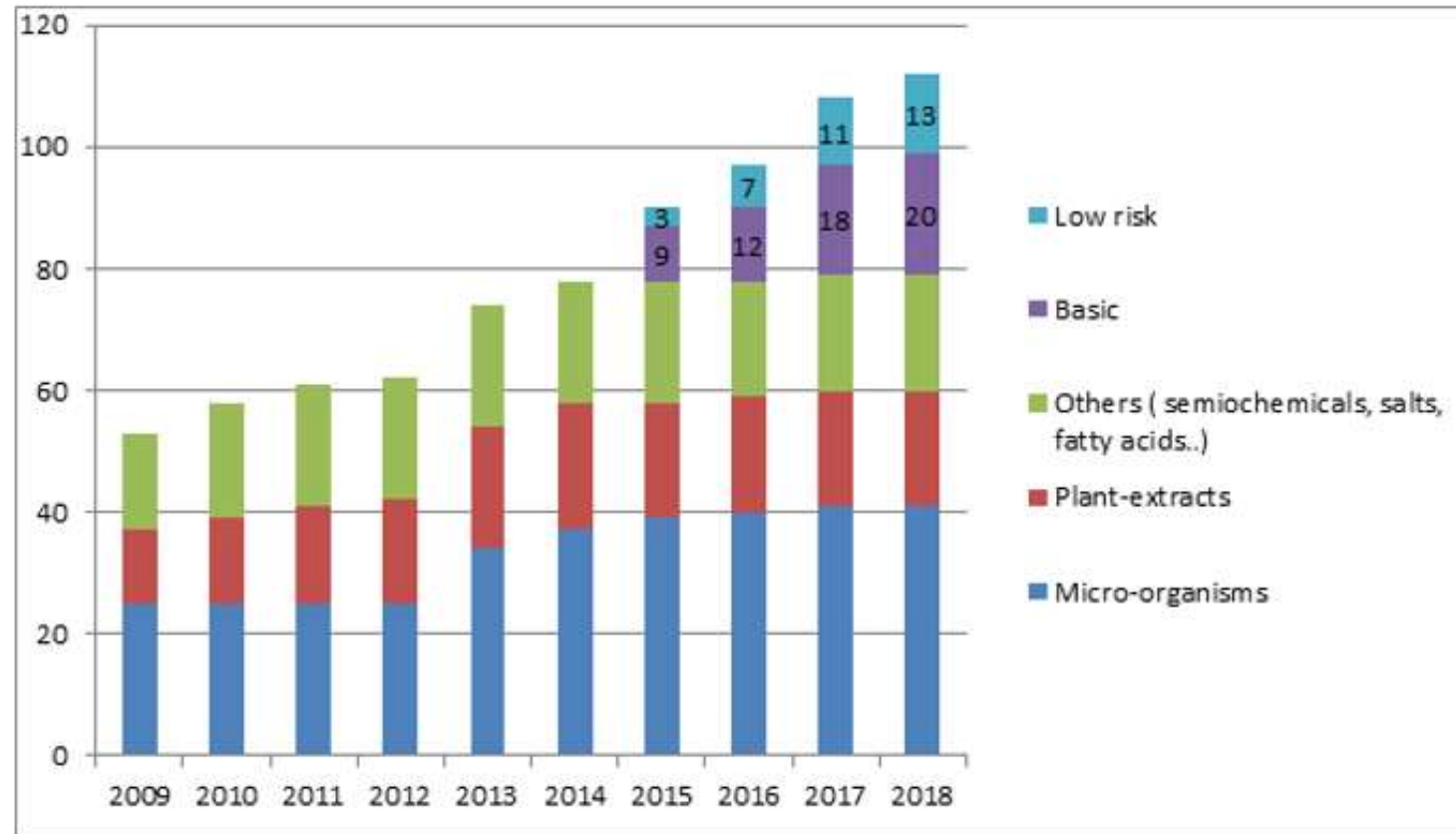
Biologicals



APPLICATION FOR NEW ACTIVE SUBSTANCES SINCE 1996



Availability of Low Risk Substances



Formulation Technology

i-Q4 Technology: Impact on Application



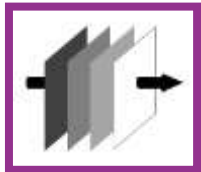
Retention

Excellent dilution and spray droplet retention



Coverage

Near 100% spread on the leaf surface



Penetration

Liquid film results in rapid penetration



Uptake

Higher levels of active into the plant tissue



Formulation Technology

PHYSICAL DRIFT



TANK MIX OF GLYPHOSATE +
