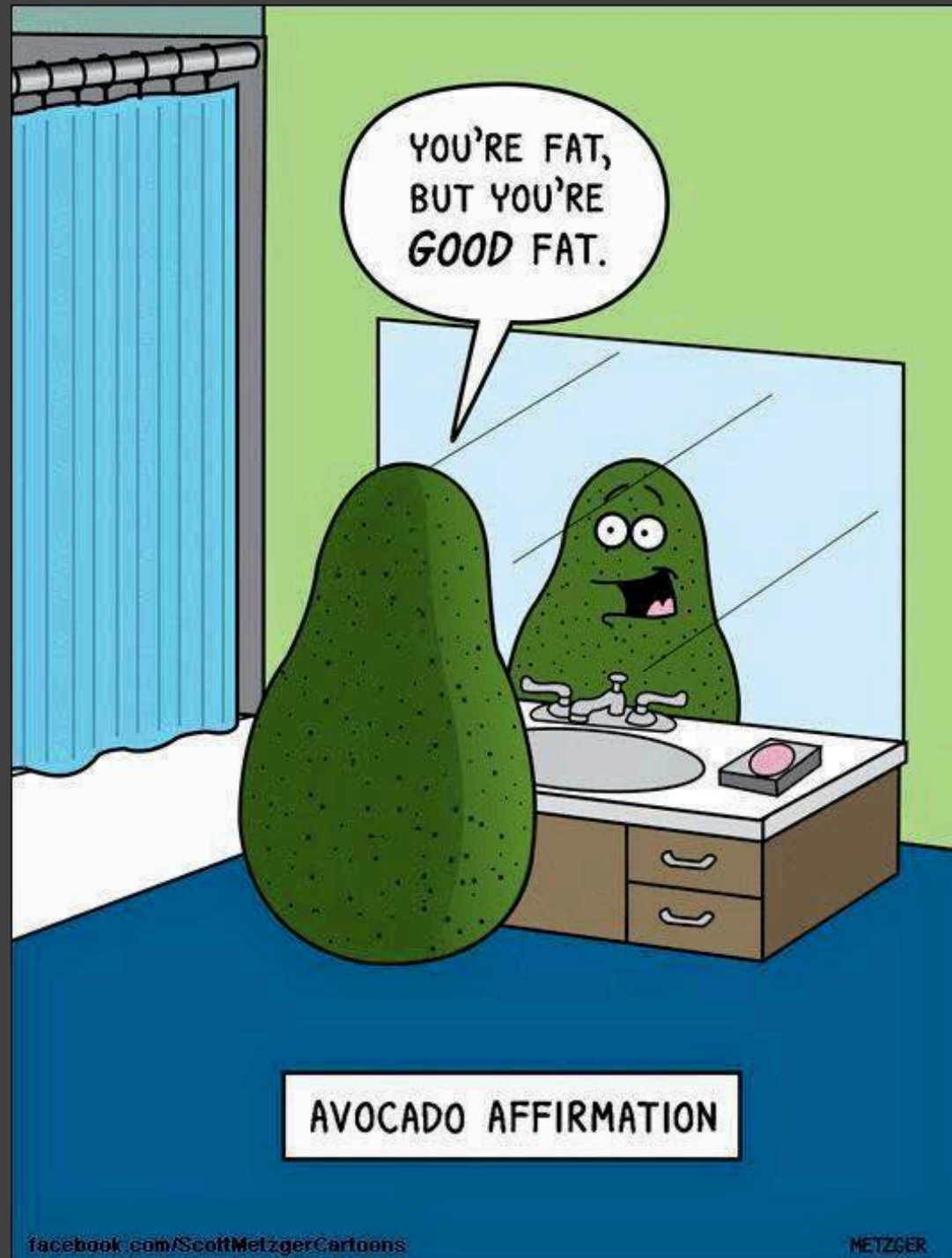


Genetic resource & plant breeding possibilities & limitations for fruit & vegetable crops

Colin Khoury



“Innovating global fruit and vegetable food systems to help bring sustainable nutrition security” workshop
Keystone, Colorado
31th July 2018



