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Global GMO/Biotech Overview & Economic Impact of Türkiye's Bio-safety Regulation

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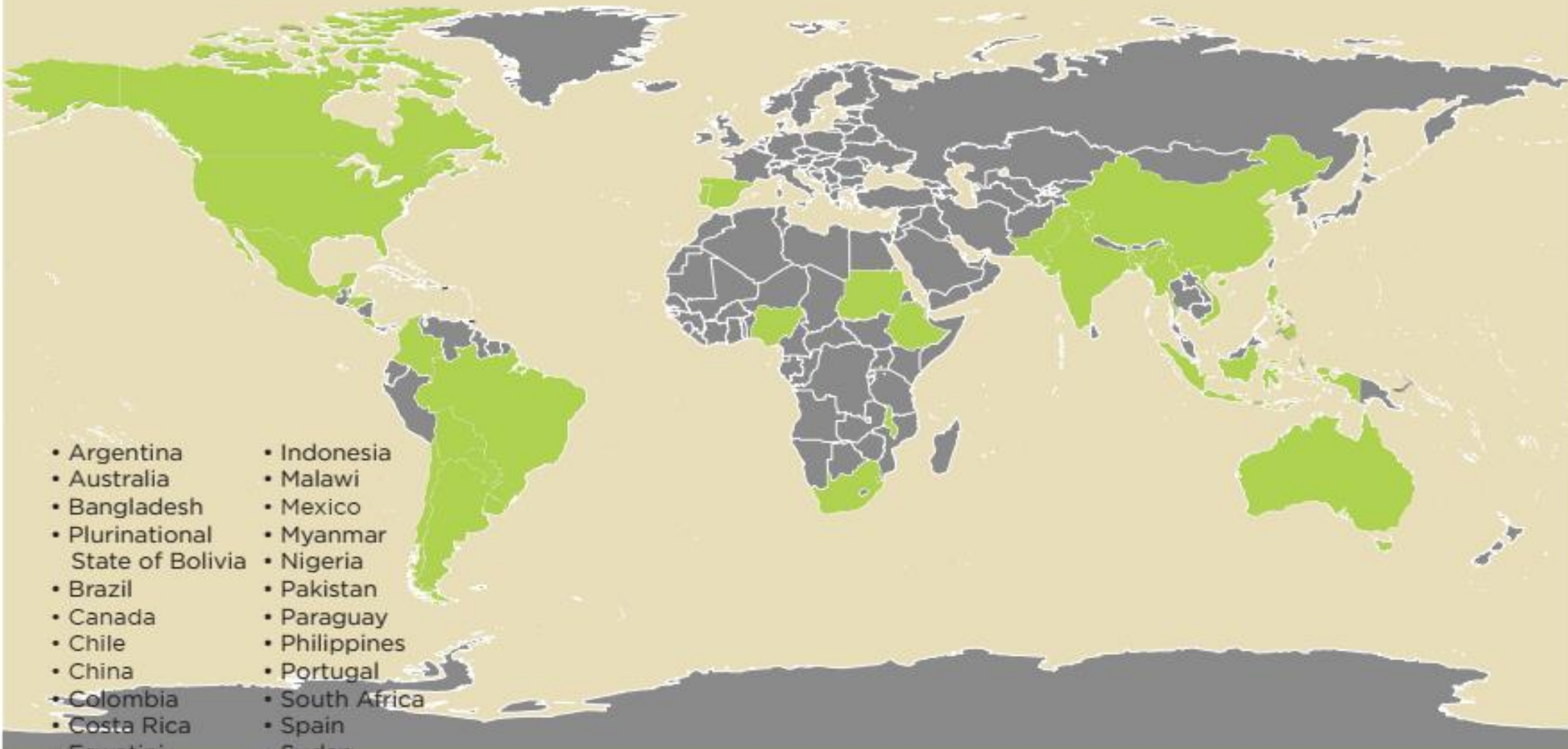
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Presentation Overview

- Where GMO/Biotech is grown and imported
- Key facts and safety of GM/biotech crops
- EU and China planting and import approvals – regulations support their industry
- Positive environmental impact of GM/Biotech crops
- Economic impact of Türkiye's Bio-safety Regulation and (Risk) Appropriate Regulation to local feed and food industry
- Cost or current regulation situation
- Regulatory opportunities to support local food/feed/consumers