TRADITIONAL 2,4-D



ENLIST DUO® HERBICIDE WITH
COLEX -D® TECHNOLOGY

In-Can Drift Technology :

Colex-D® technology :

Reduces driftable fines — those prone to move away from the target during application — without decreases in droplet size.

Helps Enlist™ herbicides land and stay on target.

+ the use of qualified nozzles helps reduce the drift potential even more.

Closed Transfer Systems

Reduce Operator Exposure,

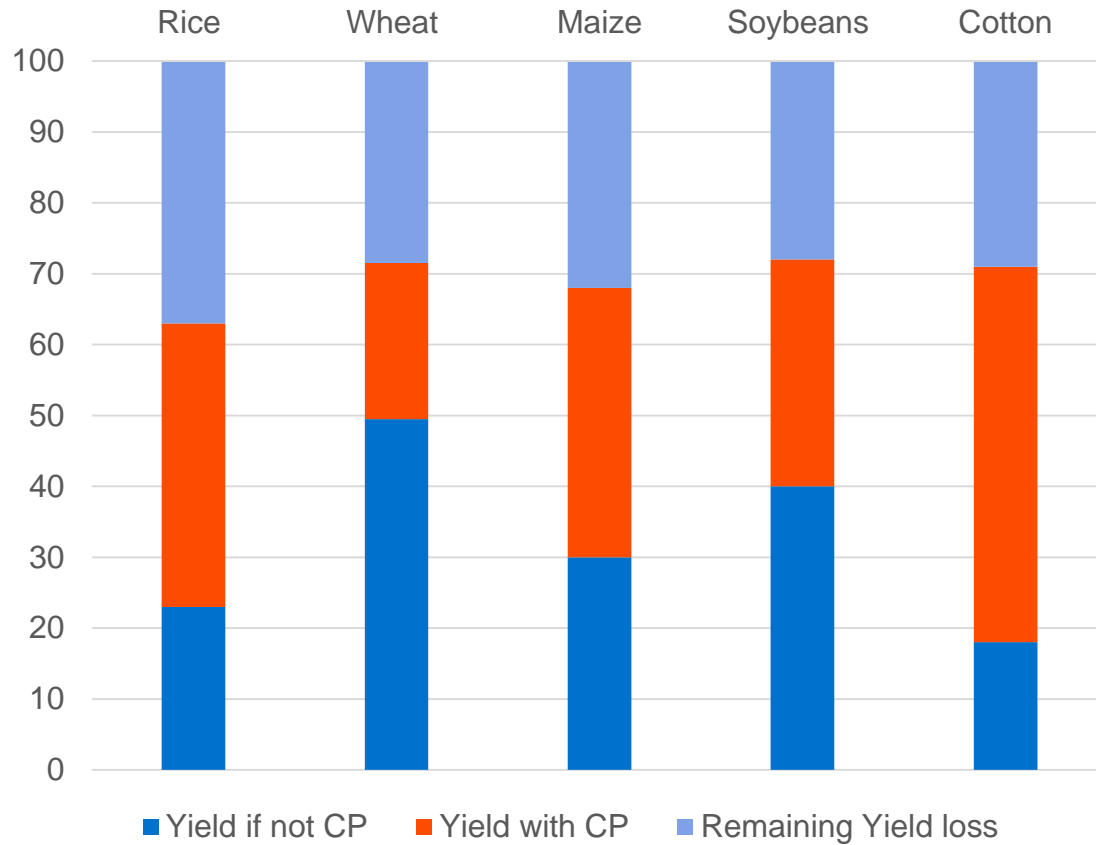
Reduce environmental risks from splashing or spilling

Convenient with faster emptying and rinsing.



