

Overview presentation about the latest trends in the global research and product development

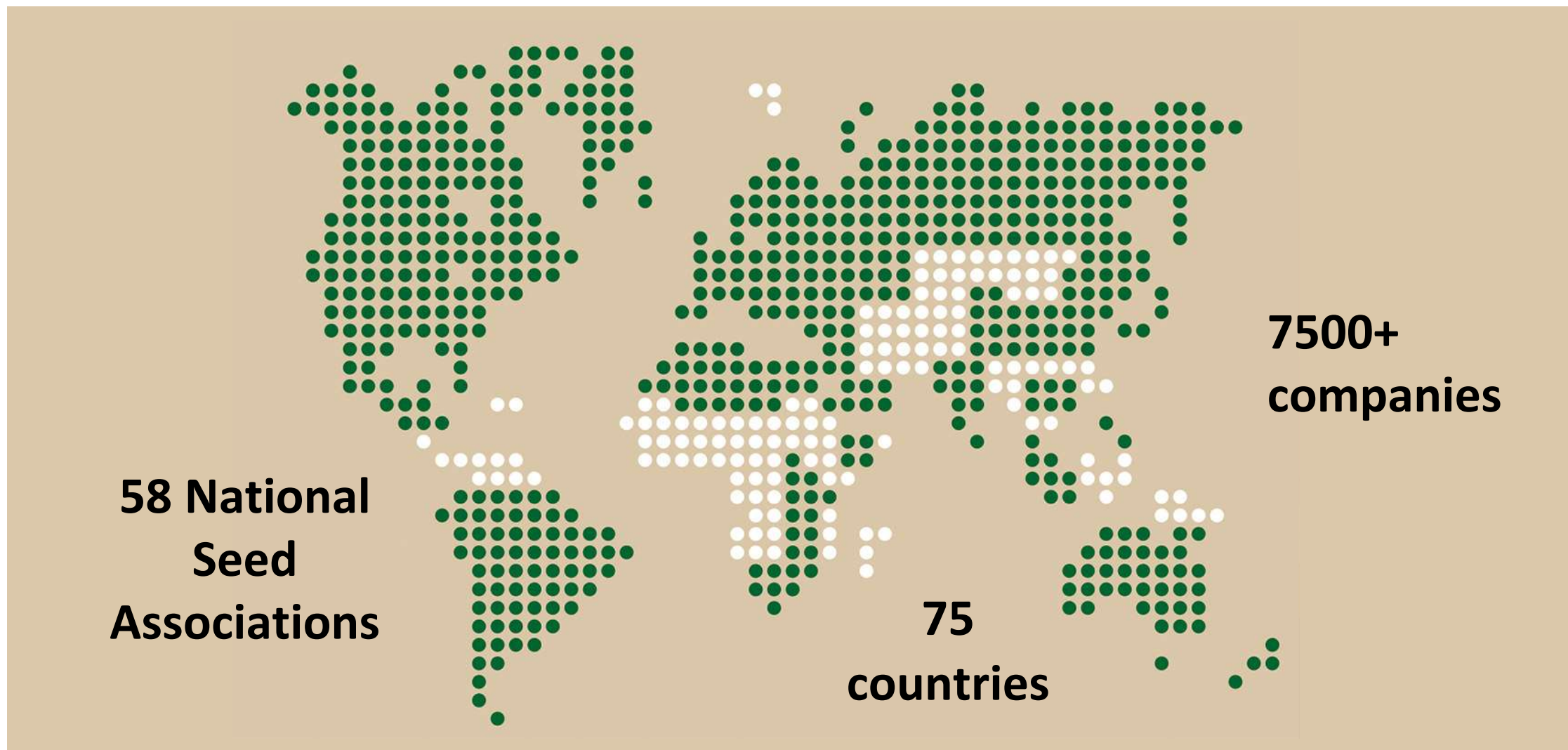
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Regulatory Affairs Manager

What is ISF?

- Voice of the global seed industry
- **Non**-governmental, **non**-profit making organization
- Recognizes its members' contributions to
food security and **sustainable agriculture**



