

# *R&D trends in Crop Protection*

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# *Industry background*

## Market Performance 2011

(Distributor level – average exchange rates - Nominal US\$)

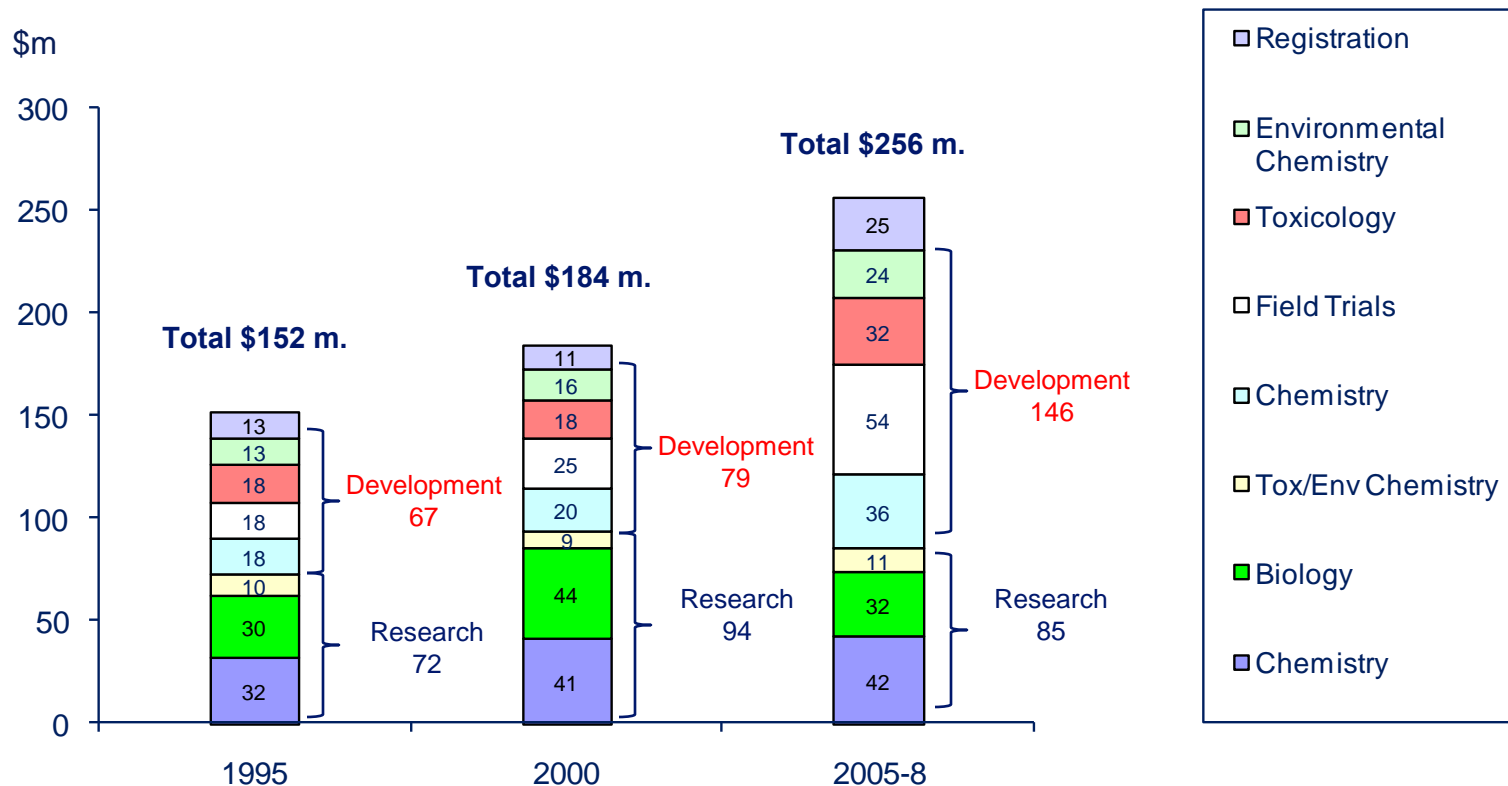
Year	Crop Protection (\$m)	Non-Crop Agrochemicals (\$m)	GM Seed (\$m)	Conventional Seed (\$m)
2000	27830		2195	14269
2001	25760		2778	13597
2002	25150	4270	3140	13060
2003	26710	4445	3709	13521
2004	30725	4675	4476	14524
2005	31190	4905	5095	14657
2006	30425	5150	5855	14485
2007	33390	5365	7062	14648
2008	40475	5655	9150	16870
2009	37860	5860	10570	17185
2010	38315	5880	12870	17950
2011	44015	6290	15685	18810
<b>2011/2010 %</b>	<b>+14.9</b>	<b>+7.0</b>	<b>+21.9</b>	<b>+4.8</b>