Some figures...

Yield losses with and without Crop Protection Products



Investment into Crop Protection Development Global

Annual

% of Sales

3B\$

8-10%

Crop Protection Innovation - Europe

Zorvec™ active

- › *Oxathiapiprolin*: Game-changer technology that provides consistent disease control and new mode of action

Arylex™ active

- › *Halauxifen-methyl*: Innovative herbicide for the control of broadleaf weeds in cereals and other crops

Rinskor™ active

- › *Florpyrauxifen-benzyl*: Broad-spectrum rice and corn herbicide essential for resistance management

Lumiposa®

- › *Cyantraniliprole*: Next-generation seed applied technology

Isoclast™ active

- › *Sulfoxaflor*: Controls economically important sap-feeding insects

Spinetoram

- › Award-winning insecticide of natural origin with broad pest spectrum

Inatreq™ active

- › *Fenpicoxamid*: Fungicide with unique mode of action for *Septoria* on wheat



Sustainability

Sustainable Food System Report : Consensus Exists

European regulators,
stakeholders and
consumers want to:

Reduce natural
resource
consumption

Reduce
environmental
footprint

Reduce GHG
emissions

This leaves the door open for
collaboration and dialogue

On the Farm: Crop Protection Innovation

**Improved
regulatory
profile**

Durability

**Natural
products**

Reduced drift

Reduced use rates

**Integration
into IPM**

**Improved
environmental
profile**

Mode of action

**And
Many
more...**



Sustainability

- Read and Follow the Label !

DIRECTIONS FOR USE

IMPORTANT: This information is approved as part of the Product Label. All instructions within this section must be read carefully in order to obtain safe and successful use of this product.

IMPORTANT INFORMATION.

FOR USE ONLY AS A PROFESSIONAL HERBICIDE

Maximum Individual Dose (L/ha)	Maximum Total Dose per crop (L/ha)	Latest Time of Application
0.5	0.5	Before beginning of side shoot development (BBCH 21)

BEFORE USE, USING THIS PRODUCT IN A MANNER THAT IS INCONSISTENT WITH THE LABEL MAY BE AN OFFENCE. FOLLOW THE CODE OF PRACTICE FOR USING PLANT PROTECTION PRODUCTS.

MODE OF ACTION

Post-emergence herbicide for use in winter oilseed rape.

Activity against a wide range of annual broadleaved weeds including ryegrass, mayweed, shepherd's purse and cranesbill. BELKAR is mainly effective at the 2-leaf stage of the target weeds. The ideal timing is when the weeds are 2-4 cm high.

Stress. Stress can be caused by many factors including frost, trace element deficiency, disease and pest attack, etc. BELKAR may cause transient crop yellowing, growth inhibition or leaf deformation, resulting in a reduction in final crop yield and quality.

PRECAUTIONS

Operator exposure must be used where appropriate in addition to the following personal protective measures:

Wear PROTECTIVE CLOTHING (COVERALLS), PROTECTIVE GLOVES AND FACE PROTECTION when handling the concentrate. Wear PROTECTIVE GLOVES when handling the concentrate.

DO NOT SPRAY.

DO NOT EAT, DRINK OR SMOKE.

WASH hands from skin and eyes immediately.

DO NOT EXPOSE SKIN before eating and drinking.

Environmental protection:

Non-target aquatic organisms respect an unsprayed buffer zone of 10 m from water bodies.

Do not contaminate water with the product or its container. Do not use agricultural equipment near surface water. Avoid contamination via roads, farmyards and roads.

