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Current GHG Emission Estimates Across Countries, Products and Trade Routes

Kiseok Shin, Jason Grant, Xi He, Shawn Arita, Sharon Sydow, Hazelle Tomlin, and Jason Jones

Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2023 Annual Meeting: The Future of (Ag-) Trade and Trade Governance in Times of Economic Sanctions and Declining Multilateralism, December 10-12, 2023, Clearwater Beach, FL.

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Presented at the IATRC Annual Meeting, Clearwater Beach, FL, Dec. 10-12, 2023

***The findings and conclusions presented here are those of the authors and do not represent any official U.S. Department of Agriculture (USDA) or U.S. Government (USG) determination or policy*

Research Motivation

1. **Key Drivers of Emissions:** What are the main drivers of agricultural emission intensities across production activities and countries?
2. **Agricultural Emissions Stocktaking:** what is the range of current GHG emission intensity estimates from the literature, international modeling communities, and subscription-based data products?
3. **Cross-Country Comparison:** How do emission intensities embodied in production and international trade of agricultural products differ across countries?
4. **Role of Trade:** Can agricultural trade policies reduce global GHG Emissions by shifting the sourcing of products from high- to low-carbon footprint countries while at the same time providing food availability and security for import dependent countries?

Emissions intensity by dataset, crop and continent

T of CO2E per 1T of product	BLONK	FAO	GLOBIOM	GTAP	IFPRI	OECD	Literature
Maize							
Africa	0.24	0.17	0.35			0.16	
Asia	0.29	0.10	0.49			0.21	(Mean) 0.34
Europe	0.24	0.13	0.12			0.13	(Median) 0.07
North America	0.20	0.15	0.12			0.15	(Min) 0.03
Oceania		0.26	0.64			0.19	(Max) 2.77
South America	0.19	0.13	0.20			0.14	
World	0.23	0.13	0.27			0.17	
Soybean							
Africa	0.69	0.13	0.38	0.04	0.03	0.17	
Asia	0.56	0.15	1.03	0.07	0.06	0.20	(Mean) 0.29
Europe	0.42	0.13	0.11	0.23	0.07	0.13	(Median) 0.29
North America	0.24	0.07	0.15	0.19	0.11	0.07	(Min) 0.29
Oceania		0.08	0.68	0.23	0.09	0.12	(Max) 0.29
South America	0.24	0.08	0.36	0.18	0.09	0.07	
World	0.27	0.08	0.35	0.12	0.07	0.09	
Wheat							
Africa		0.22	0.77	0.22	0.21	0.23	
Asia	0.41	0.20	0.61	0.18	0.30	0.24	(Mean) 0.34
Europe	0.23	0.15	0.15	0.18	0.20	0.16	(Median) 0.20
North America	0.30	0.26	0.21	0.22	0.30	0.22	(Min) 0.04
Oceania	0.29	0.20	0.34	0.28	0.22	0.26	(Max) 1.06
South America	0.26	0.22	0.15	0.22	0.26	0.20	
World	0.32	0.19	0.51	0.19	0.26	0.22	