ISF in figures

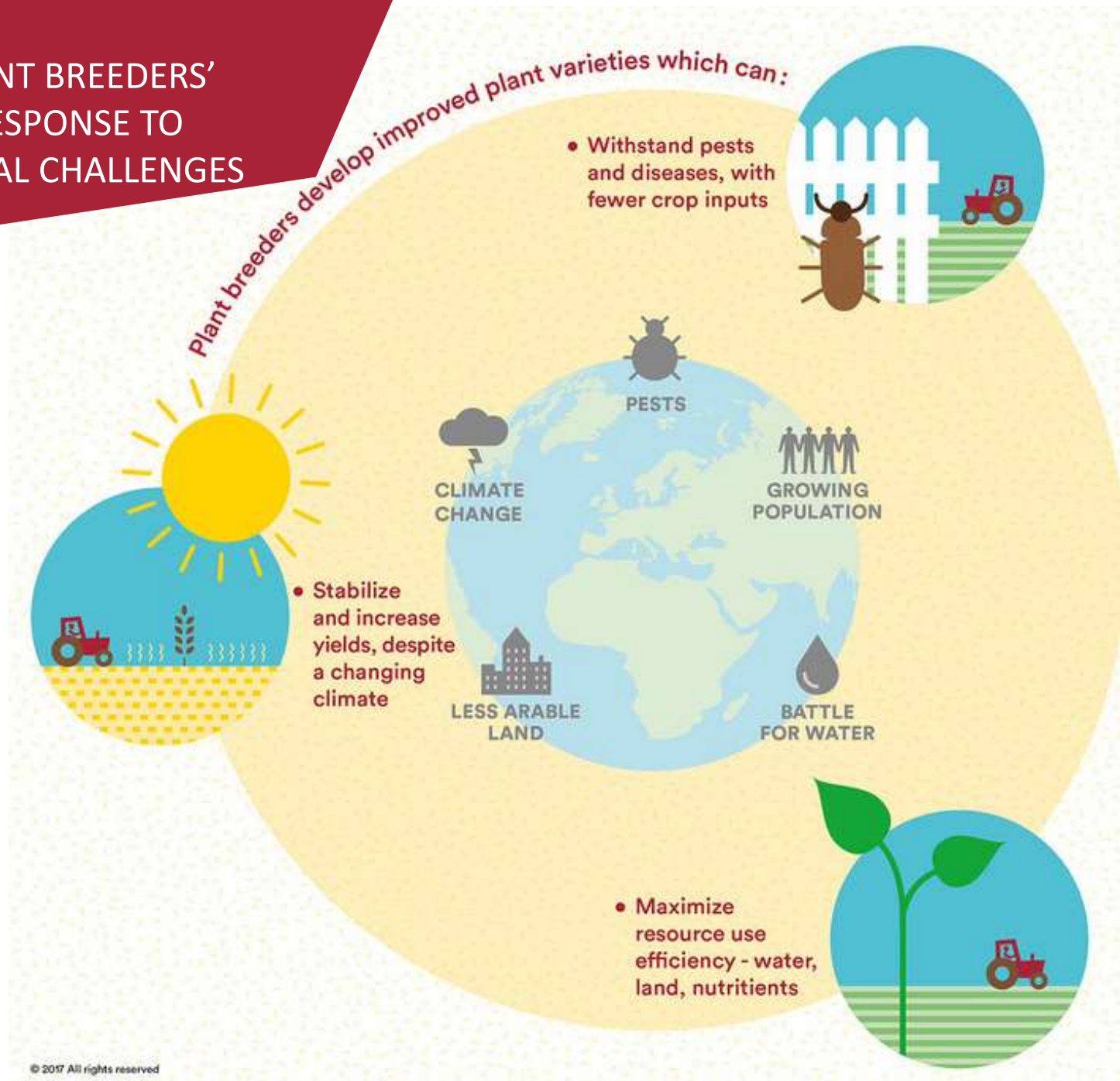


Scope of the presentation

1. What is plant breeding innovation and why it is important
2. Latest trends in the global research and product development



PLANT BREEDERS' RESPONSE TO GLOBAL CHALLENGES



Plant Breeding Innovation: Background

- Plant Breeding Innovation reflects the continuum of innovation in plant breeding
- Plant breeders continue to develop methods to safely increase precision and efficiency of breeding
- Creating variability: the source material for new plant characteristics
- Gene editing is an additional tool in the plant breeder's toolbox will be part of the breeding cycle and won't make "traditional" tools obsolete



Plant Breeding Innovation as part of the Breeding Cycle



EMBRACING
THE POWER
OF NATURE

#EmbracingNature

Impact of Public Policy

- Regulatory policy will determine utilization of methods across companies and across crops



- Importance of science based, consistent policies across countries

Latest trends in the global research and product development

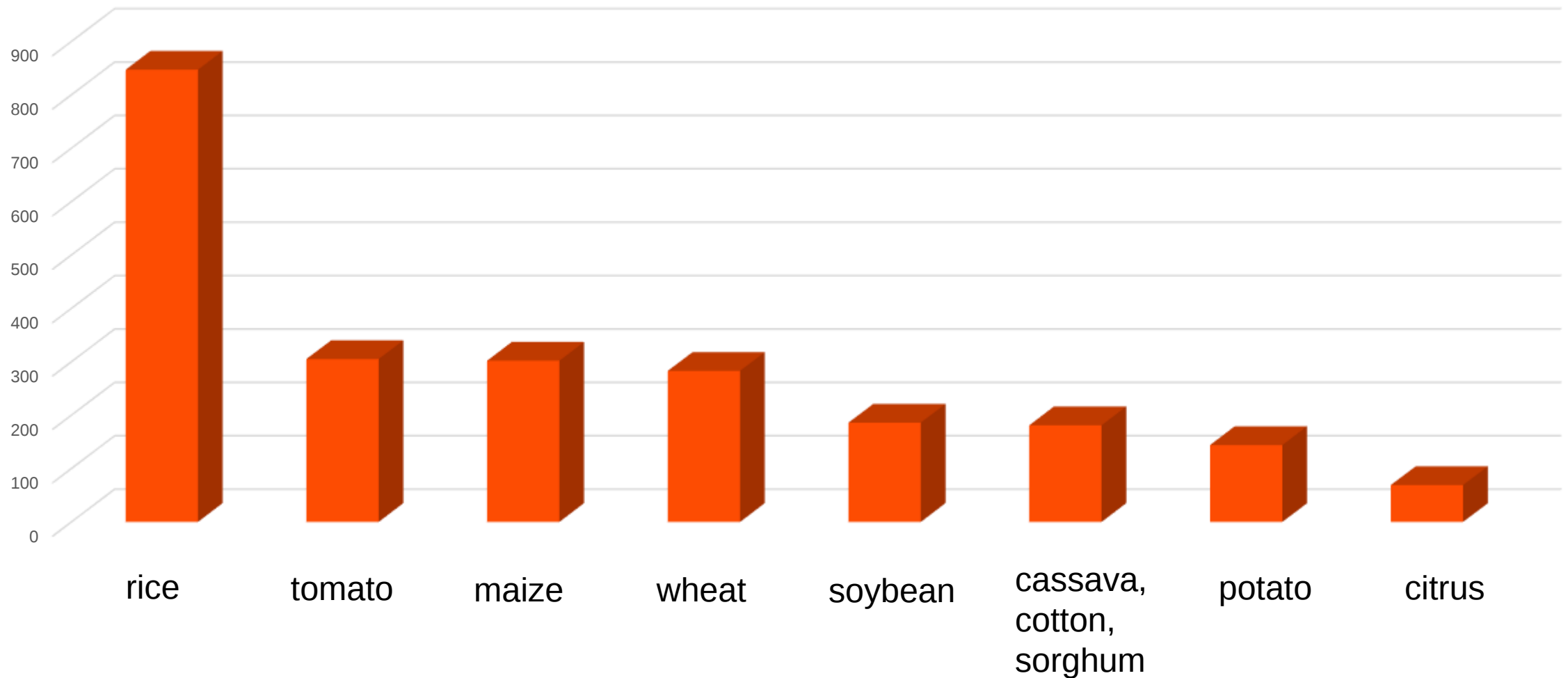
- Democratizing research
- Diversity of
 - Products
 - Applications
 - Developers



