



Non-Crop Pesticides **2020:**

**Markets; Company Profiles & Portfolios; Weed, Disease
& Insect Control; PGRs; Formulations**

Please find the contents, executive summary and sample pages below. If you have any questions or would like to speak to a member of our team about this report, please use our [contact us](#) page.

Contact Us

Contents

Executive Summary	7
Chapter 1: Introduction	7
Chapter 2: Non-crop pesticide markets	7
Chapter 3: Company profiles and portfolios	7
Chapter 4: Weed control	8
Chapter 5: Disease control	9
Chapter 6: Control of insects and other pests	9
Chapter 7: Plant growth regulation	10
Chapter 8: Formulations for non-crop pesticides	10
1. Introduction	12
1.1 Summary	12
1.2 Introduction	12
1.3 Scope	13
1.4 Markets	13
1.5 Companies	13
1.6 Products	14
1.7 Formulations	14
1.8 Regulation	14
1.8.1 Europe	14
1.8.2 USA	16
1.8.3 OECD	16
1.8.4 Glyphosate toxicity controversy	16
1.9 Associations	19
2. Non-crop pesticide markets	20
2.1 Summary	20
2.2 Introduction	20
2.3 Overall market value	21
2.4 Drivers of market growth	22
2.5 Market segmentation	22
2.6 Market sectors	23
2.6.1 Aquatic	23
2.6.2 Forestry	23
2.6.3 Home & Garden	24
2.6.4 Industrial Vegetation Management	24
2.6.5 Pest Control Operations	25
2.6.6 Public Health	26
2.6.7 Timber preservation	26

2.6.8	Turf & Ornamentals.....	27
2.6.8.1	Turf.....	27
2.6.8.2	Ornamentals.....	27
2.7	Biopesticides in non-crop markets.....	28
2.8	References and resources.....	29
3.	Company profiles and portfolios	30
3.1	Summary.....	30
3.2	Introduction.....	30
3.3	Adama.....	31
3.4	AMVAC.....	37
3.5	BASF.....	39
3.6	Bayer.....	44
3.7	Corteva.....	52
3.8	FMC.....	54
3.9	Gowan.....	57
3.10	Oxitec.....	58
3.11	PBI Gordon.....	60
3.12	NuFarm.....	62
3.13	OHP.....	68
3.14	S C Johnson.....	70
3.15	Scotts Miracle-Gro.....	71
3.16	Sipcam Agro.....	73
3.17	SMB Life Science.....	75
3.18	Syngenta.....	75
3.19	UPL.....	81
3.20	Valent.....	84
3.21	Valent Biosciences.....	86
3.22	References and resources.....	87
4.	Weed control	88
4.1	Summary.....	88
4.2	Introduction.....	89
4.2.1	New active ingredients.....	89
4.2.2	Weed resistance.....	90
4.3	Industrial Vegetation Management.....	90
4.3.1	Key targets.....	90
4.3.2	Key products.....	91
4.3.3	New developments.....	92
4.4	Aquatic.....	92
4.4.1	Key targets.....	92
4.4.2	Key products.....	93
4.5	Turf & Ornamentals.....	93
4.5.1	Key targets.....	94
4.5.1.1	Turf grasses.....	94
4.5.1.2	Weeds.....	94

4.5.2	Key products.....	95
4.5.3	New developments	96
4.6	Forestry	97
4.6.1	Key targets	97
4.6.2	Key products.....	97
4.7	Home & Garden	98
4.8	References and resources	98
5.	Disease control	100
5.1	Summary	100
5.2	Introduction	100
5.3	Key Targets.....	101
5.3.1	Diseases of turf grasses	101
5.3.1.1	Turf grasses.....	101
5.3.1.2	Turf diseases.....	101
5.3.2	Diseases of ornamentals	103
5.4	Key products	104
5.4.1	Established active ingredients.....	104
5.4.2	Newer active ingredients	104
5.4.3	Active ingredient properties	105
5.4.4	Biofungicides	106
5.4.4.1	New developments.....	107
5.5	References and resources	108
6.	Control of insects and other pests.....	109
6.1	Summary	109
6.2	Introduction	109
6.3	Key targets	110
6.3.1	Ants	110
6.3.2	Termites	110
6.3.3	Cockroaches	111
6.3.4	Mosquitoes	111
6.3.5	Turf pests.....	112
6.3.6	Insect pests of ornamentals	112
6.3.7	Insect pests in forestry	113
6.4	Key Products	114
6.4.1	Established active ingredients.....	114
6.4.2	New active ingredients.....	115
6.4.3	Insecticides for mosquito nets	116
6.4.4	Bioinsecticides and repellents.....	116
6.5	Rodents and Rodenticides	117
6.6	References and resources	119
7.	Plant growth regulation	121
7.1	Summary	121
7.2	Introduction	121