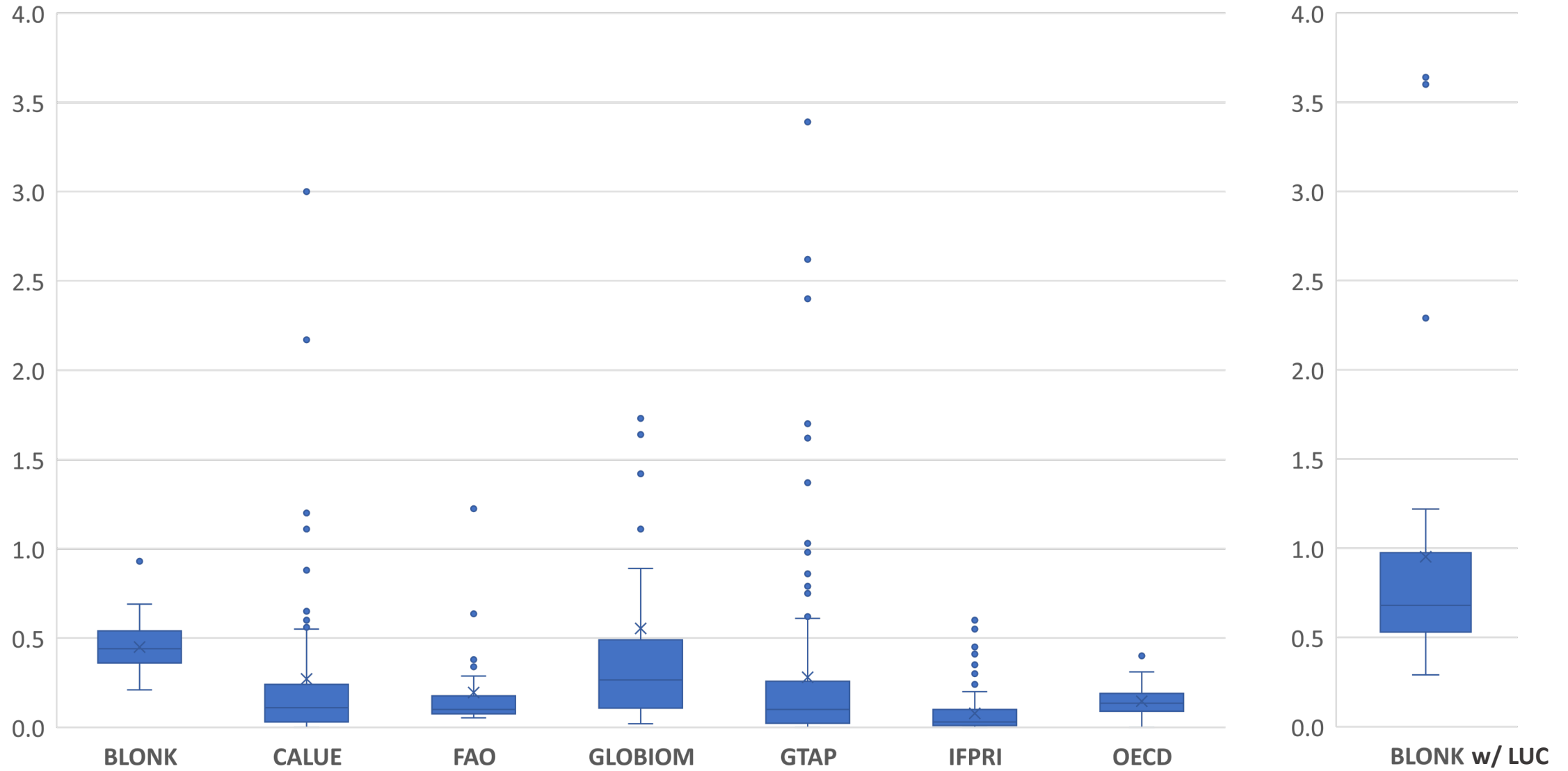
Emissions intensity by dataset, crop and continent

T of CO2E per 1T of product	CALUE	GCAM	GTAP	IFPRI	UNFCCC
Cereals					
Africa	0.42		0.14	0.15	
Asia	0.77		0.14	0.21	
Europe	0.20		0.17	0.18	
North America	0.21		0.15	0.18	
Oceania	0.19		0.24	0.17	
South America	0.26		0.14	0.15	
World	0.50		0.15	0.18	
Crop					
Africa		0.14			
Asia		0.27			0.15
Europe		0.24			0.12
North America		0.47			0.19
Oceania					0.14
South America		0.06			
World		0.25			0.15
Oil seeds					
Africa	0.07				
Asia	0.09				
Europe	0.19				
North America	0.18				
Oceania	0.19				
South America	0.07				
World	0.11				