Where? GM crops are currently grown



- Argentina
- Australia
- Bangladesh
- Plurinational State of Bolivia
- Brazil
- Canada
- Chile
- China
- Colombia
- Costa Rica
- Eswatini
- Ethiopia
- Honduras
- India
- Indonesia
- Malawi
- Mexico
- Myanmar
- Nigeria
- Pakistan
- Paraguay
- Philippines
- Portugal
- South Africa
- Spain
- Sudan
- United States of America
- Uruguay
- Viet Nam

Source:
FAO, 2022

gm crops in 2021

the area of gm crops increased 3.7% to 195.5 million hectares in 2021



sugarcane was the latest crop to be commercialised using gm technology

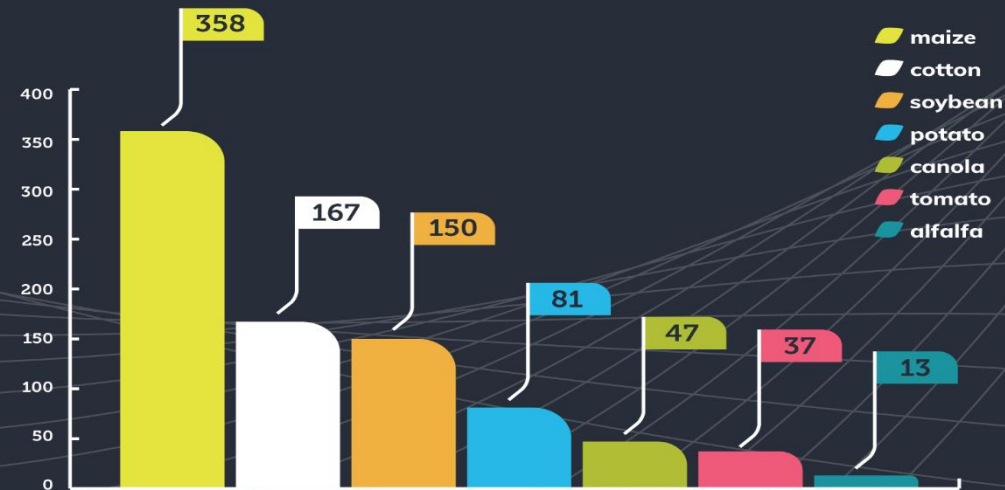
soybean represents almost 50% of the global gm crop area

gm maize traits and stacks have gained 358 cultivation approvals, more than double that of cotton

the usa holds the largest gm crop area



number of cultivation approvals globally



| rank | top 10 countries by area | gm area (ha.) | % change |
|------|--------------------------|---------------|----------|
| 1 | usa | 75.5 | +4.1 |
| 2 | brazil | 57.2 | +7.4 |
| 3 | argentina | 23.4 | -0.6 |
| 4 | india | 11.8 | -4.6 |
| 5 | canada | 11.7 | +6.8 |

| rank | top 10 countries by area | gm area (ha.) | % change |
|------|--------------------------|---------------|----------|
| 6 | paraguay | 3.0 | -8.7 |
| 7 | south africa | 2.9 | +10.8 |
| 8 | china | 2.9 | -4.6 |
| 9 | pakistan | 1.9 | -9.1 |
| 10 | bolivia | 1.4 | +2.0 |

Download all data at

gm.agbioinvestor.com



Agricultural Biotechnology/GM: Safe & Established

A Positive 28 Year History

- Biotech crops commercially cultivated since 1996
- Grown in 27 countries on 202 million hectares in 2021
- More developing countries growing GM crops, including 9 in Africa
- Consumers and livestock have safely consumed billions of metric tons of GM food/feed
- For soy and maize: most exports are genetically modified
- Global scientific consensus is solid and clear that GMOs are safe
 - 3,000+ scientific studies found GMOs are safe for humans/animals/environment
 - 4,485+ regulatory approvals by global agencies for food/feed use and cultivation
 - 284 scientific institutions (mainly in Europe) found that GMOs are safe and have economic, environmental and scientific benefits

EU –GM approvals benefit local industry

- Fact 1: EU process for assessing/approving GM crops
 - slow but functional & predictable
- Fact 2: Spain and Portugal grow GM corn
- Fact 3: The EU approved 100+ GM crops for import, use in food & feed
 - 44 GM maize events
 - 26 GM soy events
 - 15 GM cotton events
 - 8 GM canola events
 - 1 GM sugar beet event
- Fact 4: The EU imports large quantities of GM commodities every year
 - ~28 million metric tons of GM soy
 - [All](#) EU countries import GM soy, including those publicly opposed to GMOs
- Fact 5: EU allows GM use in food with labeling