Diversity of Products and Applications



Gene Editing Scientific Publications for Select Crops



As of September 23, 2020. CRISPR or gene editing and <crop>. Core Collection, CAB Abstracts, and Medline; all years

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Market oriented applications (1996-2020)

- 217 publication identified with market oriented studies
- China (101), US (78), Japan (17) Germany and France (7)

- 140 different type of application in 41 different crops

Rice (81)

Tomato (26)

Maize (25)

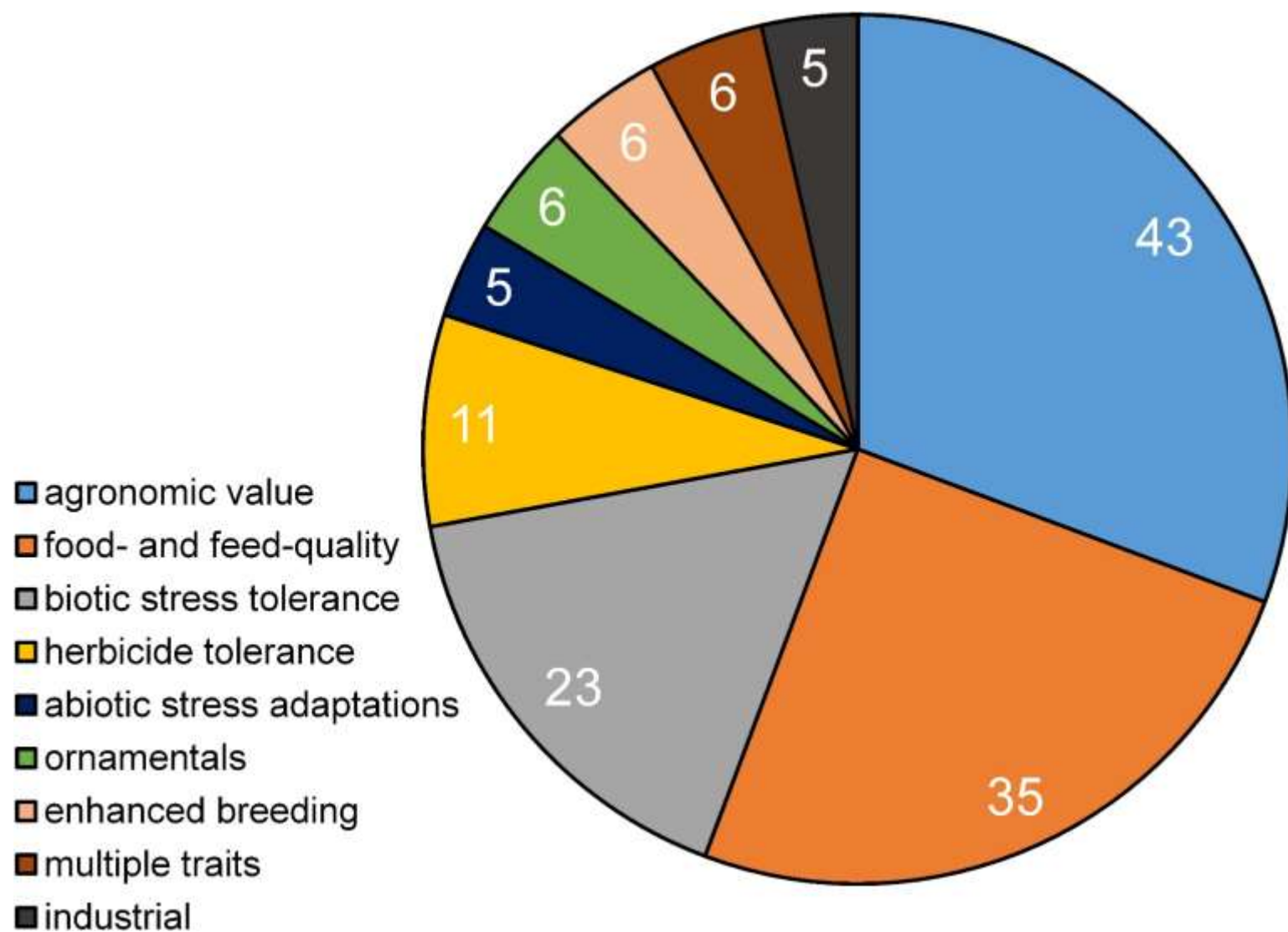
Wheat (14)

Potato (14)