Agrochemicals = \$50,305 +13.8%

Seed = \$34,495 +11.9%

# ***R&D in Crop Protection and Production***

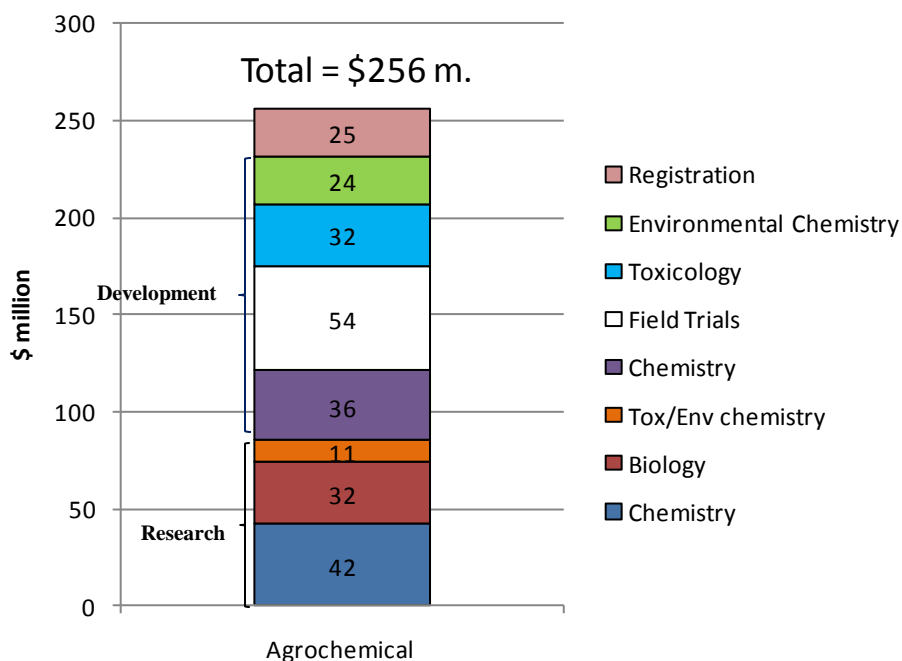
## Cost of Bringing a New Product to Market



Results of Study undertaken for ECPA and CropLife America

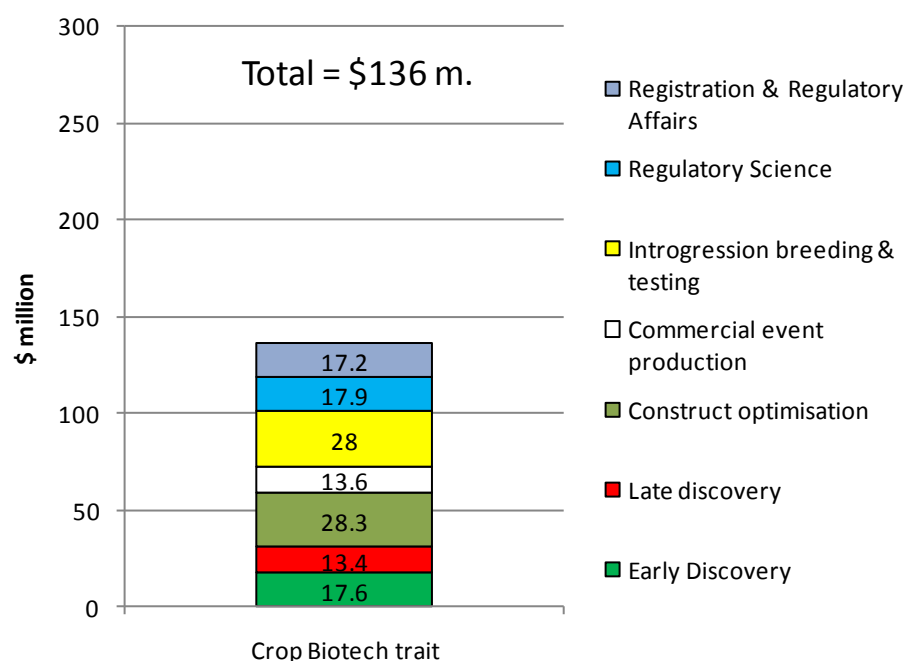
## Cost of Bringing a New Product to Market

### Agrochemical



Agrochemical costs based on 2009 Crop Life America/ECPA study

### Plant biotechnology trait



Plant biotechnology trait costs based on 2011 Crop Life International study

## ***No. of Agrochemical Products Processed Leading to a Successful Product Launch***

		<b>1995</b>	<b>2000</b>	<b>2005-8</b>
Research	Synthesis	52500	139429	140000
Development		4	2	1.3
Registration		1	1	1

Results of Study undertaken for ECPA and CropLife America

## Number of Units Associated with Biotech Trait R&D Process

Activity Stage		For an Event introduced between 2008-2012
		Mean Number of Units Evaluated
<b>I</b>	<b>Early Discovery</b>	6204
<b>II</b>	<b>Late Discovery</b>	4005
<b>III</b>	<b>Construct Optimisation</b>	511
<b>IV</b>	<b>Commercial Event Production &amp; selection</b>	1302
<b>V</b>	<b>Introgression Breeding &amp; Wide – Area Testing</b>	2
<b>VI</b>	<b>Regulatory Science</b>	1
<b>VII</b>	<b>Registration &amp; regulatory Affairs</b>	1



## Time from New Product Inception to First Introduction

### (1) Agrochemical

	1995	2000	2005-8
Number of years between the first synthesis and the first sale of the product	8.3	9.1	9.8

Results of Study undertaken for ECPA and CropLife America

### (2) Plant biotechnology trait

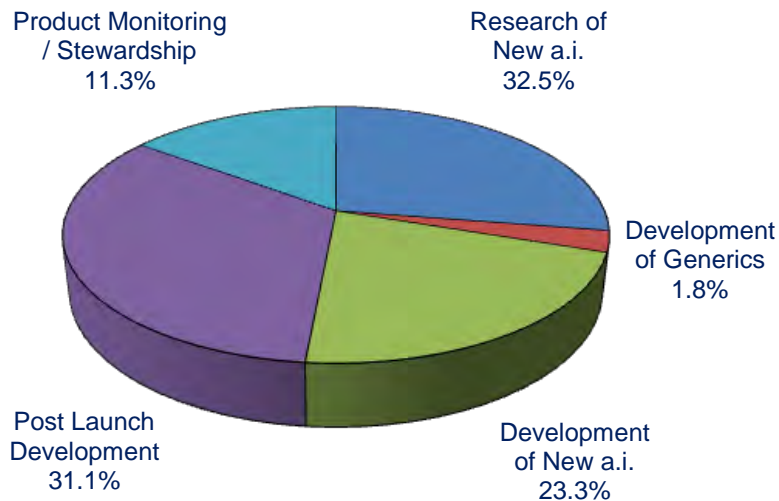
	Canola	Corn	Cotton	Soybean	All crops
Number of years from discovery of trait to first commercial sale	11.7	12.0	12.7	16.3	13.1