China – World’s largest GM Importer and increasing local GM Production

SOURCE / ECONOMY

China’s agriculture ministry approves more varieties of genetically modified corn, soybeans

By Global Times

Published: Jan 23, 2024 05:10 PM



This aerial photo taken on Oct 19, 2023 shows a farmer unloading corn to be dried in Dongsheng Village of Zhaodong City, northeast China's Heilongjiang Province. China's top grain producer Heilongjiang Province is embracing the harvest season of this year while preparing for next year's planting. Photo:Xinhua

China

China's embrace of GMO crops gains momentum with new import, planting approvals

By Mei Mei Chu

January 18, 2024 8:46 AM EST · Updated 3 months ago



Agricultural Biotechnology: Key Facts

- world-renowned scientific institutes and many regulatory agencies have declared GM food safe (3,000 studies)
- Scientific studies show reduced pesticide and fuel use, improved yields and soils and higher profit for farmers
- Africa countries are growing GM: Nigeria, Ethiopia, Malawi, Kenya
- In the EU, Spain and Portugal grow GM crops. **HOWEVER, the EU has approved 100+ GM crops for import, processing, food and feed use.**
- EU imports ~28 million metric tons of GM soy every year

Biotechnology/GM enhances productivity and sustainability

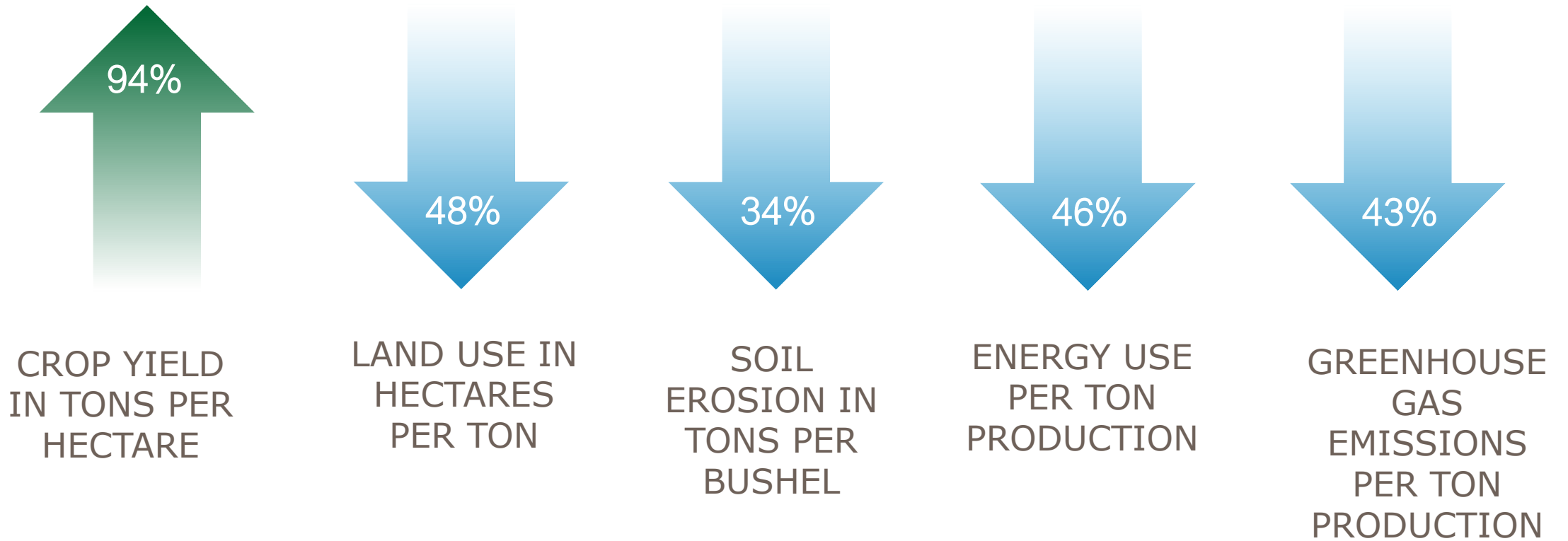
- Biotech soybeans improve weed control
- Allows increased use of no-till and direct drilling into crop stubble
- Crop residue creates a mulch layer for earthworm populations and soil microbes and improves soil structure
- Reduces pesticide use
- Retain soil moisture
- Fewer passes with machinery reduce fuel use and CO₂ emissions