7.3	Key targets	122
7.3.1	Turf.....	122
7.3.2	Ornamentals.....	122
7.4	Key products	122
7.5	References and resources	123
8.	Formulations for non-crop pesticides	125
8.1	Summary	125
8.2	Introduction	126
8.3	Aerosols.....	126
8.4	Baits.....	127
8.5	Dusts and powders.....	128
8.6	Exosect's <i>Entostat</i> powder.....	128
8.7	Fogs and mists.....	128
8.8	Mosquito nets	129
8.9	Smoke generators	129
8.10	Water soluble sachets.....	129
8.11	References and resources	130
	Appendix 1: Abbreviations	131

List of Tables

Table 1:	Categories of biocides recognised under the EU Biocidal Products Regulation 528/2012	15
Table 2:	Value of pesticides in crop and non-crop markets 2014-2018 (ex-manufacturer)	21
Table 3:	Sales value (ex-manufacturer) of non-crop pesticides by region 2016 and 2021 forecast	21
Table 4:	Adama's US non-crop herbicide portfolio sold by Quali-Pro.....	31
Table 5:	Herbicides for Aquatics, Range & Pasture, IVM and Forestry sold by Alligare.....	32
Table 6:	Adama's US non-crop fungicide portfolio sold by Quali-Pro	34
Table 7:	Adama's US non-crop insecticide and nematicide active ingredient portfolio	36
Table 8:	Adama's US plant growth regulator portfolio	37
Table 9:	AMVAC's US non-crop herbicide active ingredient portfolio	38
Table 10:	AMVAC's US non-crop fungicide active ingredient portfolio	38
Table 11:	AMVAC's US non-crop insecticide and molluscicide active ingredient portfolio	39
Table 12:	BASF's US non-crop herbicide portfolio for Turf & Ornamentals.....	40
Table 13:	BASF's US non-crop fungicide portfolio for Turf & Ornamentals	40
Table 14:	BASF's US non-crop insecticide portfolio	42
Table 15:	BASF's US non-crop biopesticide portfolio.....	43
Table 16:	Bayer's US non-crop herbicide portfolio	46
Table 17:	Bayer's US non-crop fungicide portfolio.....	48
Table 18:	Bayer's US non-crop insecticide and nematicide portfolio	50
Table 19:	Bayer's US non-crop PGR portfolio.....	52
Table 20:	Corteva's US non-crop herbicide portfolio.....	52
Table 21:	Corteva's US non-crop fungicide portfolio	54

Table 22:	Corteva’s US non-crop insecticide and nematicide portfolio	54
Table 23:	FMC’s US non-crop herbicide portfolio	55
Table 24:	FMC’s US non-crop fungicide portfolio	56
Table 25:	FMC’s US non-crop insecticide portfolio	56
Table 26:	Gowan’s Turf & Ornamental portfolio.....	58
Table 27:	PBI-Gordon’s herbicide and PGR portfolio	60
Table 28:	PBI-Gordon’s fungicide portfolio	62
Table 29:	PBI-Gordon’s insecticide portfolio.....	62
Table 30:	Nufarm’s US non-crop herbicide portfolio	63
Table 31:	Nufarm’s US non-crop fungicide portfolio	65
Table 32:	Nufarm’s US non-crop insecticide portfolio	67
Table 33:	Nufarm’s US non-crop PGR portfolio.....	67
Table 34:	OHP’s US non-crop herbicide and PGR portfolio for T&O markets	68
Table 35:	OHP’s US non-crop fungicide portfolio for T&O markets	69
Table 36:	OHPs US non-crop insecticide portfolio for T&O markets.....	69
Table 37:	S C Johnson’s US pest control portfolio.....	71
Table 38:	Scotts Miracle-Gro Ortho brand active ingredients	72
Table 39:	Sipcam Agro’s US non-crop herbicide and PGR portfolio for T&O markets	74
Table 40:	Sipcam Agro’s US non-crop fungicide portfolio for T&O markets.....	74
Table 41:	Syngenta’s US non-crop herbicide portfolio.....	76
Table 42:	Syngenta’s US non-crop fungicide portfolio.....	78
Table 43:	Syngenta’s US non-crop insecticide and rodenticide portfolio	80
Table 44:	Syngenta’s US non-crop PGR portfolio	81
Table 45:	UPL’s US non-crop herbicide portfolio	82
Table 46:	UPL’s US non-crop fungicide portfolio	82
Table 47:	UPL’s US non-crop insecticide portfolio	83
Table 48:	Valent’s US non-crop herbicide portfolio	84
Table 49:	Valent’s US non-crop fungicide portfolio	84
Table 50:	Valent’s US non-crop insecticide portfolio	85
Table 51:	Valent’s US non-crop PGR portfolio	86
Table 52:	Valent Biosciences’s biopesticide and other products for non-crop markets	87
Table 53:	New herbicide active ingredients scheduled to be registered in the US in 2019 - 2021.....	89
Table 54:	Basic profiles of Turf & Ornamentals herbicides	96
Table 55:	Non-crop fungicide active ingredients, their fungicidal action and common mixture partners ..	105
Table 56:	Examples of biofungicides sold in non-crop sectors.....	107
Table 57:	Bioinsecticides used in non-crop markets.....	116
Table 58:	Rodenticides listed on Annex 1 of the EU Biocidal Products Directive	118
Table 59:	PGRs used in Turf & Ornamentals	123

Executive Summary

Chapter 1: Introduction

The scope of the report is defined and outlined, together with some background information.