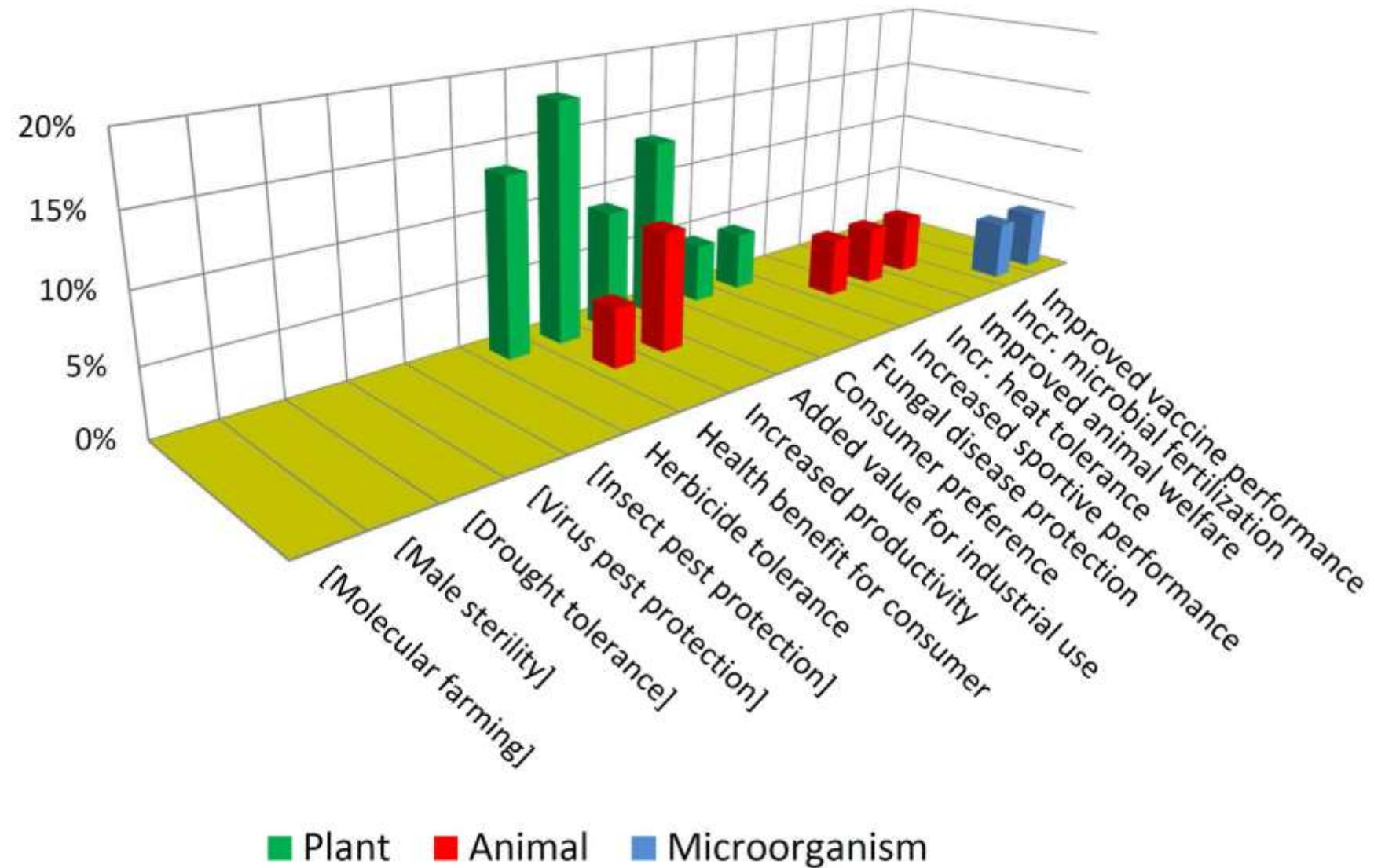
Soybean (12)

peanut, kiwi, lettuce, lemon, poppy, salvia, cacao, banana, manioc and sugar cane.

Source: Menz et al 2020



Genome-edited products that assessed by the case-by-case consultation in Argentina



Source: Whelan et al 2020

The landscape of potential U.S. crop products enabled by genome editing

Products Completing USDA “Am I Regulated” Process: 60 to date

As of 25 Aug. 2020

CROPS: 59 total (1 fungus)

Soybean - 10

Potato - 8

Tomato - 6

Corn/Maize - 5

Pennycress – 5

Camelina – 3

Canola - 3

Rice - 2

Wheat - 2

Avocado – 2

Other (1 each) - Alfalfa, Setaria,
Lettuce, Tobacco, Citrus, Petunia,
Flax, Barley, Pea, Nicotiana,
Strawberry, *B.juncea* (mustard)

Characteristics:

Product Quality - Composition/flavor – 27

Longer shelf life/storage - 7

Pest resistant – 6

Growth Habit – 5

Yield improvement - 3

Herbicide tolerance – 2

Stress tolerant – 1

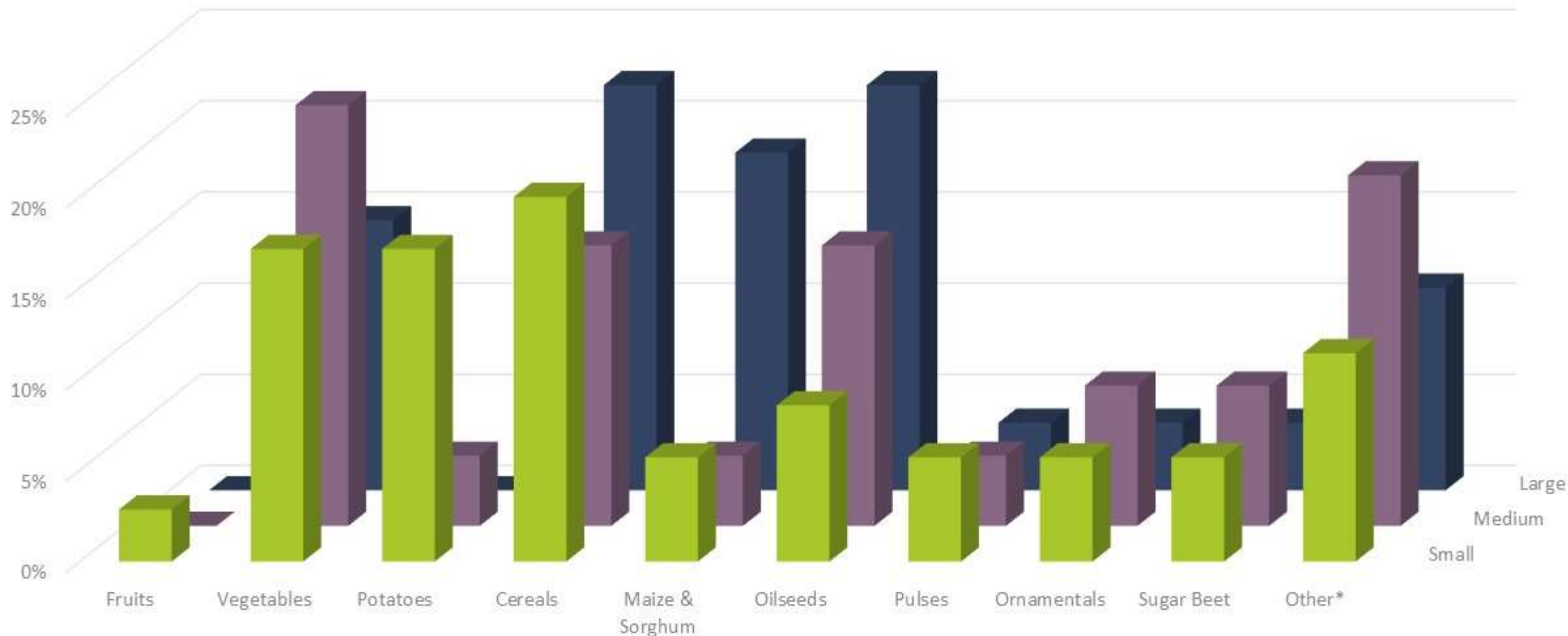
Modified Color - 1

Research purpose – 4

Confidential trait/other - 4

Source: Aphis website

In which crops/crop groups is your company currently active in R&D with NBTs?



* soybean, cotton, rice, forage crops (grasses, legumes), chicory, model plants for gene discovery research, poppy for pharmaceutical industry, peanut, ornamentals as food and medical plants, hemp, dandelion, legumes, and stevia

Examples and benefits of genome edited products



Waxy corn or potato



- Less chemical and energy use during starch processing
- Clean Food Label



Non-browning mushroom



- Less food waste



Fungi - resistant wheat

*Pilot project German Plant Breeders
(<https://pilton.bdp-online.de/?lang=en>)

Gluten-free wheat



- Less pre-harvest losses and less pesticides
- Avoid food intolerance



High Oleic Acid Soybean Oil*

*first product on US-market
(<http://www.calyxt.com/first-commercial-sale-of-calyxt-high-oleic-soybean-oil-on-the-u-s-market/>)



- Stable frying oil
- No Trans Fatty Acids – healthier Food



High GABA tomato

*first product approved in Japan (<https://sanatech-seed.com/en/20201211-2-2/>)

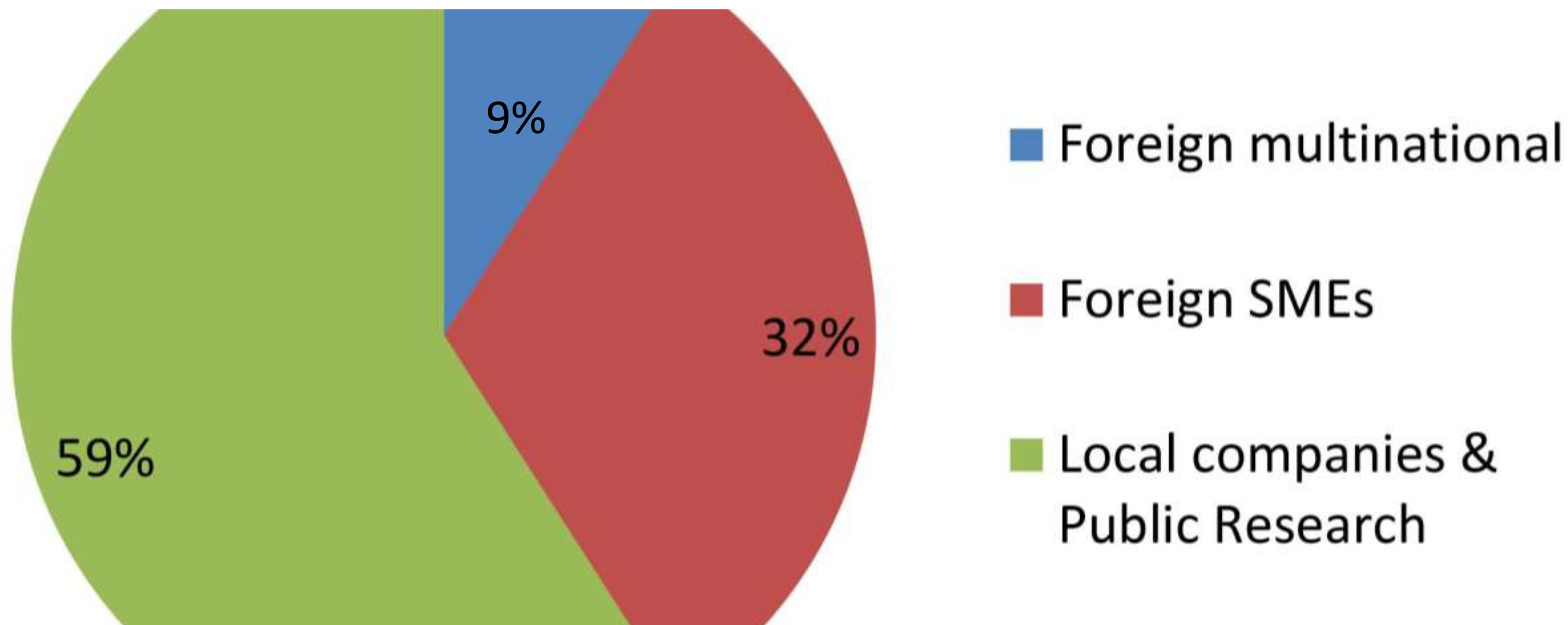


- Lowering Blood Pressure – Food with health effect

Diverse range of developers



Segmentation of type of developers in Argentina



Source: Whelan et al 2020

The landscape of potential U.S. crop products enabled by genome editing

Products Completing USDA “Am I Regulated” Process: 60 to date

As of 25 Aug. 2020

DEVELOPERS:

Private COMPANIES: 44 total (73%)

Simplot – 9

Calyxt/Collectis: 7)

Yield10 Biosci – 4

Cibus – 4

Inari - 3

Corteva – 2

ToolGen – 2

Benson Hill – 2

CoverCress – 2

Evogene - 2

Others - 7

PUBLIC SECTOR: 16 total (27%)