Results of Study undertaken for CropLife International

# Agrochemical Industry R&D Expenditure by Function

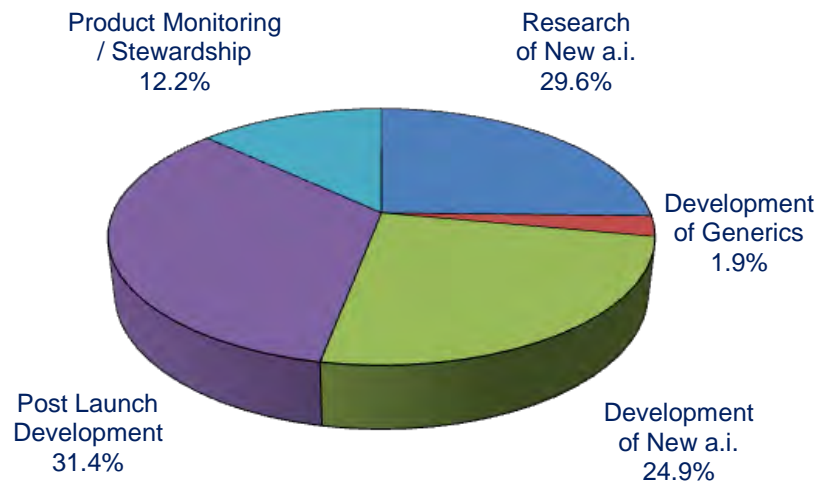
(Fourteen Reporting Companies Only)

2007



Total = \$2,328million

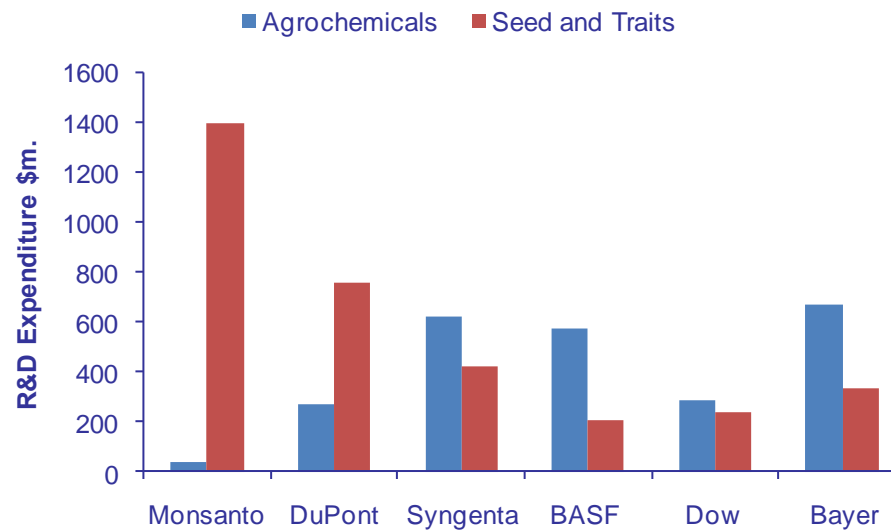
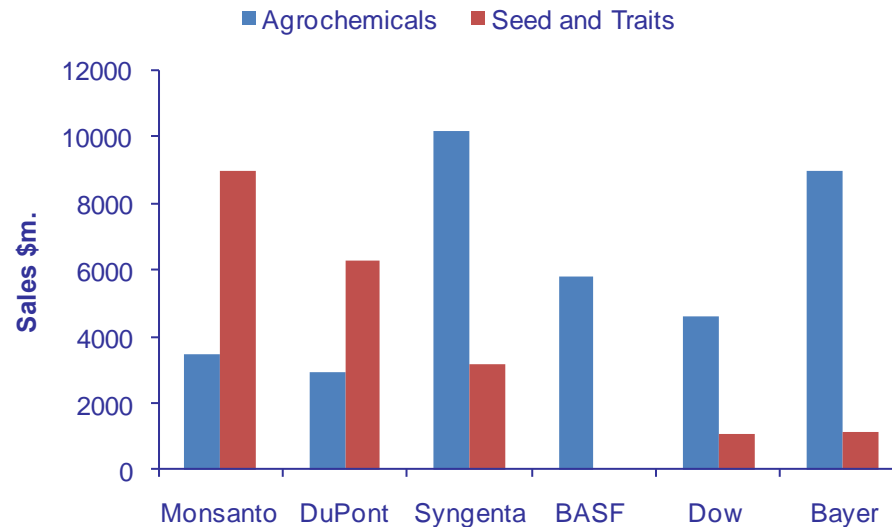
2012