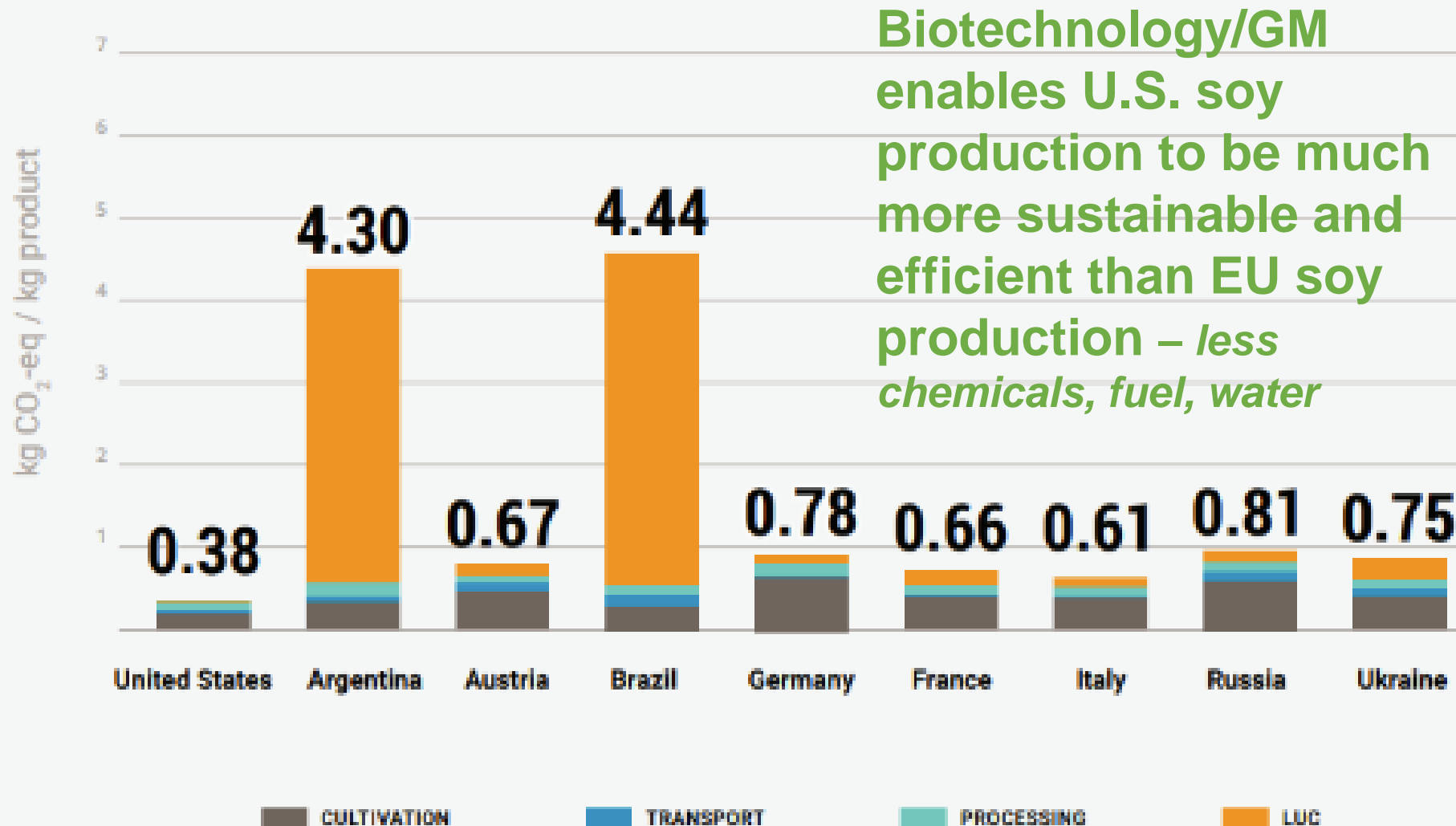
GM/Biotech Reducing Environmental Impact of U.S. Soybean Production (1980-2020)

U.S. GM soy production = 93%



Field to Market: The Alliance for Sustainable Agriculture, 2021. Environmental Outcomes from On-Farm Agricultural Production in the United States (Fourth Edition). ISBN: 978-0-578-33372-4

Carbon footprint (including LUC) of whole soybeans crushed in Europe



Value calculations are country averages.
Specific supply chains may have different carbon footprint results.