Illinois State – 3

Univ. Minnesota – 2

Univ. Florida – 2

Iowa State - 2

Other institutions - 7

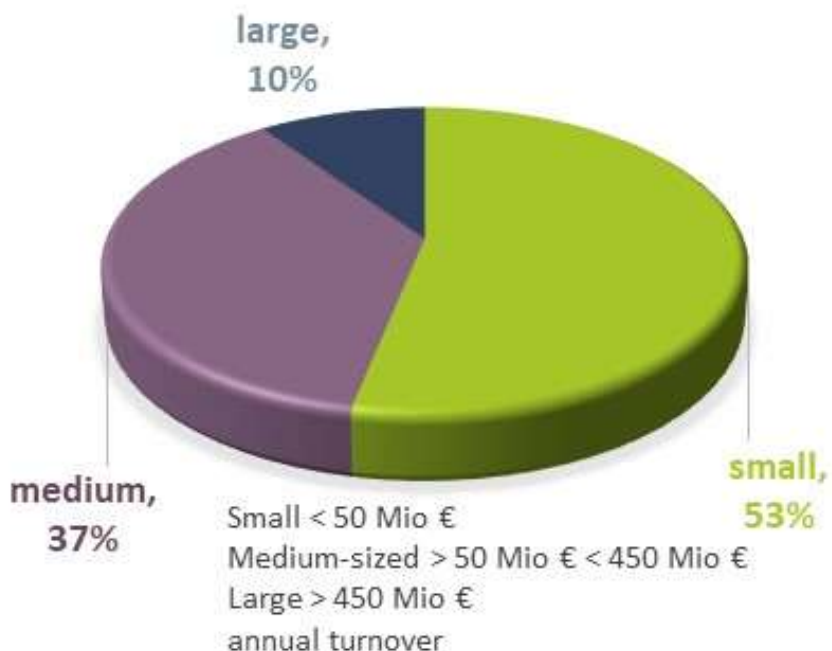
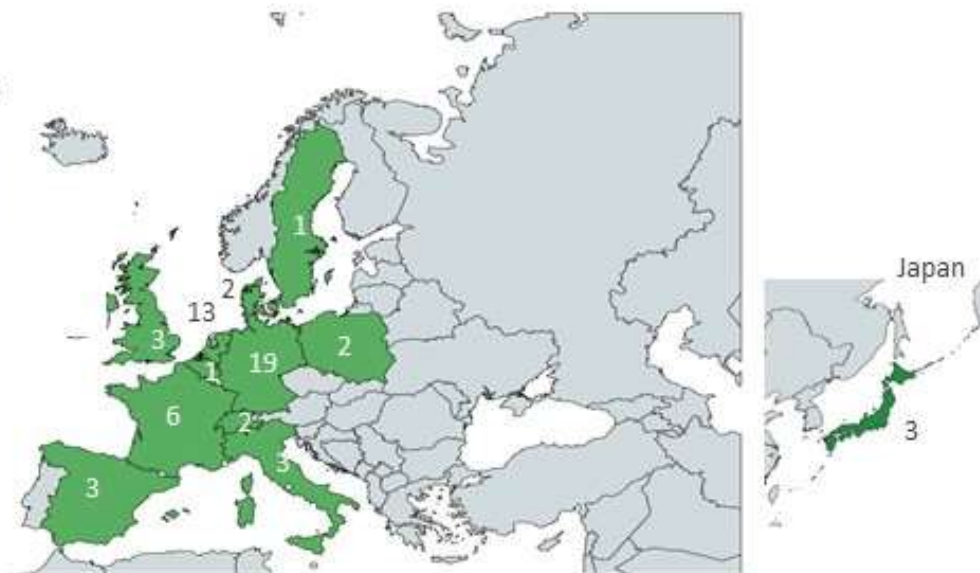
Source: Aphis website

Euroseeds Survey on Plant Breeding Innovation

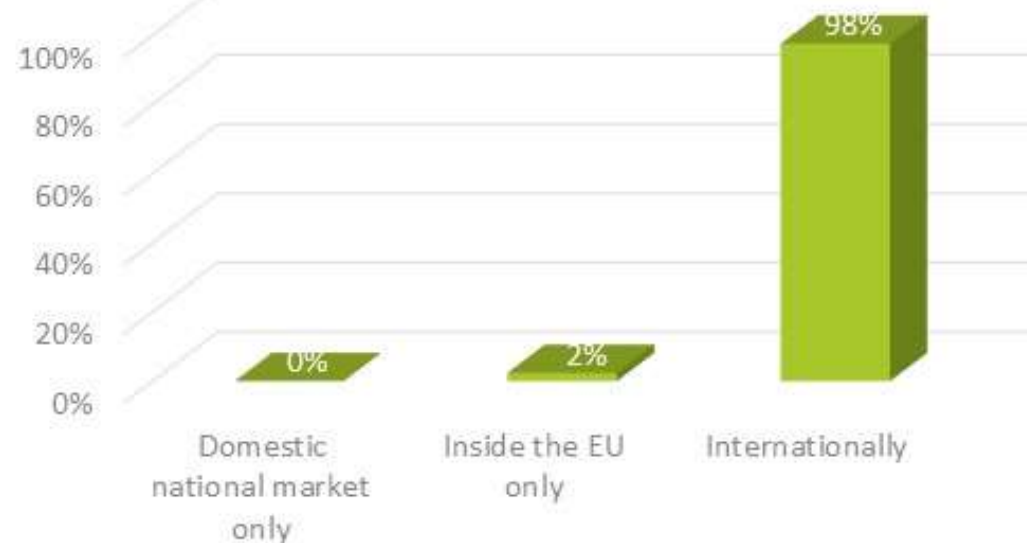
62 Companies

(incl. 92% of relevant* direct
Euroseeds Members)