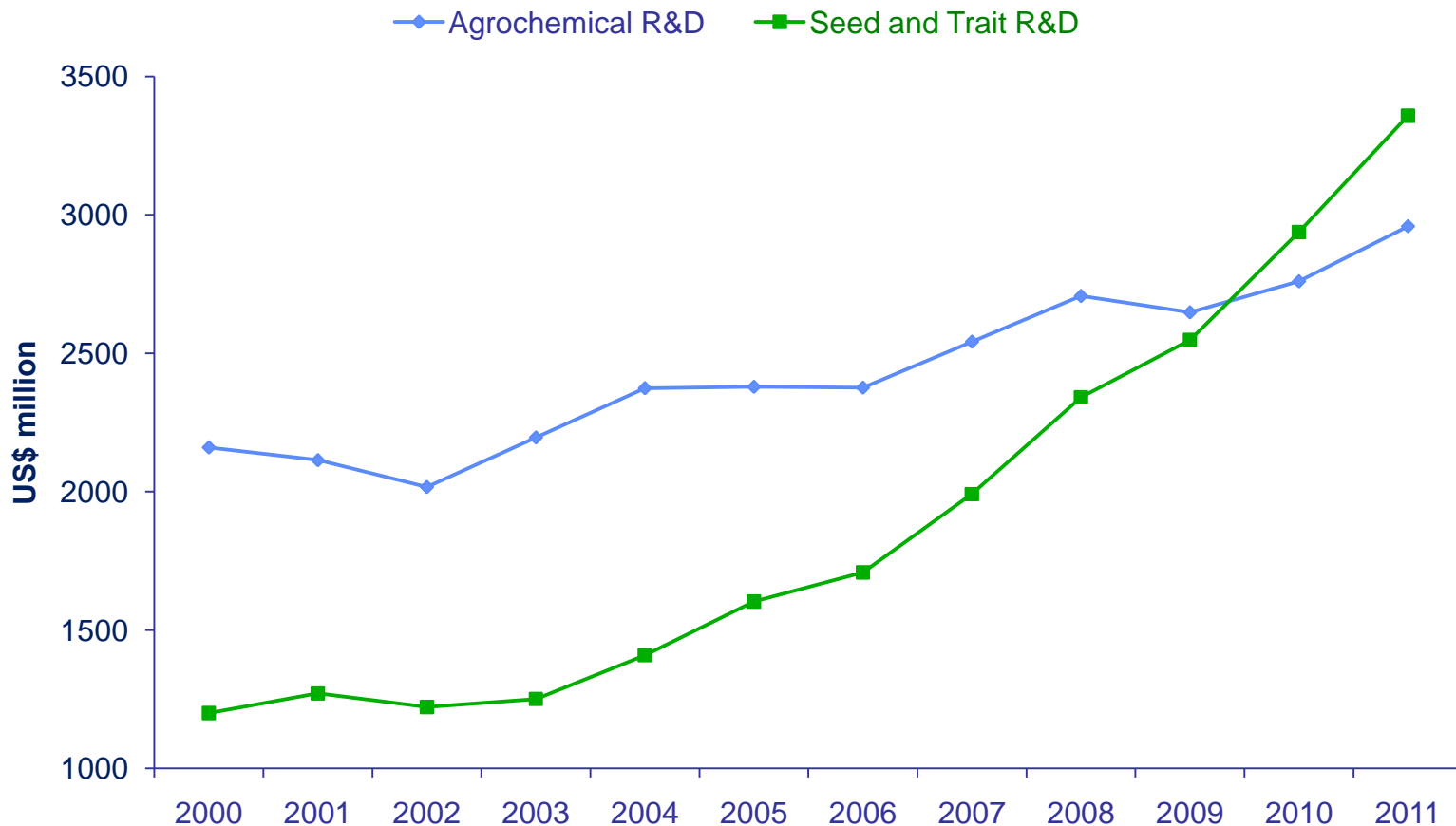
Total = \$2,943 million

Results of Study undertaken for ECPA and CropLife America

## Company Sales and R&D Expenditure 2011



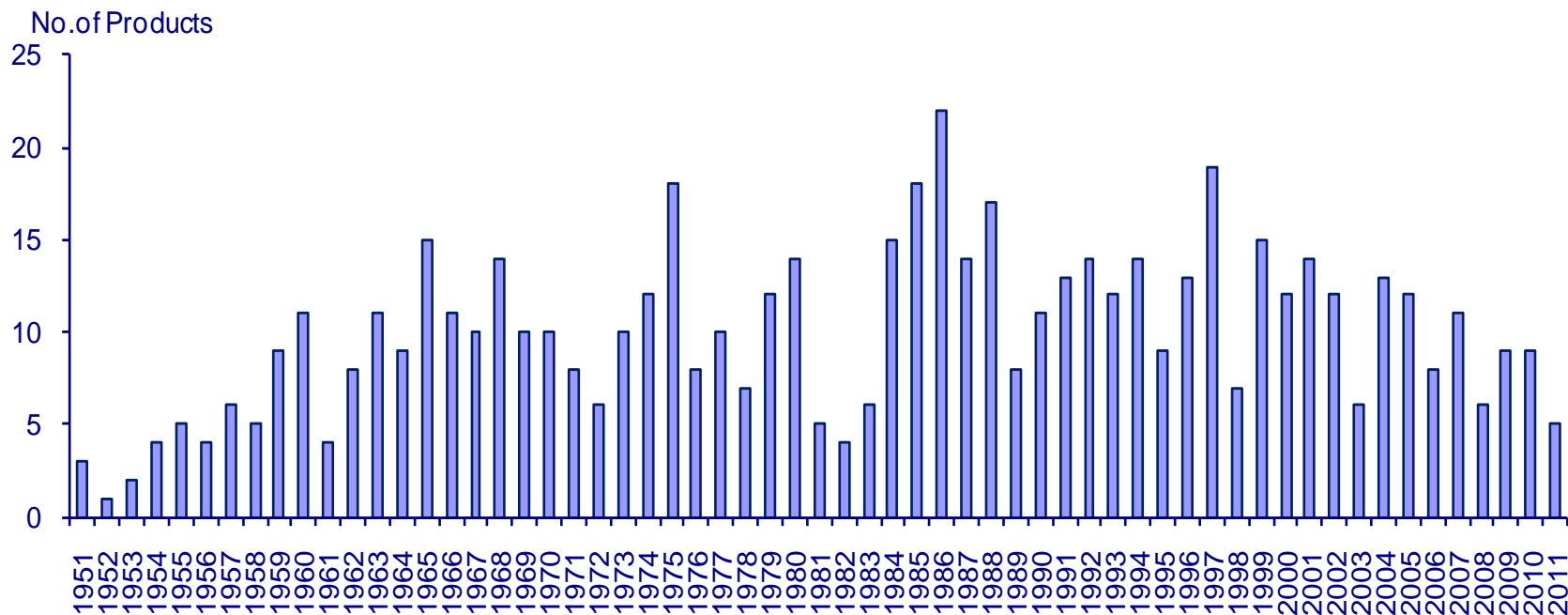
## R&D Expenditure of Leading Agrochemical Companies