Emissions intensity by dataset, crop and economic status

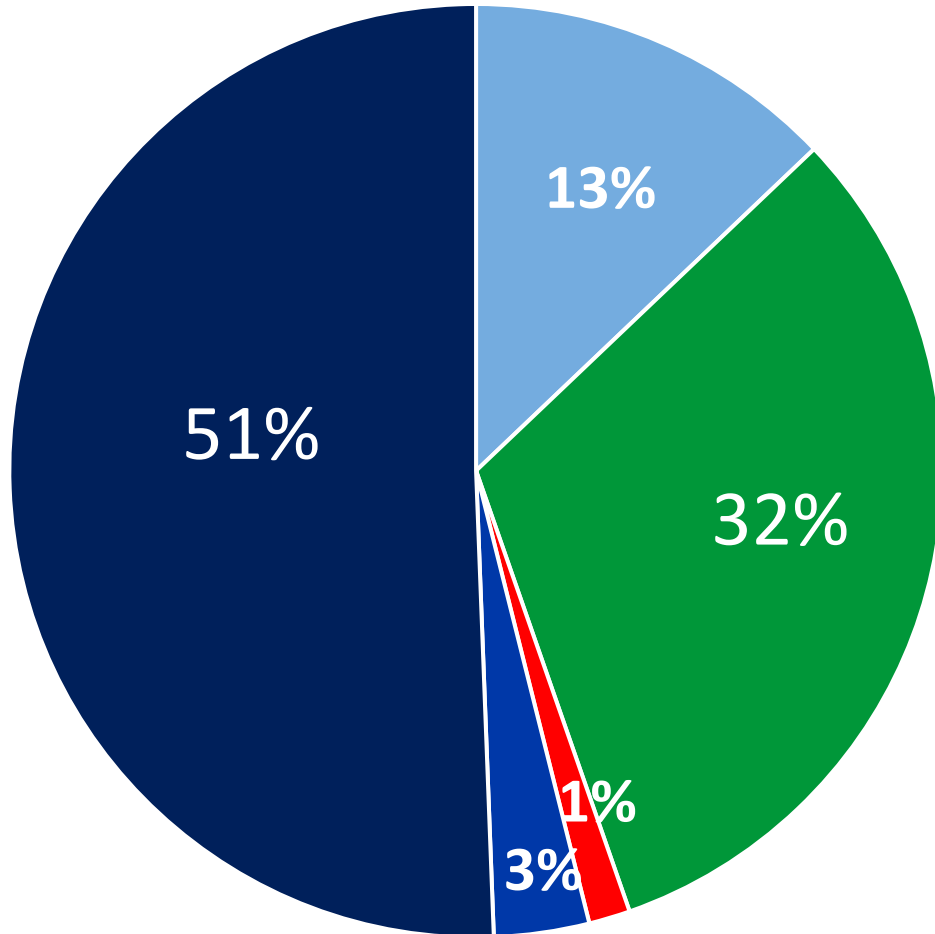
T of CO2E per 1T of product	BLONK	CALUE	FAO	GCAM	GLOBIOM	GTAP	IFPRI	OECD	UNFCCC
Cereals									
Developed		0.21				0.16	0.17		
Developing		0.66				0.14	0.19		
Crop									
Developed				0.48					0.15
Developing				0.20					0.10
Maize									
Developed	0.20		0.14		0.11			0.14	
Developing	0.27		0.12		0.38			0.19	
Oil seeds									
Developed		0.19							
Developing		0.09							
Rice									
Developed	1.50		1.29		1.48	1.22	1.02	1.64	
Developing	0.99		1.07		1.13	1.04	0.93	1.70	
Soybean									
Developed	0.25		0.08		0.15	0.21	0.10	0.08	
Developing	0.28		0.09		0.46	0.09	0.06	0.09	
Wheat									
Developed	0.25		0.18		0.17	0.20	0.22	0.19	
Developing	0.40		0.20		0.56	0.19	0.29	0.23	