The regulatory framework for non-crop pesticides, including plant protection products and biocides, is introduced.

An issue for non-crop and crop markets alike is the controversy around the toxicity of glyphosate. The situation to date is summarised.

Industry associations involved in the topic are listed and described.

Chapter 2: Non-crop pesticide markets

The global non-crop pesticides market is valued at nearly 12% of the total pesticide market, being worth over \$7.5 billion (ex-manufacturer) in 2018.

Major market sectors for products are Home & Garden, Turf & Ornamentals, Pest Control Operations, Industrial Vegetation Management, Forestry, Public Health, Aquatic. Another medium-sized sector is Timber Preservation. There are various sub-sectors such as Range & Pasture. Care must be taken because various organisations and publications use inconsistent segmentation and may cross those used in this report, *e.g.* Lawn & Garden.

The NAFTA and APAC are by far the largest regional markets.

There is increasing interest in the use of biopesticides in Turf & Ornamentals.

Chapter 3: Company profiles and portfolios

Product portfolios and recent relevant activities of the leading companies in the various non-crop pesticide markets are reviewed.

Companies comprise the leading crop protection R&D intensive majors; some larger crop protection companies that have a particular focus on non-crop sector; the leading off-patent agrochemicals companies; and global distributors of branded consumer products.

Most active ingredients sold into non-crop markets are important in crop protection and primarily developed for such uses. However, a significant number are important non-crop pesticides in their own right.

There is increasing interest in biopesticides, particularly in sectors that are sensitive to actual and perceived issues of toxicology and environmental impact.

Chapter 4: Weed control

Each main sector of the non-crop pesticide market is considered with regard to the weed control objectives and targets, and the herbicides used.

The most widely used active ingredients include the world's biggest selling plant protection active ingredient the non-selective herbicide glyphosate, one of the original selective herbicides 2,4-D and one of the first sulfonylureas, metsulfuron-methyl.

New active ingredients include Corteva's new synthetic auxin herbicides halauxifen-methyl (*Arylex*) and florpyrauxifen-benzyl (*Rinskor*) and the choline salt of 2,4-D. Syngenta has launched products containing the field crop herbicides mesotrione and pinoxaden into Turf & Ornamental markets. New herbicide active ingredients in late development or early commercialisation that may be introduced into non-crop sectors are listed.

Weed resistance is an increasingly important issue where weed populations are repeatedly subjected to single herbicidal modes of action.

In the IVM sector selectivity is not needed except in the important Range & Pasture segment where selectivity to grasses, used for hay and livestock grazing, is essential. IVM herbicides control annual and perennial BLW and grasses, sedges, brush (*e.g.* brambles and other woody shrubs) and tree saplings growing in warm and cool climates. Major herbicides are glyphosate and those from synthetic auxin, PSII inhibitor and ALS inhibitor modes of action.

In the Aquatic sector, problems may occur in and along the banks of rivers, canals, irrigation ditches, and ponds and lakes. Key features of invasive and other aquatic weeds include rapid growth, multiple reproductive methods, wide dispersal and survival, adaptation to many different environments and tenacity. Herbicides need to control floating, emergent and submerged weeds. Maintaining herbicidal concentrations in flowing water is a particular issue. Major herbicides include glyphosate, fluridone and diquat. Newer products contain bispyribac-sodium and flumioxazin.

In Turf & Ornamentals there must be absolutely no damage to turf grasses including domestic lawns, golf courses and other sports surfaces, and amenity landscapes; or to ornamentals, including flowers, bedding plants, shrubs and trees. Golf courses are especially important and various warm and cool-climate turf grasses are grown. BASF, Bayer and Syngenta have comprehensive product portfolios and services dedicated to the sector.

Forestry weed control is similar to IVM, although selectivity to trees is obviously essential and a variety of application methods are used. The main forestry herbicides include active ingredients with systemic action, effective on tougher perennial weeds and brush, such as glyphosate, imazapyr, sulfometuron-methyl, hexazinone and picloram.

Home & Garden weed control is similar to Turf & Ornamentals, but products are purchased and applied by amateurs. The range of active ingredients used is narrower with particular emphasis on controlling BLW in lawns, and on paths and drives or by spot application. Formulation and packaging innovations are used in branding and product differentiation.

Chapter 5: Disease control

The principal sector for fungicides is Turf & Ornamentals with smaller product ranges sold into Forestry, and Home & Garden.