## Product Introductions and R&D by Crop

Number of new Active Ingredients		Time period				
		1980/1989	1990/1999	2000/2009	2010/11	In R&D
Herbicides	Cereals	15	12	12	1	1
	Soybean	11	10	1	0	0
	Maize	2	10	9	0	1
	Rice	11	19	15	0	4
	F&V	2	1	0	1	0
	Other	10	5	2	1	1
	Total	51	57	39	3	7
Insecticides	F&V	11	16	16	2	4
	Rice	5	2	3	0	3
	Cotton	9	12	3	0	0
	Others	4	7	5	1	3
	Total	29	37	27	3	10
Fungicides	F&V	13	9	17	4	4
	Cereals	14	16	8	2	5
	Rice	9	5	7	1	1
	Others	0	0	0	0	0
	Total	36	30	32	7	10
Others	7	3	5	1	0	
Total	123	127	103	13	27	
Average annual rate of introduction		12.3	12.7	10.3	6.5	5.4

## New Active Ingredient Introductions



## Agrochemical Product Introductions and R&D Products

	Introduced 1995-2010	Currently in R&D
Bayer	35	6
Syngenta	15	4***
BASF	20	3*
Dow	17	2
Sumitomo	15	1
DuPont	7	3*
Monsanto	2	0
Other Japanese	42	12
Rest	22	2
<b>Total</b>	<b>175</b>	<b>32**</b>

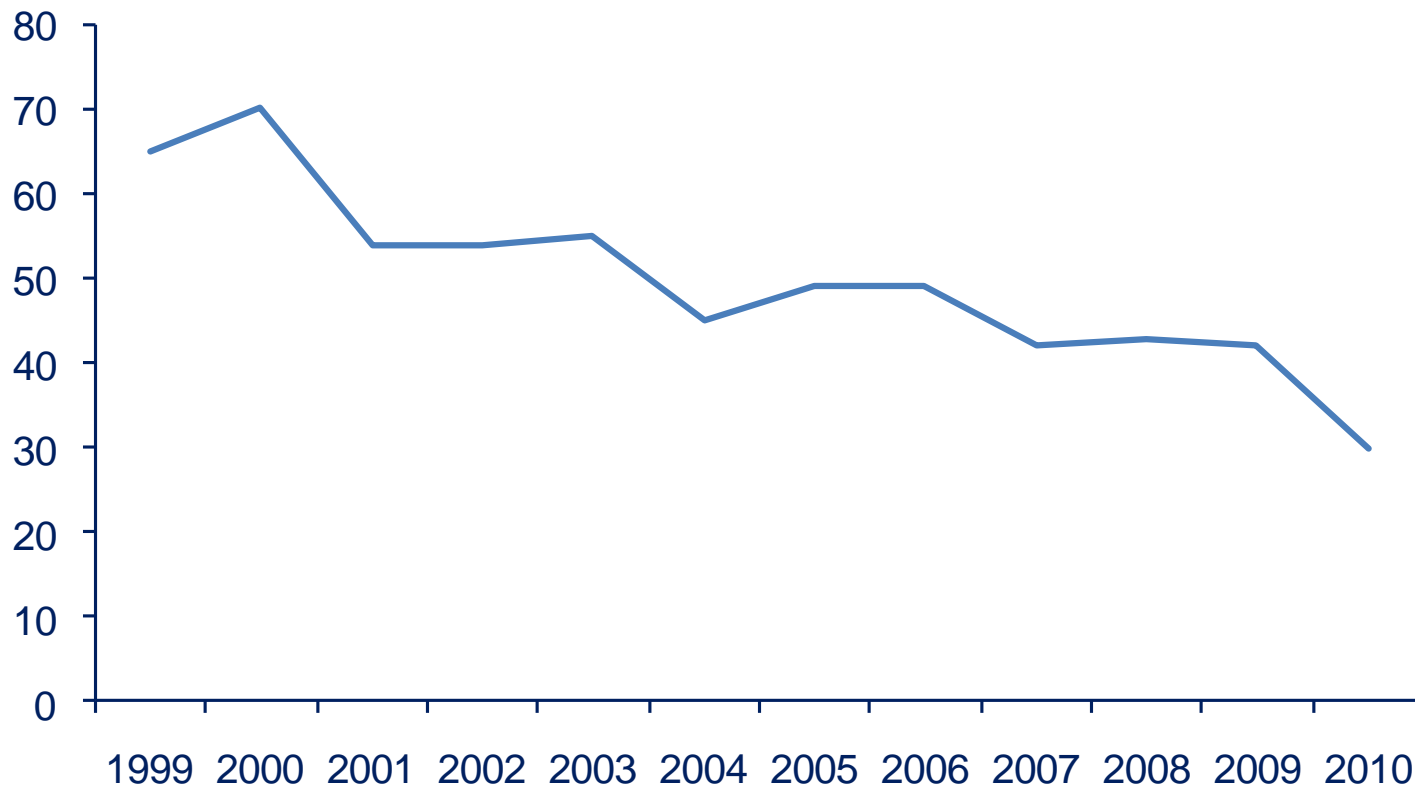
\* Some in co-development with other companies