Soybean emissions intensity by dataset

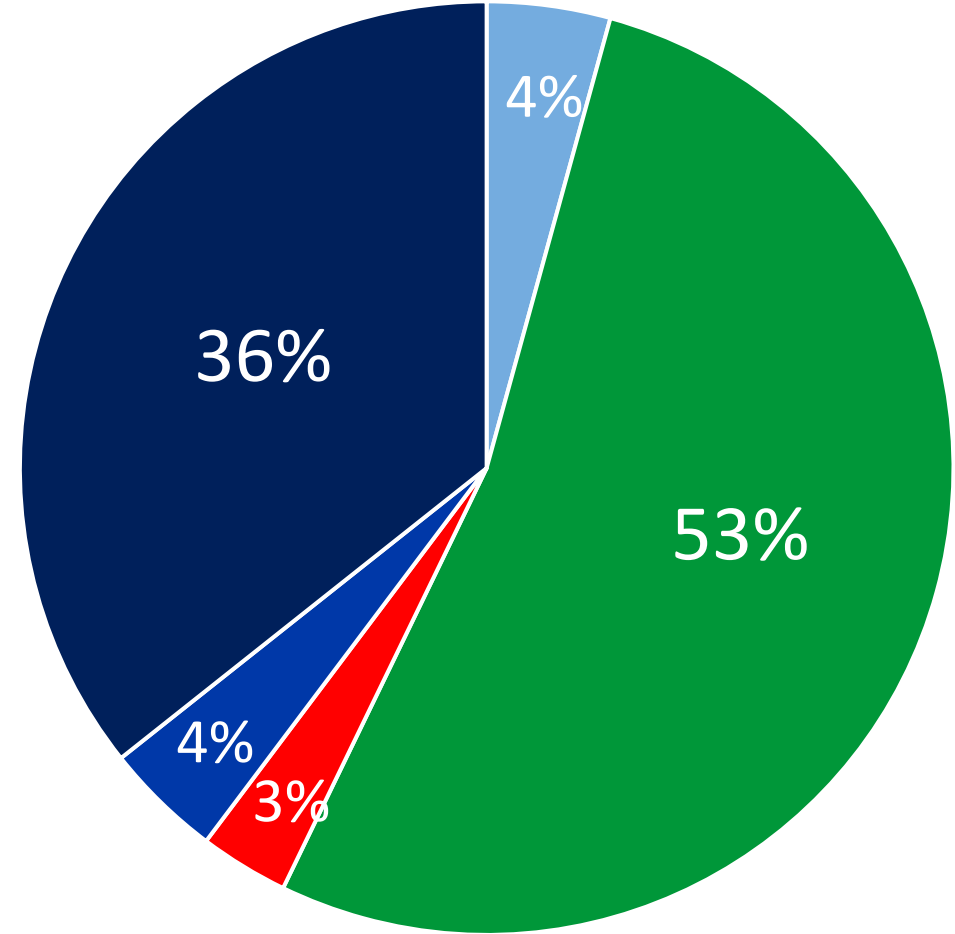


Share of top soybean exporting countries

2000-2004

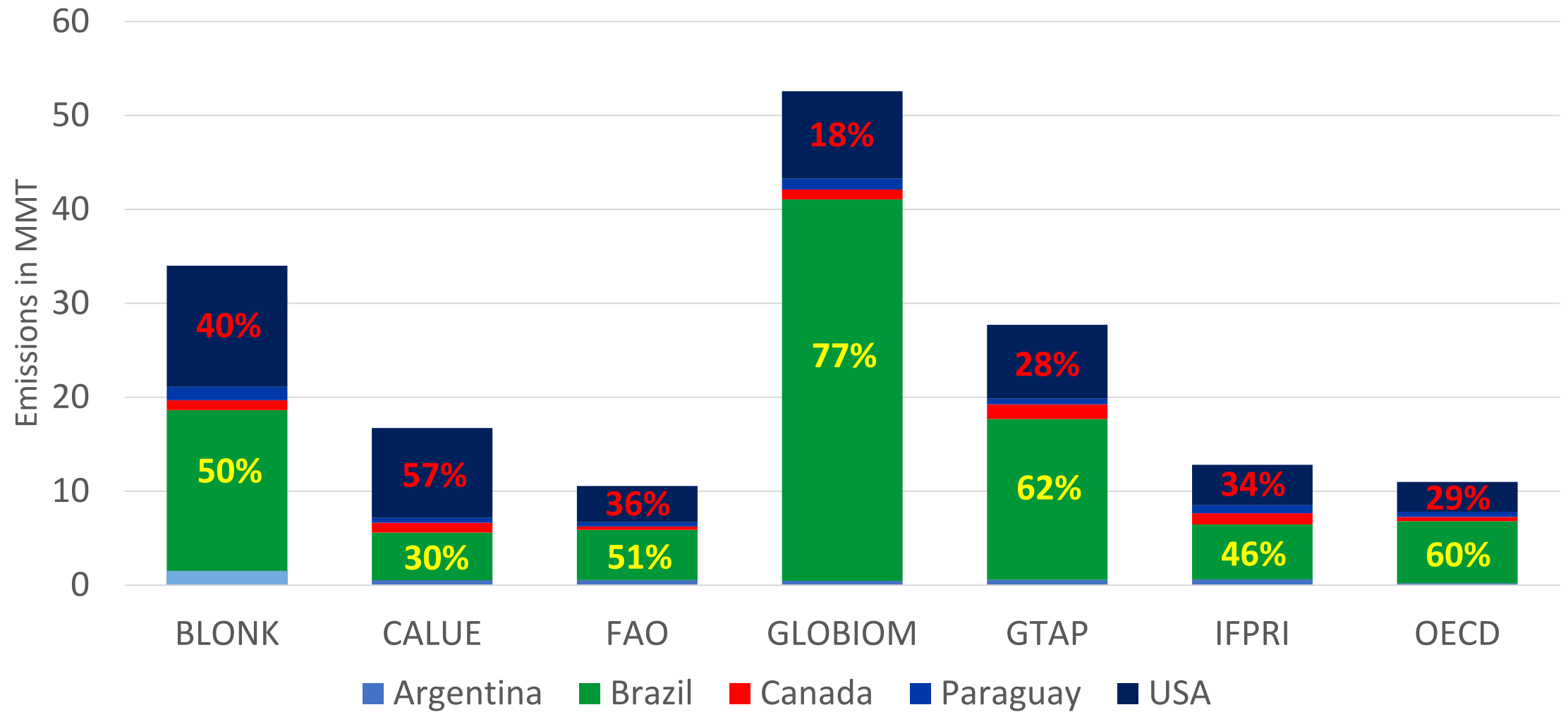


2017-2021



Argentina Brazil Canada Paraguay USA