Special care must be taken to avoid spray drift onto non-crop areas outside of the target area.

Storage and disposal:

Keep in ORIGINAL CONTAINER, tightly closed in a safe place.

RINSE CONTAINER THOROUGHLY by using an integrated pressure rinsing device or manually rinsing three times. Add washings to sprayer at time of filling and dispose of safely.

DO NOT RE-USE CONTAINER for any purpose.

- Consult your supplier before mixing BELKAR with growth regulators and fungicides known to have growth regulatory effects, e.g. metconazole, tebuconazole, or with boron.

MODE OF ACTION and RESISTANCE MANAGEMENT

BELKAR contains two active ingredients: halauxifen-methyl and picloram. Both actives have a Group O HRAC classification and the risk of resistance developing to these Group O herbicides is considered to be low. However the following precautions are recommended to minimize resistance development.

- use rates to maximise control of high risk/difficult to control weed species
- follow label statements concerning rates and timing of application
- apply the use of cultural control methods and crop rotation where possible

SOIL TYPE

BELKAR can be used on all soil types.

CROPS

BELKAR can be applied to all varieties of winter oilseed rape.

RATES and TIMINGS

BELKAR can be applied at 0.25 L/ha once the crop has reached the 2-leaf stage (BBCH 12) or up to 0.5 L/ha from the 6-leaf stage (BBCH 16). The latest time of application is before the beginning of side shoot development (BBCH 21).

RATE OF USE and WEED SUSCEPTIBILITY

BELKAR 0.25 L/ha will control the following weeds:

Weed species	Maximum growth stage controlled	Susceptibility*
Cleavers	Up to 2 cm high/across	S
Common fumitory	Up to 3 cm high/across	S
Red deadnettle	Up to 2 cm high/across	S
Scented mayweed	Up to 2 cm high/across	S
Shepherd's purse	Up to 2 cm high/across	S
Small-flowered cranesbill	Up to 2 cm high/across	S
Common poppy	Up to 2 cm high/across	MS

Dow Dow AgroSciences

Belkar

HERBICIDE

PCS No. 06195

An emulsifiable concentrate (EC) formulation containing 10 g/L of halauxifen-methyl + 48 g/L picloram. A post-emergence herbicide for use on winter oilseed rape for the control of certain broadleaved weeds.

PROTECT FROM FROST.

READ DIRECTIONS FOR USE ON ATTACHED LEAFLET.

3 Litres e

Dow AgroSciences Limited

CPC2 Capital Park, Fulbourn, Cambridge CB21 5XE, England

Telephone: +44 1462 457272

24 Hour Emergency Telephone Number: +44 1553 761251

For Technical Enquiries Call +44 800 6898899

National Pesticides Information Centre, Ireland: 01-8092166

*Trademark of The Dow Chemical Company ("Dow") or an Affiliated Company of Dow

Product Identifier according to Art. 18 of Reg. (EC) No 1272/2008 (CLP): BELKAR®

Warning
Causes serious eye irritation.
May cause respiratory irritation.
Very toxic to aquatic life with long lasting effects.

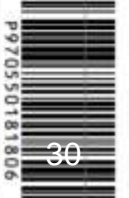
Wear protective gloves/protective clothing/eye/face protection.
IF ON SKIN: Wash with plenty of soap and water
IF IN EYES: rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Dispose of contents / container to a licensed hazardous-waste disposal contractor or collection site except for triple rinsed empty clean containers which can be disposed of as non-hazardous waste. Repeated exposure may cause skin dryness or cracking.
To avoid risks to human health and the environment, comply with the instructions for use.
PCS No. 06195

IMPORTANT INFORMATION.

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Crops	Maximum Individual Dose (L/ha)	Maximum Total Dose per crop (L/ha)	Latest Time of Application
Winter oilseed rape	0.5	0.5	Before beginning of side shoot development (BBCH 21)

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Thank you!