The major diseases of cool and warm climate turf grasses for golf courses and lawns are listed and described. These include leaf spots, *e.g.* dollar spot; blights such as caused by *Pythium* and *Rhizoctonia* species; rusts and others. Disease of ornamentals are very extensive and some examples of common diseases of roses are noted.

The most popular fungicide active ingredients include chlorothalonil, iprodione and propiconazole. Many products are mixtures with the most popular mixture partners being azoxystrobin, fludioxonil, thiophanate-methyl and trifloxystrobin.

New fungicide active ingredients recently introduced into non-crop markets include BASF's fluxapyroxad; Bayer CropScience's fluopyram; ISK's isofetamid; Syngenta's benzovindiflupyr, oxathiapiprolin, penthiopyrad and pydiflumetofen; and Valent USA Corporation's metconazole.

In future, biofungicides, with their good toxicological and environmental profiles, and 'green image', may become more important. Examples in current use are *Bacillus subtilis* (*Subtilex*) and *Trichoderma fertile* (*TrichoPlus*). More examples are listed, together with new developments.

Chapter 6: Control of insects and other pests

Many of the key pest targets in the Home & Garden, PCO and Public Health sectors are the same. The problems posed by ants, termites, cockroaches and mosquitoes are discussed. In Turf, Ornamentals and Forestry, the major pest targets are more specific to the individual sectors and, therefore, these are discussed on a sector basis. A section on rodenticides is included.

Resistance to pesticides is an increasingly important issue. Repeated use of a single mode of action selects for resistant individuals in populations. With fewer new active ingredients with novel modes of action being commercialised and more stringent regulations resulting in the loss of active ingredients, the use of less broad-spectrum products and IPM practices is being strongly advocated.

The most popular non-crop insecticides include abamectin, bifenthrin, chlorpyrifos, deltamethrin, fiprinol, imidacloprid, lambda-cyhalothrin and permethrin. Many products are mixtures of two or more active ingredients. The most popular mixture partners are bifenthrin and cyfluthrin. Note that bifenthrin has been withdrawn from sale for non-crop use in the European Union. Pyrethroid insecticides are impregnated into mosquito nets for vector control.

A number of new active ingredients have been introduced into non-crop markets recently. These include: Adama's nematicide fluensulfone, BASF's afidopyropen (Meiji Seika Pharma) and broflanilide (Mitsui Chemical Agro); Bayer CropScience's flupyradifurone and the fungicide/nematicide fluopyram; Nihon Nohyaku's buprofezin; and Corteva's sulfoxaflor.

Bioinsecticides based on micro-organisms, nematodes or semiochemicals (*e.g.* pheromones) are becoming established in non-crop markets, especially where 'green' products attract a premium.

Chapter 7: Plant growth regulation

Plant growth regulators (PGRs) have been arguably more commercially successful in non-crop markets, especially in Turf & Ornamentals, than in mainstream agriculture.

The benefits from using PGRs include savings in the labour required and the costs involved in operations such as mowing or pruning; greater aesthetic appeal of treated plants; and an enhanced ability to withstand abiotic stresses such as drought and extremes of temperature.

Uniformity of application is essential to achieve an even effect on sports and amenity turf and treatment is usually by professional applicators. Some suppression of weeds may also occur.

PGRs may be applied to ornamental plants by a variety of methods including sprays, drenches or bulb soaks. Grower trials and sequential applications are often employed to ensure the correct dose and level of effect, given the great number of variants of species and varieties, as well as growing conditions.

Categories of ornamentals treated include bedding plants and plugs, bulbs, pot plants, woody plants and larger landscape ornamentals.

PGRs used in Turf & Ornamentals are mainly growth retardants. Most inhibit the biosynthesis of gibberellins at various points in the pathway, *e.g.* ancymidol, CCC, daminozide, paclobutrazol, trinexapac-ethyl. Some have alternative modes of action, *e.g.* ethephon, which decomposes to the plant hormone ethylene; and others such as mefluidide and dikegulac-sodium have poorly understood or unknown modes of action.

Chapter 8: Formulations for non-crop pesticides

A number of distinctive formulation types are used for non-crop pesticides (in addition to more conventional sprayable ones as used in crop protection), which address important key customer values such as: safety to all

who might be exposed; particular features of pests and their habitats and locations; and ease and convenience of use.

Aerosols are a combination of formulation and specialized pack for spraying a fine mist or a forceful directed jet. Markets include household, garden, farm buildings, public or commercial premises and aircraft. They are often insecticides such as pyrethroids for rapid knockdown and kill, but suit any product where a small, localised application is needed.

Baits are solid formulations designed to attract and kill insects, molluscs or rodents. Palatability, texture, colour and shape can all effect successful control. Various types of bait are available to be deployed according to pest behaviour.

Dusts and powders are old types of formulation still used for the control of crawling insects and rodents; for use on wasp and ant nests; and to access cracks and cervices, and voids such as roof spaces or electrical service ducts where spraying would be difficult or undesirable. However, a modern innovation is Exosect's (now Terramera) *Entostat* for formulating stored products.