\*\* some licensed products counted twice

\*\*\* Syngenta has another 4 unidentified products in early development

## Agrochemical Active Ingredients in Development

a.i.s in development





## Seed Companies: Input Traits - Development

	Maize	Soybean	Cotton	Canola	Others
BASF		Herbicide Tolerance* Nematode Resistance* Disease Resistance			
Bayer		GlyTol GlyTol + HPPD Herbicide Tolerance	Twinlink insect resistance Dual Mode Herbicide Tolerance Novel Insect Resistance	Roundup Ready Liberty Link + Roundup Ready Roundup Ready 2	Insect Resistant Rice Fungus Resistant Rice
Dow	Enlist Corn	Enlist Soybeans Triple Mode Herbicide Tolerance	Enlist Cotton		
DuPont	Optimum AcreMax Xtreme Optimum Intrasect + DP4114 Lepidoptera Resistance III Coleoptera Resistance III	Multiple Mode Herbicide Tolerance Aphid Resistance Lepidoptera Resistance Hemiptera Resistance Asian Soybean Rust Resistance		Optimum GLY Glyphosate Tolerance Liberty Link	Herbicide Tolerant Rice Insect Resistant Rice
Monsanto	Dicamba and Glufosinate Tolerance Genuity Rootworm Resistance III Genuity Corn borer Resistance III FOP Herbicide tolerance Goss's Wilt Resistance*** Gray Leaf Spot resistance	Genuity Intacta Dicamba Tolerance Roundup Ready 2 Xtend 2nd Generation Cyst Nematode Resistance Asian Rust Resistance* 2nd Generation Phytophthora Root Rot Resistance	Genuity Bollgard III Dicamba and Glufosinate Tolerance Lygus Control Reniform Nematode Resistance Root Knot Nematode Resistance	Roundup Ready 2 Dicamba tolerance Roundup Ready + Liberty Link	Insect protected Roundup Ready Sugarcane Herbicide tolerant wheat Gemini Virus Resistant Tomato*** Phytophthora Resistant Peppers
Syngenta	Agrisure Viptera 3222 Agrisure Duracade	Insect Resistance Disease Resistance	Insect resistance (COT 102)		Insect Resistant Rice

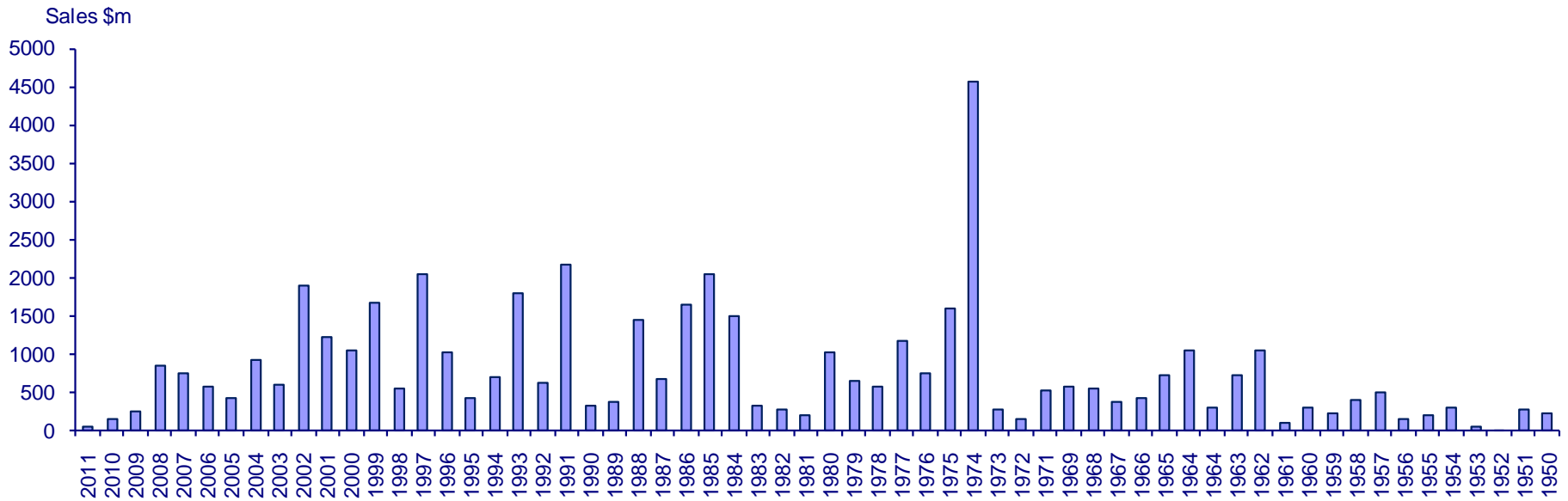
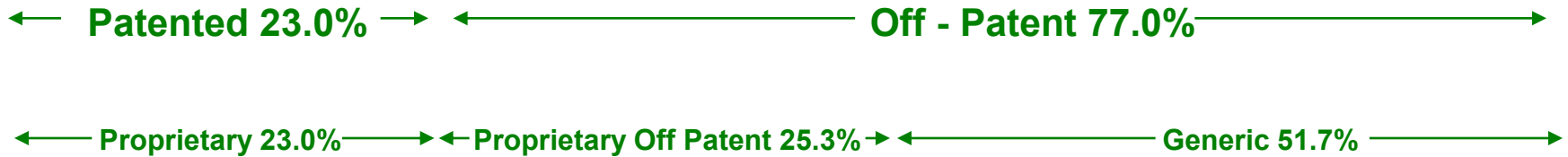
\*BASF / Monsanto partnership \*\* BASF / Embrapa partnership \*\*\*Developed through conventional breeding