Economic Impact of Türkiye's Bio-safety Regulation and (Risk) Appropriate Regulation

Graham Brookes
PG Economics Ltd, UK

- Agricultural economist
- Specialist in impact of new technology in agriculture, impact of regulation and policy change
- 35 years experience of examining these issues in many countries
- More information available at www.pgeconomics.co.uk
- **Full written report is available**
- **Report updated 2021 from similar analysis in 2011**

Key challenges facing global agriculture

- Feeding an expanding world population: 9.7 billion by 2050
- Climate change: increasing production/supply insecurity and variability
- Significant bio-diversity loss
- Global agriculture contributes to these issues: changes needed
- New technology and innovation have vital role to play in delivering a more sustainable food production system

How new technology is regulated has a major influence on our ability to deliver on this!

Purpose of regulation

- Key purposes: consumer health and safety protection, protection of environment, ensuring consumer confidence
- Cost of meeting regulatory requirements are a necessary and key part of bringing new products to market

Good regulation:

- **Needs to be science-based, transparent, predictable and show how any risks are assessed in a clear way**
- If regulation delivers all of these points, it minimises uncertainty and risk for new product innovators and encourages innovation

What can we learn from experience of current regulatory system operation?



Graham Brookes - Analysis of Impact of regulation on economic activity and competitiveness: the case of Turkey's bio-safety regulations

- An independent assessment of the economic impact on sourcing and use of raw materials
- Sectors: importing, crushing, feed, food manufacturing, livestock production, aquaculture
- Basis of research: desk research/analysis and a survey of representatives of companies and organisations in the importing, raw material processing and using sectors:
- Respondents accounted for more than 70% of total soybean and derivative use, 40% of total corn use and about 50% of corn/cereal derivative use
- Conducted in 2021 covering 12 year period from introduction of bio-safety regulations in 2009

Bio-safety regulatory issues affecting markets and businesses in Turkey

- ▶ Zero tolerance policy for low level presence of unapproved GMOs in non feed uses & 0.1% threshold for events unapproved (awaiting assessment) for feed
- ▶ Impossible to guarantee zero presence of unapproved GMOs – testing technology can detect dust and soil borne micro organisms!
- ▶ Slower speed of Turkey regulatory approval process for GMOs compared to any other country with regulations for import/use of GMO events – much slower than GMO producing countries
- ▶ No GMOs approved for food and industrial uses in Turkey
- ▶ Approval only of a limited number of corn and soybean GMO events – no approvals for canola/rapeseed, cotton, sugar beet

General impacts/costs

| Issue | Million \$ |
|--|-----------------|
| Testing and certification: 2009-2020 | 162.2 to 275.00 |
| Demurrage/delay costs: mostly applicable 2009-2011 | 47.0 |
| Short term impacts on raw material prices: | |
| Late 2009 | 48.04 |
| 2017-2018 | 6.00 |
| Late 2020-2021 | 33.95 |
| Increased stock holding | |
| 2009-11 | 47.70 |
| Late 2020-21 | 36.86 |
| Regular/structural additional stock holding (since 2018) | 12.31 |
| Annually recurring price/cost impacts (feed sector): loss of price flexibility from not using US origin: | |
| soybeans and derivatives | 34.0 |
| corn/derivatives | 22.75-260.75 |
| Additional costs for dealing with poorer quality (alternative) supplies of soy/derivatives | 2.4-4.8 |
| Cost of additional staff to administer GMO regulatory requirements | 7.5-10.0 |
| Legal costs, fines, product recalls, disposal of disallowed raw materials and products | 12.25-15.25 |
| Higher price of domestic corn (2009-2011) | 362.0 |

Food/industrial/poultry/egg sectors impacts

| Issue | Million \$ |
|--|---------------------------------------|
| Replacement of soy oil with sunflower oil in food uses (2009-2020) | 301.0 |
| Replacement of (US origin) corn oil and certification of non-GM status in food uses (2009-2020) | 69.61 |
| Loss on flexibility on pricing of corn: not using US origin raw materials in food & industrial sectors (2009-2020) | 157.6 to 278.8 |
| Replacement of soy derivatives in food uses (2009-2020) | 60.0 to 66.0 |
| Inability to access soy-based raw materials in poultry/egg sectors late 2009-2011 | 103.0 |
| Total | Total \$1.53 to \$2.01 billion |