Fogs may be hot (thermal) or cold (mists). Both are generally used to treat large spaces, with inaccessible places. Thermal fogs are used for the fumigation of warehouses, grain stores, ships' holds and sewers. Cold fogs or mists have larger droplets so fall to the ground more quickly and are less penetrating.

Mosquito nets impregnated with insecticides (usually pyrethroids) are recommended by WHO as a key element in the fight against malaria as a vector control measure.

Smoke cartridges, pellets, tablets, tins and coils generate hot gases when ignited that condense on cooling to form a dense smoke. They give good coverage, but active ingredients must be stable to short periods of high temperatures (350–450 °C) and there is always the risk of fire.

Water soluble sachets make convenient doses of wettable powder formulations safer and easier to handle. When added to water the sachets burst and dissolve, dispersing the powder ready for spraying. PVA sachets must be compatible with the active ingredient and formulants and are sold in polythene or aluminium film packs to insure against accidental rupture.

Destroying undesired plants or parts of plants, except algae unless the products are applied on soil or water to protect plants;

Checking or preventing undesired growth of plants, except algae.

Active substances: substances or micro-organisms, including viruses, having general or specific action against harmful organisms or on plants, parts of plants or plant products.

Therefore, Regulation 1107/2009 also covers the regulation of many non-crop pesticides, e.g. when not used for hygiene purposes or as preservatives.

In the EU, biocides are covered by Regulation 528/2012, which came into force on 1 September 2013. This Regulation repealed and updated the earlier Biocidal Products Directive 98/8/EC. This was based on the Plant Protection Products Directive 91/414/EEC (now superseded by Regulation 1107/2009). Under Regulation 528/2012, as previously, the approval of active substances takes place at EU level and the subsequent authorisation of particular products is by individual Member States. This authorisation can be extended to other Member States by mutual recognition. However, the new regulation also allows authorisation at the EU level. Details can be found on the website of the European Chemicals Agency (ECHA).

Under the Biocides Regulation products are classified into 22 types under four main groups. These are listed in Table 1.

Table 1: Categories of biocides recognised under the EU Biocidal Products Regulation 528/2012			
Disinfectants	Preservatives	Pest control	Other biocides
Human hygiene use (skin or scalp)	Use in storage of non-food/cosmetics/medicines (e.g. pesticides)	Rodenticides	Antifouling products
Products not for direct application to humans or animal (e.g. use in buildings, materials, swimming pools)	Film preservatives (e.g. paints and other coatings)	Avicides	Embalming and taxidermist fluids
Veterinary hygiene use	Wood preservatives	Molluscicides, vermicides and other products to control invertebrates	
Food and feed equipment and area use	Fibre, leather, rubber and polymer preservatives	Piscicides	
Drinking water use	Use in construction material	Insecticides, acaricides and other products to control arthropods	
	Use in liquid coolants	Repellents and attractants	
	Slimicides	Control of other vertebrates	
	Use in cutting fluids		

Source: EU Biocidal Products Regulation 528/2012

are many examples where there are possible ambiguities or specific uses of products, in which cases product labels would need to be consulted. The product portfolios listed for each company are compiled from company websites.

3.3 Adama

Adama Agrochemical Solutions Ltd is one of the world's leading generic agrochemical companies, based in Airport City, Israel, just outside Tel Aviv and with regional headquarters in Switzerland, USA and Singapore. ChemChina acquired a 60% stake in Adama in 2013, then known as Makhteshim-Agan Industries. The name was changed to Adama in 2014. In mid-2016, it was announced that ChemChina would acquire the remaining 40% stake held by Koor Industries.

Adama claims to serve all non-crop markets through its designated entities around the world. These include:

- Control Solutions (US): PCO, Home & Garden
- Quali-Pro (US): Turf & Ornamentals
- Alligare (US): IVM markets, Forestry, Aquatic
- Kollant (Italy)

The operations of Quali-Pro (Raleigh, North Carolina) are integrated with Control Solutions (Pasadena, Texas). In addition, Quali-Pro/Control Solutions Inc. market the Martins brand of consumer products.

Herbicides

Herbicides for the various non-crop sectors sold by Adama companies in the US are listed in Tables 4 and 5.