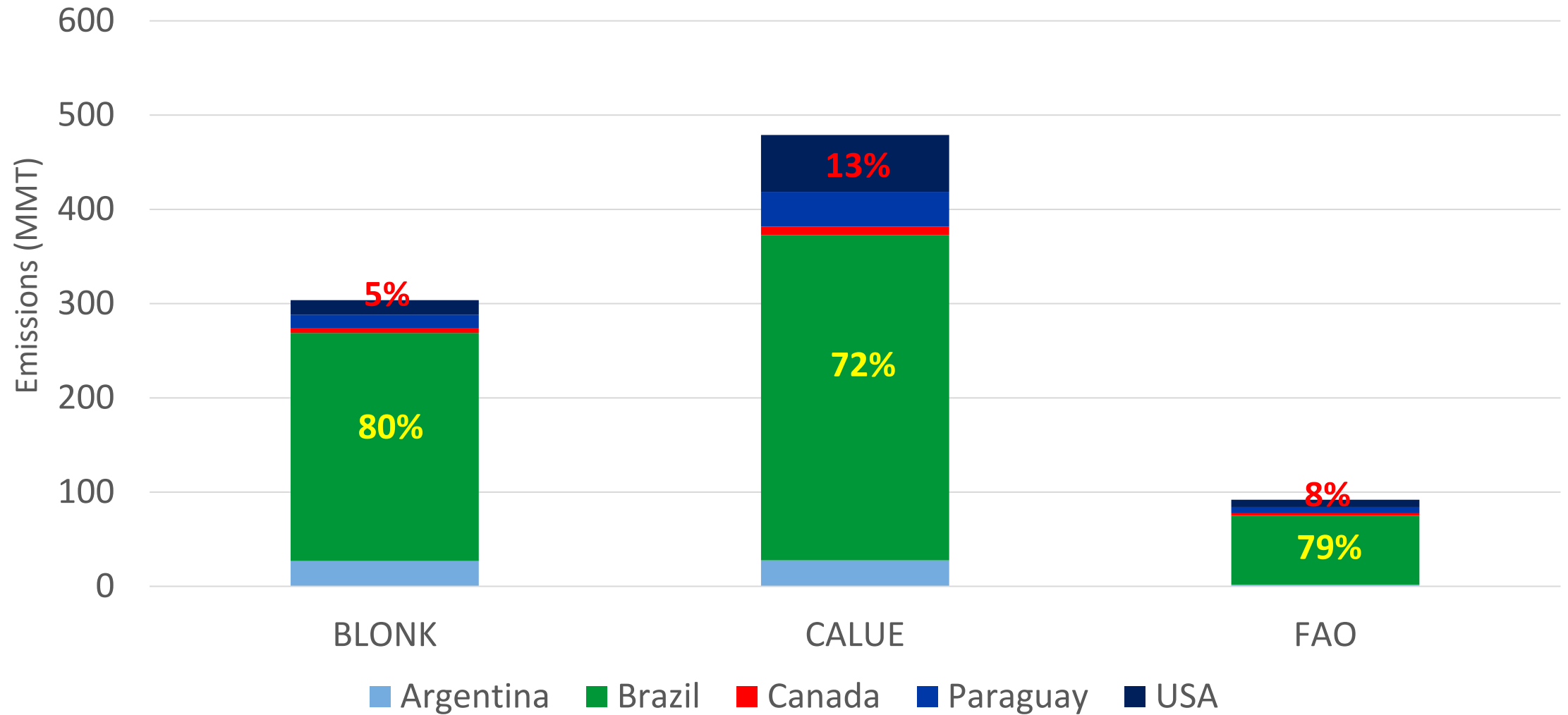
Soybean emissions (excl. LUC) embodied in trade by top export countries



Source: BLONK (2017), CALUE (2017), FAO (2017), GLOBIOM (2020), GTAP (2018), IFPRI (2017), OECD (2018).