Location of company headquarters

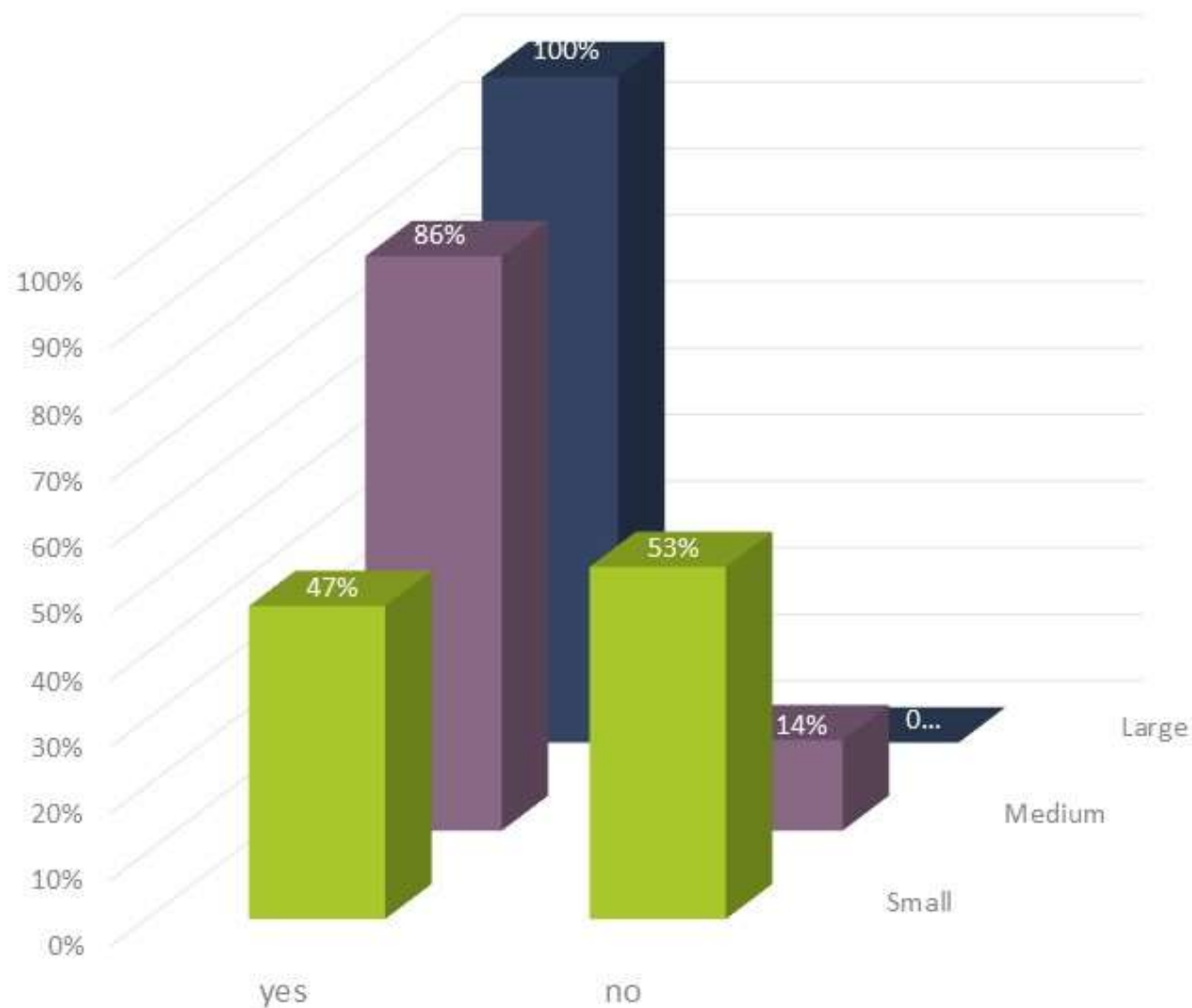


Where is your company in general active (R&D & Breeding & Seed Production/Sales)?