Table 4: Adama's US non-crop herbicide portfolio sold by Quali-Pro			
Active Ingredient	Products	Sectors	Key Targets and Features
2,4-D dimethylamine	3-D (+ mecoprop + dicamba) 2DQ (+ dicamba + quinclorac)	Turf, IVM	Selective control of many annual and perennial BLW
Dicamba	<i>Fahrenheit</i> (+ metsulfuron-methyl)	Turf, IVM	Annual and perennial BLW and some grasses. Selective to warm season grasses
Dithiopyr	<i>Dithiopyr L, 40WSB</i>	Turf, ornamentals	Selective pre-emergence and early post-emergence control of crabgrass, and pre-emergence control of other annual grasses and BLW

Table 14: BASF's US non-crop insecticide portfolio			
Hydramethylnon	<i>Amdro Pro Fire Ant Bait</i>	Turf, ornamentals	Fire ants
Metaflumizone	<i>Siesta Fire Ant Bait</i>	Turf, ornamentals, PCO	Fire ants
Novaluron	<i>Trelona</i>	PCO	Termites
Pyrethrins + piponeryl butoxide (synergist)	<i>1600 X-clude Formula 2, Pyreth-it, MotherEarth, Pyrethrum TR</i> and many others	Ornamentals, PCO	Knockdown and control of ants, aphids, beetles, fungus gnats, spider mites, mealybugs, whiteflies
Sodium tetraborate decahydrate	<i>Advance ant gel bait, Advance liquid ant bait</i>	PCO	Ants
Z-9, E-12 tetradecadien-1ylacetate (semiochemical)	<i>Allure</i>	PCO	Moths
Source: BASF websites			

Biopesticides

BASF has a biopesticide range including the microbial fungicide *Subtalex (Bacillus subtilis)* and several products containing nematodes for the control of soil dwelling insects or their larvae. In 2012, BASF acquired US-based Becker Underwood for \$1.02 billion. The company operated in markets including legume inoculants and other seed treatments, horticulture and amenity, especially golf courses.

A new R&D centre for biologicals was opened at the crop protection HQ at Limburgerhof (Germany) in 2016.

BASF also sell biocides into a range of industries including home care, automotive, mining and oilfields, printing inks and adhesives through their European organisation BTC.

BASF's non-crop biopesticide portfolio for the US is shown in the following table.

Table 15: BASF's US non-crop biopesticide portfolio			
Active Ingredient	Products	Sectors	Key Targets and Features
<i>Agrobacterium radiobacter</i> strain K1026 Biofungicide	<i>NOGALL</i>	Propagation stock of ornamentals	Crown gall, caused by soil bacterium <i>Agrobacterium tumefaciens</i>
<i>Bacillus subtilis</i> Biofungicide	<i>Subtalex NG</i>	Greenhouse ornamentals	Damping-off and other root diseases caused by soil-borne pathogens, e.g. <i>Rhizoctonia solani</i> , <i>Pythium</i> spp., <i>Fusarium</i> spp., powdery mildew (<i>Leveillula taurica</i> , <i>Oidiopsis taurica</i> , <i>Sphaerotheca</i> spp., <i>Erysiphe</i> spp.)

Table 20: Corteva's US non-crop herbicide portfolio

	<i>Confront (+ clopyralid)</i>	Turf	
Clopyralid	<i>Transline</i> <i>Lontrel</i>	IVM Turf, ornamentals	Post-emergence and soil residual control of clover, dandelion, thistle and dollarweed and other BLW, with selectivity to turf grasses
Dithiopyr	<i>Dimension</i>	Turf, ornamentals	Pre-emergence and early post-emergence control of crabgrass, and residual control of crabgrass, goosegrass, foxtail, spurge and <i>Poa annua</i>
Florasulam	<i>Defender</i>	Turf, ornamentals	Early season BLW control and pre-emergence crabgrass control
Fluroxypyr	<i>Vista XRT</i>	IVM	Post-emergence control of BLW in grasses
Glyphosate (dimethylamine salt)	<i>Accord XRT II,</i> <i>Rodeo</i>	IVM Aquatics	Post-emergence non-selective control of very broad spectrum of annual and perennial BLW, grasses and sedges by translocated systemic action
Isoxaben	<i>Gallery</i>	Turf, ornamentals	Pre-emergence residual control of BLW
Penoxulam	<i>Lock-up, Sapphire</i> <i>Cleantraxx</i> (+oxyfluorfen)	Turf, ornamentals IVM	Post-emergence control of annual and perennial BLW in turf grasses
Picloram	<i>Pathway</i> <i>Tordon</i> <i>Graslan (+2,4-D)</i> <i>Surmount (+ fluroxypyr)</i>	IVM Pasture	Foliar and soil-acting systemic herbicide for control of annual and perennial BLW
Pronamide	<i>Kerb SC T&O</i>	Turf, ornamentals	Pre-emergence and early post-emergence control of annual and perennial grasses, including <i>Poa annua</i> and perennial ryegrass and some BLW
Tebuthiuron	<i>Spike 80DF</i>	IVM, pasture	A persistent soil-acting herbicide with low selectivity
Triclopyr	<i>Garlon</i> (various formulations), <i>Turflon ester Ultra</i> <i>Vastlan</i> <i>Pathfinder II</i> <i>Remedy Ultra</i> <i>PastureGard (+ fluroxypyr)</i>	IVM, turf, ornamentals Pasture	Post-emergence and soil residual control of tough BLW, brambles and shrubs
Trifluralin	<i>Snapshot (+ isoxaben)</i>	Ornamentals	Residual control of BLW and annual grasses