Total cost burden on Turkish agri-food sector

- **\$1.53 billion to \$2 billion 2009-2020**
- **Ongoing annual costs of \$107-\$133 million**
- Loss to Turkish economy of value added/income generation as some processing of agricultural raw materials moved to locations outside Turkey
- Loss of employment generation in Turkey
- **Survey identified at least \$500 million worth of lost jobs and value added**



Summary of findings on impact of existing GMO regulations around the world


- Regulatory costs can be up to 50% of total cost of bringing product to market
- Regulatory delays reduce attractiveness to innovate
- Additional costs, time for approval and uncertainty in countries/regions that have dysfunctional regulatory systems is dis-incentive to innovate
- Adds economic costs to supply chains, reduces value added and employment levels, leads to trade diversion
- Dysfunctional regulatory systems are those where an overly precautionary principle is applied and leads to a lack of clarity on evidence standards and limits.
- Role of science and evidence becomes unclear and evidence of benefits can be ignored in favour of a total avoidance risk approach

What is a risk-appropriate regulatory system?

- ▶ Science and evidence of impact of GM crop technology does not support a precautionary approach being applied to gene edited (GE) technology just because GE technology is relatively new
- ▶ Regulatory authorities in many countries (eg, Argentina, Brazil, Canada, Japan, USA) have already drawn on this experience and concluded/ implemented regulatory systems for Gene Edited technology that is less onerous than GM regulation
- ▶ Science and evidence shows best way to address global challenges of food security, climate change and bio-diversity loss is to embrace new technology

Addressing the deficiencies in Turkey: changes to GMO regulations needed

- Protocols for testing are not published and inconsistency in test results from different laboratories = added business uncertainty and risk
- No GMOs approved for food or industrial uses – coupled with zero tolerance threshold for presence of unapproved GMOs adds complications and risks to trading
- No GMOs approved for importation and use in oilseed rape/canola, sugar beet or cotton = adds complications and risks to trading
- Consistently slower GMO approval than other countries with GMO import regulations – adds business uncertainty and risk
- Liability provisions lack clarity with business owners facing fines and jail even if they have taken reasonable care to avoid importing and using unapproved GMOs



Addressing the deficiencies: changes to GMO regulations needed

- Operate a science-based approval system in which the procedures for assessment (and data requirements) are transparent
- Operate approvals in timely manner with clear timelines for completing the assessment process
- Staff the organisation(s) with this responsibility with sufficient numbers of suitably qualified staff
- Clarify and amend the liability provisions of the regulations to remove the current risks, uncertainty, costs and stress faced by importers
- Introduce workable thresholds for the presence of unapproved GMOs in commodities/derivatives. A zero-tolerance threshold is undeliverable in any commodity trading system.
- It is also inconsistent and unworkable to operate a zero-tolerance threshold for the presence of materials that have been assessed as safe for food, feed and industrial use elsewhere in the world.

Conclusions

- **Inappropriate regulatory adds economic costs to supply chains, reduces employment levels and leads to trade diversion**
- **Turkey economic impact - \$1.53 billion to \$2 billion 2009-2020**
- **Turkey ongoing annual costs of \$107-\$133 million**
- **EU, China, India, and North & South America and most major ag production countries allow GM production and ease of import**
- Inefficient regulation creates barriers to entry and reduce innovation
- For the world to adequately address food security, climate change and biodiversity challenges, evidence-based regulations required for new technology adoption
- Systems should assess risk according to clearly defined scientific criteria & evidence
- Global response to covid (GM) vaccine development demonstrates what can be done –Consistency of approach in pharmaceuticals need applied to agri-food sector
- **Turkey's regulation of technologies like GMOs can better reflect science allowing for more competitive industry and lower consumer food costs**

Conclusion

- **Türkiye's Bio-safety Regulation contributed to the Turkish agri-food sector having:**
 - **higher costs of production,**
 - **lower levels of profitability**
 - **higher levels of risk and uncertainty associated with accessing raw materials**
- **New GE breeding techniques will increase rate of chain especially to small production crops**



Thank you!