## Seed Companies: Output/Agronomic Trait Research

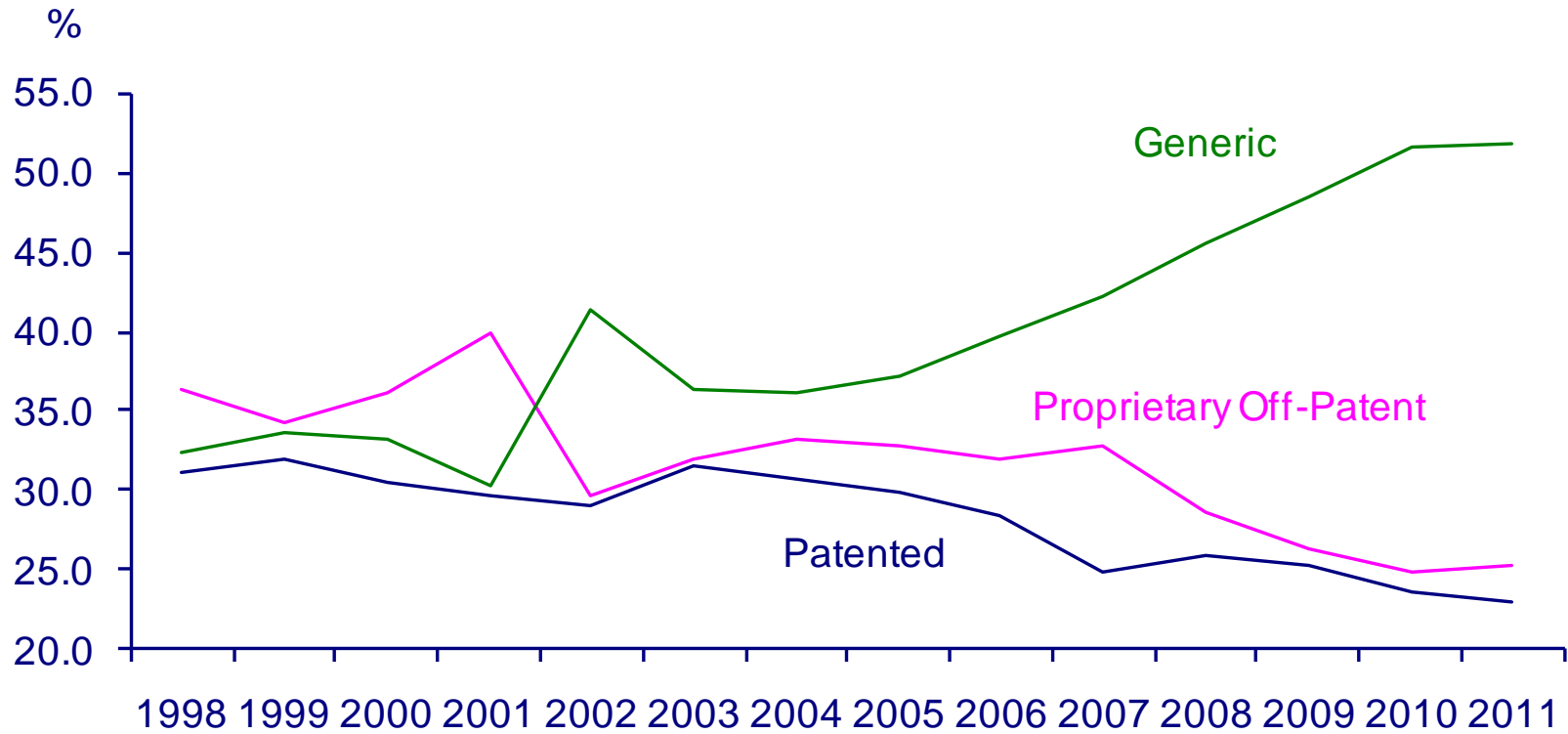
	<b>Maize</b>	<b>Soybean</b>	<b>Cotton</b>	<b>Canola</b>	<b>Others</b>
BASF	Higher yielding* Drought tolerance* Improved Nitrogen Improved feed	Higher yielding* Healthy fatty acids	Drought tolerance*	Higher yielding*	Higher yielding sugarcane Higher yielding sugarbeet Amylopectin potatoes Higher yielding wheat* Stress tolerant wheat*
Bayer			Altered oil content	Higher yielding	Plant made pharmaceuticals Stress tolerance Hybrid rice
Dow		Healthy oils			Stress tolerance Added Nutrition
DuPont	Seed production technology (yield) Improved feed Improved processing Improved Nitrogen Drought tolerance	Higher yielding Plenish modified oils Increased oils Improved feed		Higher yielding	Hybrid rice
Monsanto	Higher yielding* Drought tolerance* Improved Nitrogen	Higher yielding* SDA omega-3 oil Vistive Gold	Drought tolerance*	Higher yielding*	Higher yielding wheat* Stress tolerant wheat*
Syngenta	Improved Nitrogen Carb Yield				