Source: Corteva websites

Table 30: Nufarm's US non-crop herbicide portfolio			
Triclopyr	<i>Candor, Relegate, Tahoe</i>	IVM, Range & Pasture	Controls many unwanted trees, brush, annual and perennial broadleaf weeds without harming desirable grasses
2,4-D	<i>Weedar</i> (amine) <i>Weedone</i> (ester) <i>Weedmaster</i> , <i>Veteran</i> (+ dicamba) <i>Patron 170</i> (+ dichloroprop-p) <i>AquaSweep</i> <i>4-Speed XT</i> (+triclopyr, dicamba, pyraflufenethyl) <i>Escalade 2</i> , <i>Elliptical</i> , E-2(+ fluoroxypr + dicamba) <i>Millenium Ultra 2</i> (+ clopyralid + dicamba) <i>Quincept</i> (+ quinclorac + dicamba) <i>Triplet</i> (+ mecoprop-p + dicamba)	Aquatic, Turf, IVM, Range & Pasture	Post-emergence control of annual and perennial BLW Triclopyr adds control of some grasses, including perennials, and brush, shrubs and saplings Clopyralid improves clover control Quinclorac adds grass weed control Dicamba, mecoprop-p, dicloprop-p, broaden BLW control spectrum with specific types of selectivity
Source: Nufarm websites			

Fungicides

Nufarm's range of fungicides for non-crop markets are shown in Table 31.

Table 31: Nufarm's US non-crop fungicide portfolio			
Active Ingredient	Products	Sectors	Key Targets and Features
Chlorothalonil	<i>Spectro 90</i>	Ornamentals	Preventative and curative control of <i>Anthracoze</i> spp., <i>Rhizoctonia</i> spp., <i>Fusarium</i> spp., dollar spot, snow mould, mildews, rusts and other diseases. Thiophanate-methyl adds systemic curative control
Fenpropathrin	<i>Tame 2.4 EC</i>	Ornamentals	Knockdown of aphids, whiteflies other insects and mites
Fluazinam	<i>Traction</i> (+ tebuconazole)	Turf	Anthracoze, dollar spot, brown patch, snow mold and other diseases in cool and warm season golf turf

Table 50: Valent's US non-crop insecticide portfolio

	<i>Distance Insect Growth Regulator</i>	Indoor and landscape ornamentals	IGR controls whitefly, fungus gnat, scale and other insects by preventing eggs, larvae and pupae from maturing into breeding adults
Source: Valent website			

PGRs

Valent's range of PGRs for US non-crop sectors are shown in Table 51.

Table 51: Valent's US non-crop PGR portfolio

Active Ingredient	Products	Sectors	Key Targets and Features
Gibberellic acid (GA3)	<i>Pro-Gibb T&O</i>	Turf, ornamentals	Promotes stem elongation and flowering; maintains turf growth and prevent colour change in cold weather, and maintains regrowth of Bermudagrass in warm weather
Gibberellins A4/A7 + benzyladenine (N-(phenylmethyl)-1H-purine 6-amine)	<i>Fascination</i>	Ornamentals	Prevents leaves from yellowing, increases flower size, improves flower number, enhances the life of a flower and advances overall plant vigour and growth
Uniconazole	<i>Sumagic</i>	Ornamentals	To produce plants with denser, more consistent compact growth and with increased plant shelf life
Source: Valent website			

3.21 Valent Biosciences

Valent BioSciences Corporation (formerly a unit of Abbott Laboratories) and Valent USA Corporation are wholly owned subsidiaries of Sumitomo Chemical Company Ltd, based in California, USA, and have been under common leadership since 2009. Valent BioSciences focuses on biocontrol ('biorationals'). Some biological products are sold by Valent.

Markets for the company's product range are in agriculture, horticulture, forestry and also public health (vector control). In addition to biopesticides, the company markets a range of products for 'Biorational Crop Enhancement' and uses the term 'biorationals' to describe its whole area of interest in crop protection and crop production.

Valent BioSciences opened a \$146 million plant entirely devoted to biorationals, located on a 30 ha (73 acre) site in Osage, Iowa, in 2014. The 12,077m² plant is claimed to be the largest purpose-built biorationals facility in the world.

The Valent Biosciences range of biopesticides for US non-crop sectors are shown in Table 52.