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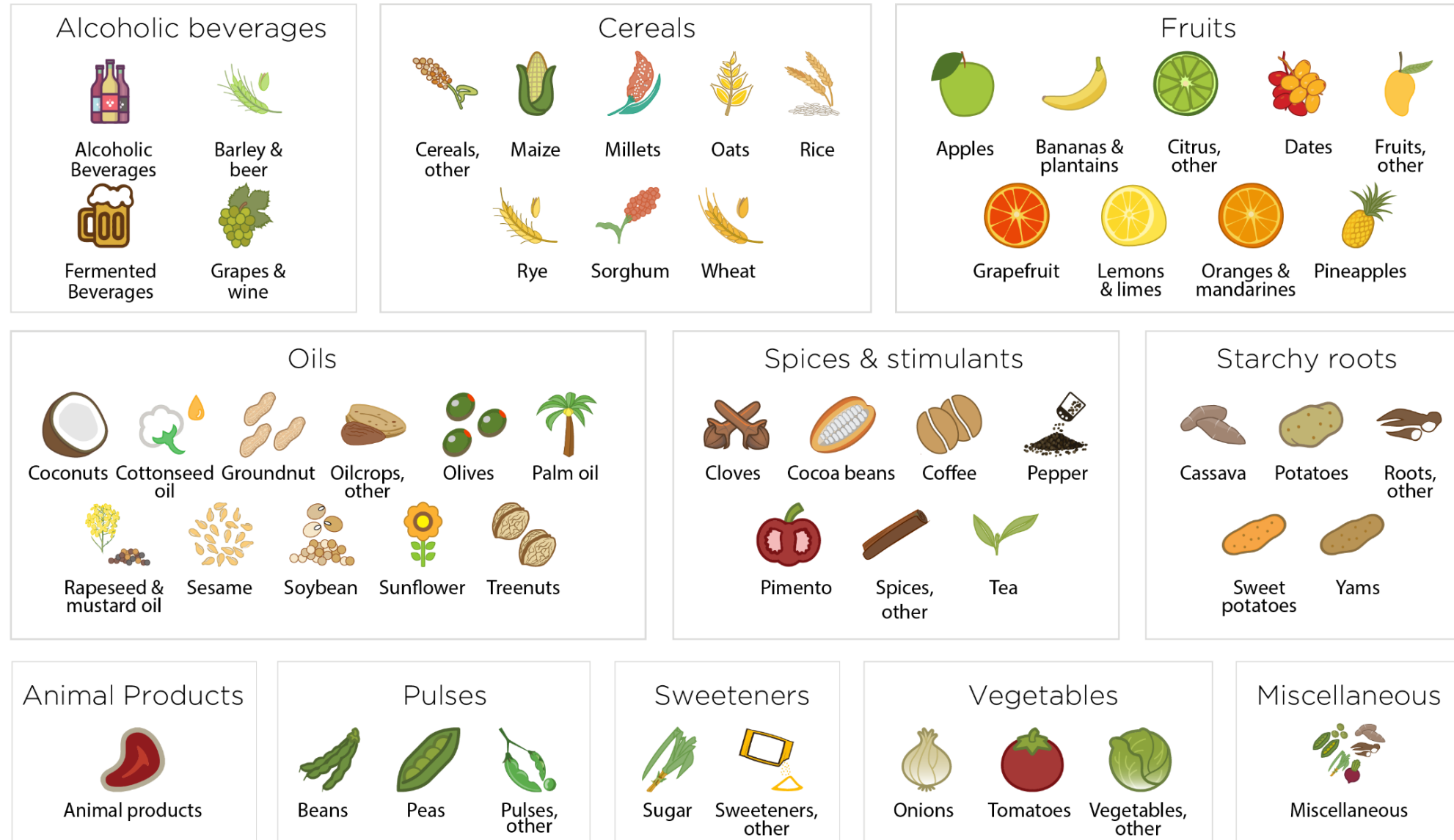


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Crop commodities measured in FAO food supply data



<http://ciat.cgiar.org/the-changing-global-diet/>

Khoury et al. 2014 *PNAS* 111(11): 4001-4006; <http://ciat.cgiar.org/the-changing-global-diet/>