Note: FAO values are calculated by emissions from crop residues and fertilizer use. The emissions intensity of oil seeds is used for CALUE.

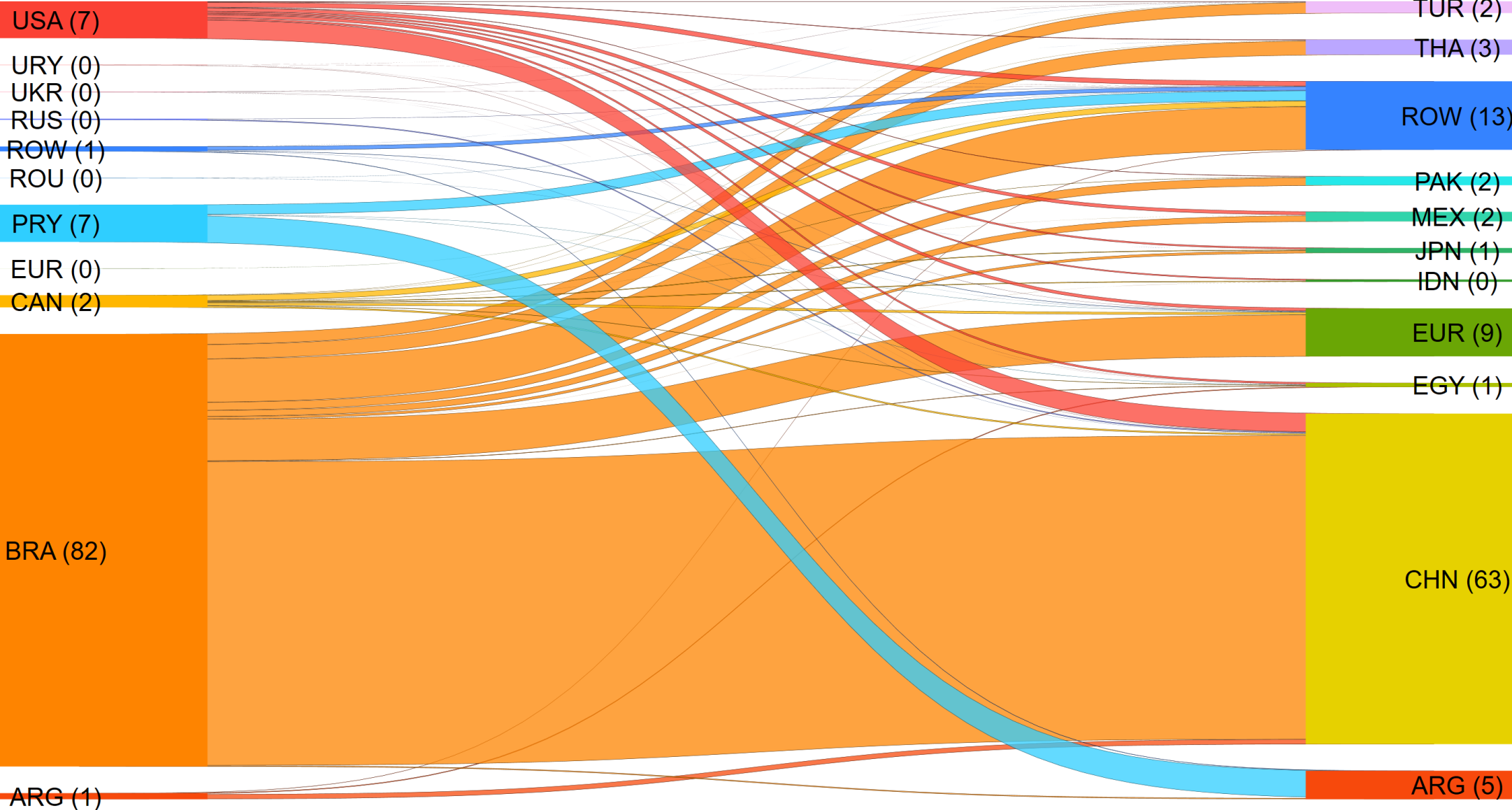
Soybean emissions (incl. LUC) embodied in trade by top export countries



Source: BLONK (2017), CALUE (2017), FAO (2017).

Note: FAO values are calculated by emissions from crop residues and fertilizer use. The emissions intensity of oil seeds is used for CALUE.

Soybean emissions flow in 2021 (101 MMT)



Source: FAOSTAT