Table 54: Basic profiles of Turf & Ornamentals herbicides

Active ingredient	Pre-emergence	Post-emergence	Grasses	BLW	Residual effect
2,4-D					
Bentazon					
Chlorsulfuron					
Clopyralid					
Dicamba					
Diclofop-methyl					
Dimethenamid					
Ethofumasate					
Fenoxypop-ethyl					
Fluazifop-p-butyl					
Foramsulfuron					
Glyphosate					
Imazaquin					
Indaziflam					
Isoxaben					
Mecoprop					
Mesotrione					
Metribuzin					
Metsulfuron-methyl					
Oxidiazon					
Oxyfluorfen					
Pendimethalin					
Prodiamine					
Quinclorac					
S-metolachlor					
Sethoxydim					
Simazine					
Sulfmeturon-methyl					
Topramezone					
Triclopyr					
Trifloxysulfuron					

4.5.3 New developments

A notable newer active ingredient in the turf market is Bayer CropScience's indaziflam (*Specticle*) for broad-spectrum pre-emergence or early post-emergence control of grasses, sedges and BLW. BASF have introduced

Table 55: Non-crop fungicide active ingredients, their fungicidal action and common mixture partners

Dimethomorph					Amectotradin
Fluazinam					
Fludioxonil					Cyprodinil, mefenoxam
Fluoxastrobin					Chlorothalonil, mycobutanil
Fluopicolide					Propamacarb
Fluopyram					Trifloxystrobin
Flutolanil					
Fluxapyroxad					
Aluminium-tris					
Imazalil					
Iprodione					Trifloxystrobin
Mancozeb					
Mandipropamid					
Mefenoxam					Fludioxonil
Metconazole					
Myclobutanil					Fluoxastrobin
Oxathiapiprolin					
Penthiopyrad					
Phosphite salts					
Polyoxin-D zinc					
Propamacarb					Fluopicolide
Propiconazole					Chlorothalonil, strobilurins
Pyraclostrobin					Boscalid, triticonazole
Quintozene (PCNB)					
Tebuconazole					
Thiophanate-methyl					Chlorothalonil
Thiram					
Triadimenol					Trifloxystrobin
Trifloxystrobin					Iprodione, triadimenol
Triticonazole					Chlorothalonil, pyraclostrobin
Vinclozolin					
Zn/Mn Bisdithiocarbamate					

5.4.4 Biofungicides

Biofungicides, with their good toxicological and environmental profiles, and 'green image', are becoming more important in non-crop markets. Some examples are presented in Table 56.

6.4.3 Insecticides for mosquito nets

One particular application method for insecticides is the impregnation of mosquito nets as a means of vector control to combat the spread of malaria (see also Section 8.8). Companies particularly active in this area include BASF, Bayer, Sumitomo and Syngenta (see Chapter 3). The products available include:

BASF: *Interceptor* nets are coated with alphacypermethrin

Sumitomo: *Olyset* nets are impregnated with permethrin

Syngenta: Nets treated with *IconMaxx* (lambda-cyhalothrin) using a microcapsule formulation and a binding agent will give protection for 20 washes as recommended by WHO

6.4.4 Bioinsecticides and repellents

Bioinsecticides based on micro-organisms, nematodes or semiochemicals (pheromones) are becoming established in non-crop markets, especially where 'green' products attract a premium. Important examples are listed in Table 57.

Active ingredient	Brand name and manufacturer	Use
<i>Bacillus thuringiensis</i>	Various brands by e.g. Bayer, Valent	Fast control of mosquito larvae including <i>Aedes</i> and <i>Culex</i> spp. in public health; fungus gnats, tent caterpillar and various bagworms, looper, tobacco budworms and armyworms in ornamentals
<i>Burkholderia</i> spp. strain A396	<i>Venerate</i> , Marrone Bio Innovations	A bioinsecticide/acaricide/nematicide for turf and ornamentals
<i>Chromobacterium substugae</i> strain PRAA4-1T	<i>Grandevo PTO</i> , Marrone Bio Innovations	Control of aphids, whiteflies, thrips and lepidopteran pests in turf and ornamentals
<i>Helicoverpa armigera</i> nucleopolyhedrovirus	<i>Helicovex</i> , Andermatt Biocontrol	Control of cotton bollworms (<i>H. armigera</i>) and budworms (<i>H. punctigera</i>) on a range of crops including ornamentals
<i>Heterorhabditis bacteriophora</i>	<i>Nemasys G</i> , BASF <i>Nemasys H</i> , BASF	Nematode effective against larval stages of garden chafer grubs; black vine weevil (<i>Otiorhynchus sulcatus</i>) of ornamentals
<i>Muscador albus</i> strain SA13,	<i>Ennoble</i> , Marrone Bio Innovations	Bionematicide for turf
<i>Paecilomyces fumosoroseus</i> strain FE 9901	<i>NoFly WP</i> , Novozymes BioAg	Control of whiteflies and thrips on greenhouse ornamentals
<i>Phasmarhabditis hermaphrodita</i>	<i>Nemslug</i> , BASF	Nematode effective against slugs: <i>Deroceras</i> spp, <i>Arion</i> spp, <i>Oxyloma</i> spp.
<i>Spodoptera frugiperda</i> multiple nucleopolyhedrovirus strain 3AP2	<i>Fawligen</i> , AgBiTech	Control of fall armyworms (<i>S. frugiperda</i>) and beet armyworms (<i>S. exigua</i>) in turf and ornamentals

If you would like to find out more about this report, please use our [contact us](#) page, and a member of our team will be in touch.

Find out more >>