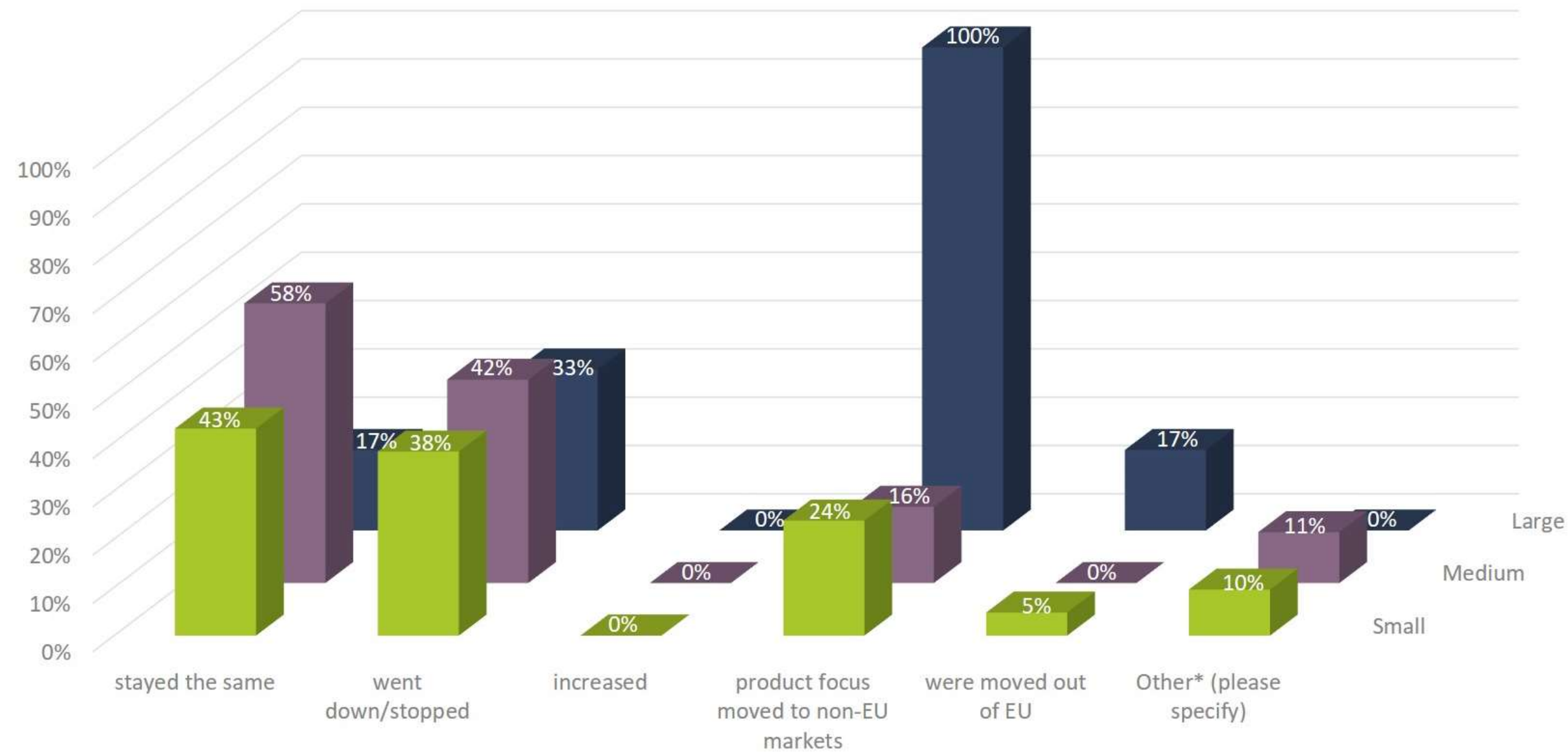


*companies involved in research & breeding

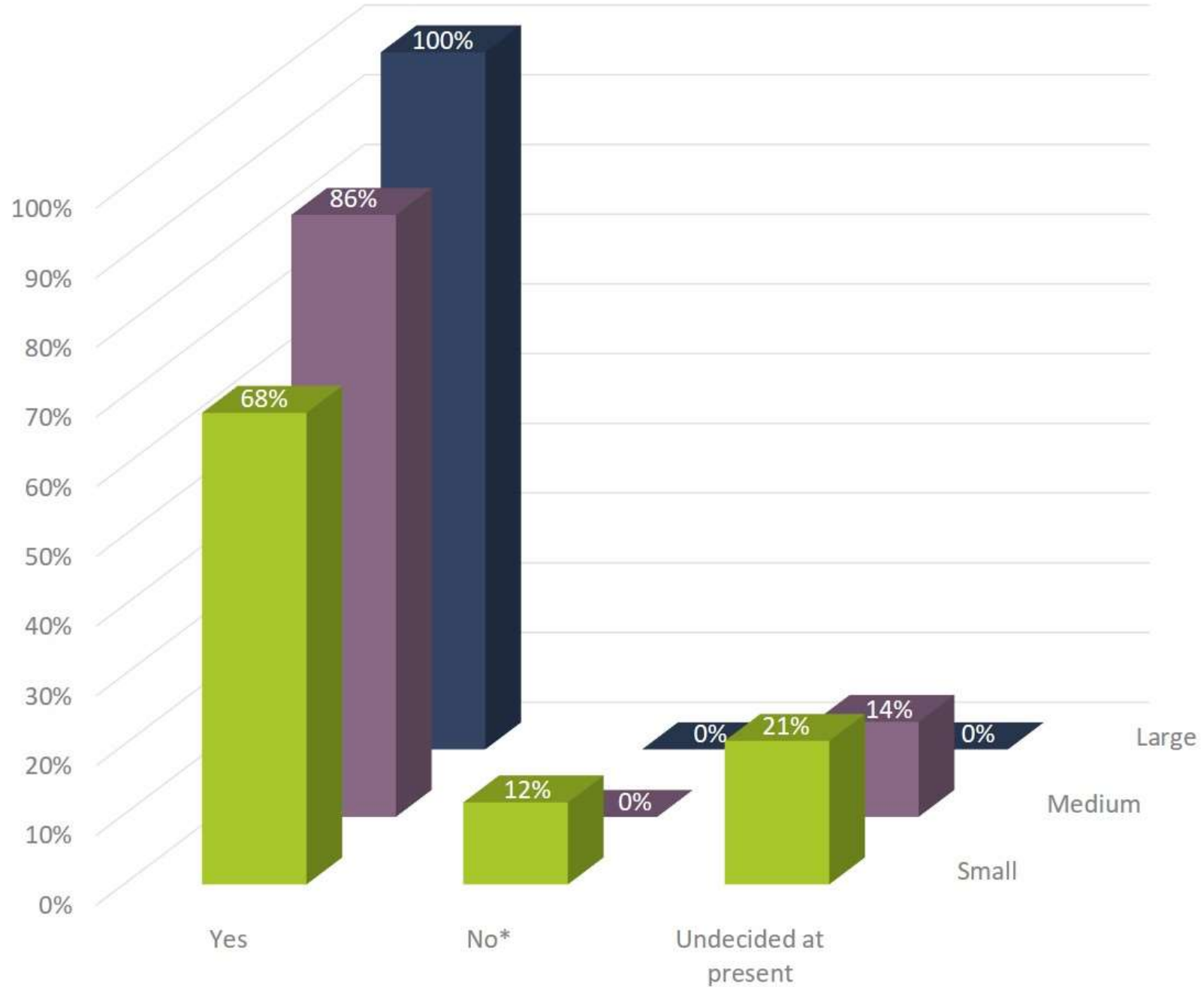
Does your company currently have research and development (R&D) activities for NBTs?



Did your R&D activities for applying NBTs change after the 25 July 2018 ECJ ruling on mutagenesis breeding ?



Would you invest in product development with NBTs for the EU market, if the varieties would not be regulated as GMO, but as conventional varieties?



Latest breeding methods provide opportunities to target global challenges as well as local needs and can help us achieve sustainable agricultural production and food security.

References used in the presentation

<https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/am-i-regulated>

<https://www.frontiersin.org/articles/10.3389/fpls.2020.586027/full>

<https://www.frontiersin.org/articles/10.3389/fbioe.2020.00303/full>

<https://www.frontiersin.org/articles/10.3389/fpls.2020.582011/full>



Seed is Life