\* In collaboration

## Proprietary v Off Patent Market Share - 2011



## Proprietary v Off Patent Market Share

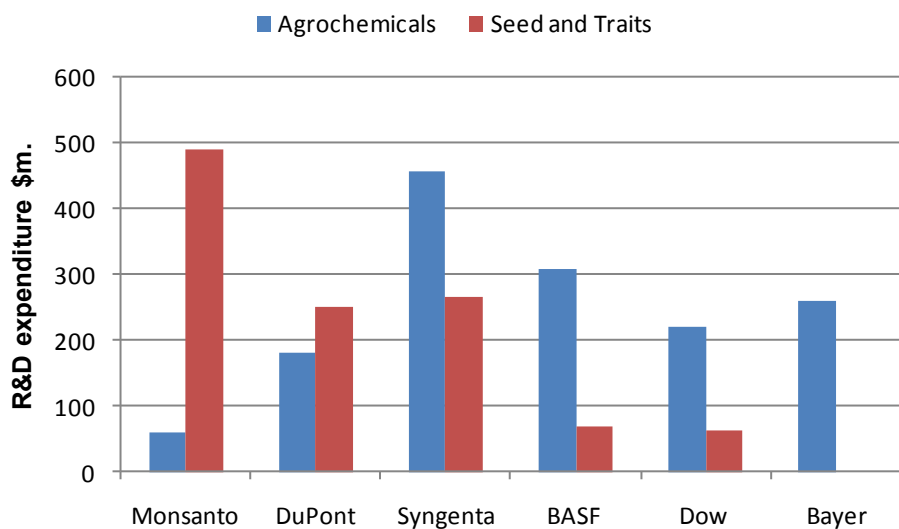


## Company Acquisitions 2011- Present

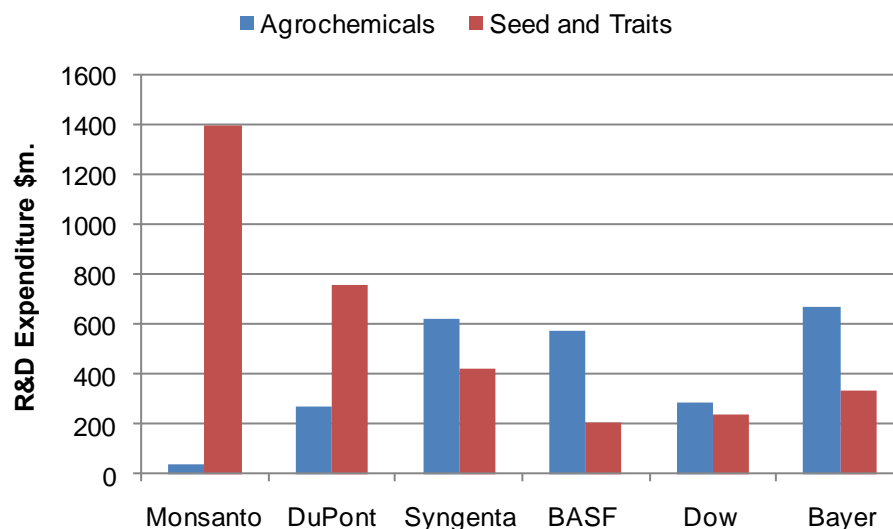
Company	Acquisition
<b>Bayer</b>	US seed company Hornbeck Seed, producer of soybean, rice and wheat Research company SoyTech Seeds Biological crop protection company AgraQuest
<b>BASF</b>	US-based biological products company Becker Underwood
<b>Monsanto</b>	U.S. based biotechnology company Divergence Bee health company Beeologics Precision Planting
<b>Syngenta</b>	Public offer for the Belgian biotechnology company Devgen US-based biotechnology company Pasteuria Bioscience DuPont Professional Products insecticide business for \$125 million GreenLeaf Genetics acquired the seed genetics licensing company JGL Inc
<b>Dow</b>	Seed company Northwest Plant Breeding Company
	Brand and marketing assets of Prairie Brand Seed
<b>DuPont</b>	US-based alfalfa and clover company Cal/West Seeds Danish enzyme and food ingredient company Danisco South African Pannar Seed US seed company Dobler's hybrids

## R&D Expenditure – Historical development

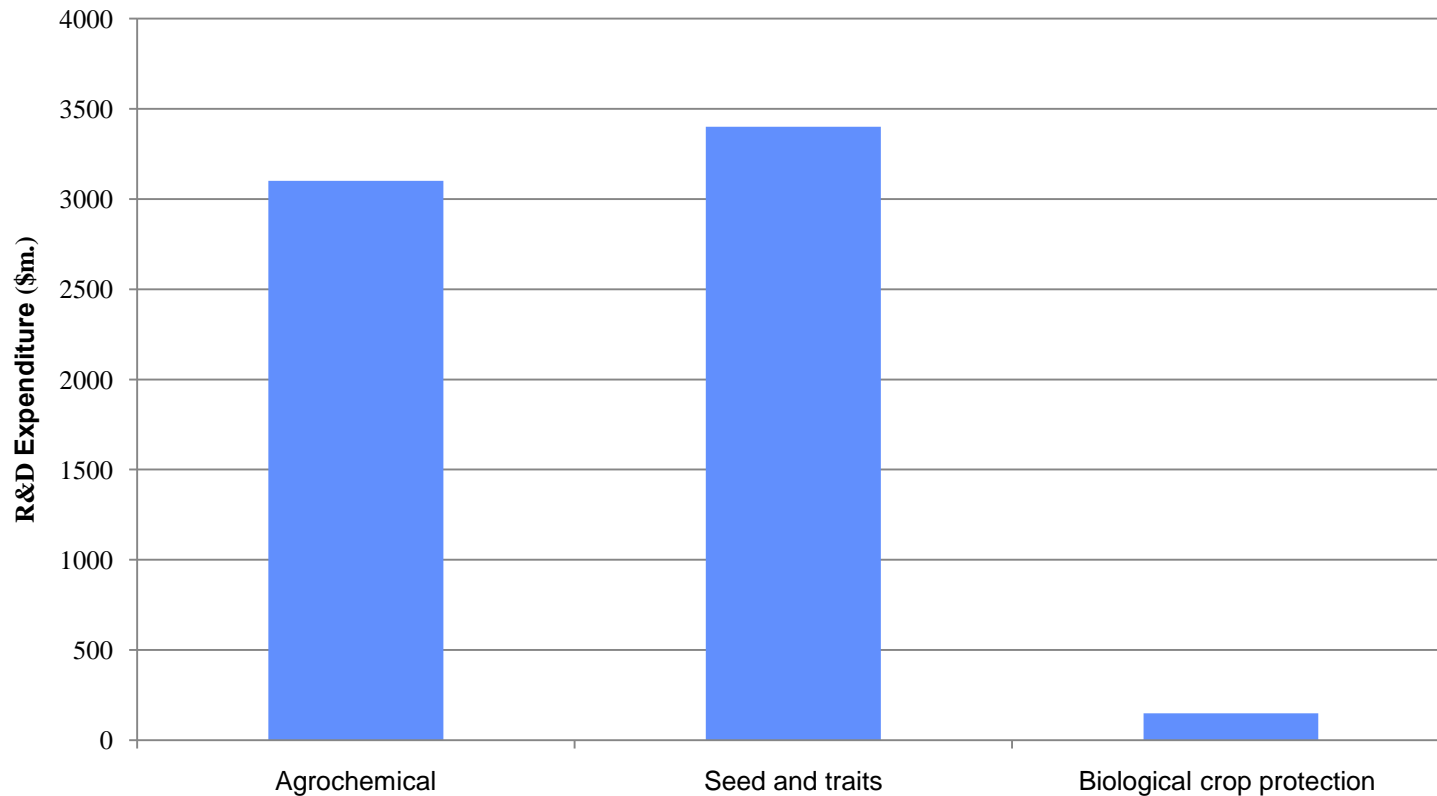
2001



2011



## R&D Expenditure 2011 by Industry (Leading companies)



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