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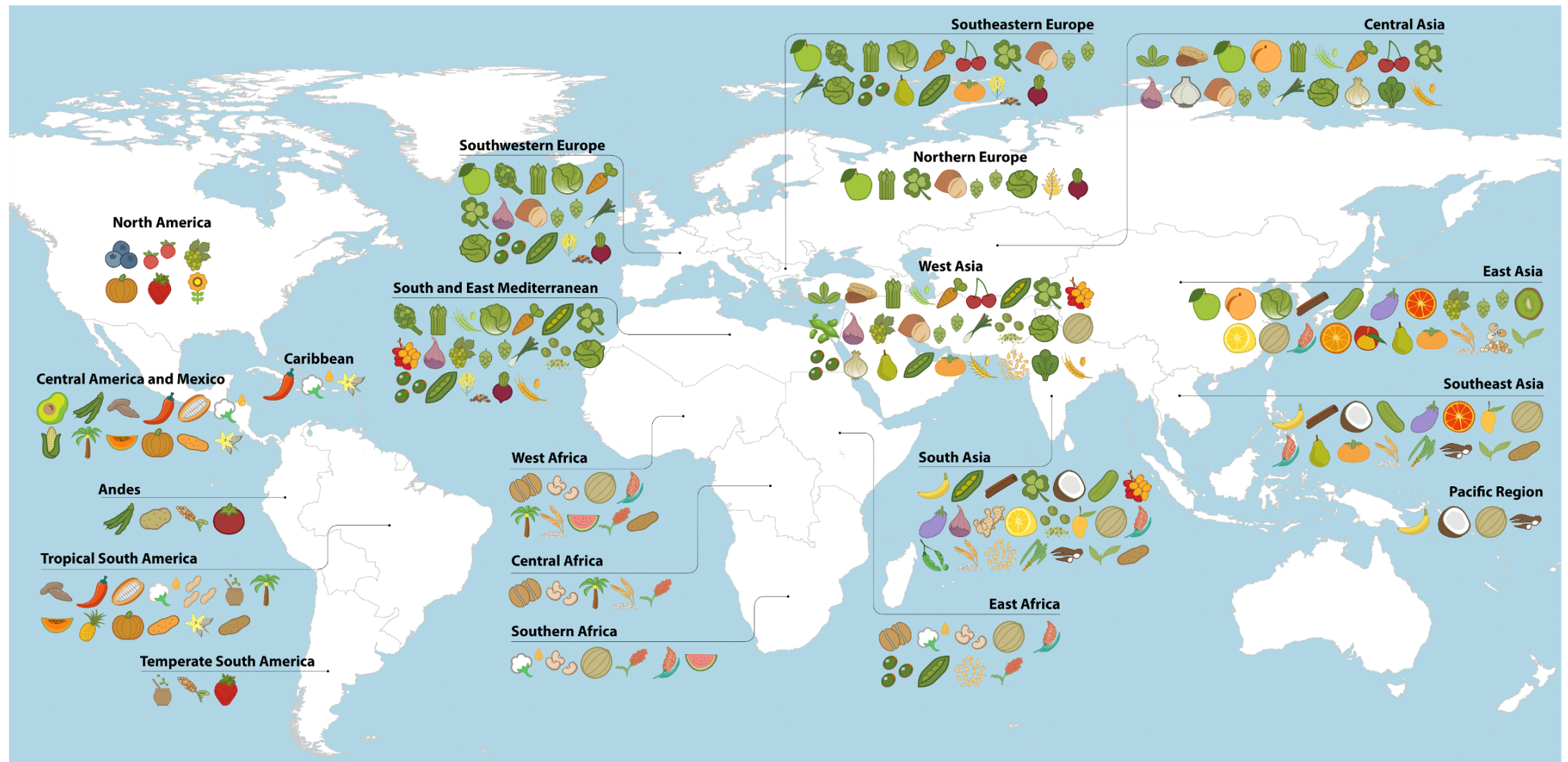
Healthier lives and more resilient livelihoods through greater diversity in what we grow and eat

The World Vegetable Center **conducts research, builds networks, and carries out training and promotion activities** to raise awareness of the role of vegetables for improved health and global poverty alleviation.

Vegetables can **alleviate poverty** by creating new jobs and new sources of income for farmers and landless laborers, **improve health** by providing essential micronutrients lacking in diets, **enhance learning and working capacities of adults and children** through improved diets and health, and improve the sustainability of food production practices by **diversifying cropping systems**. The Center's research and development work focuses on breeding improved vegetable lines, developing and promoting safe production practices, reducing postharvest losses, and improving the nutritional value of vegetables.







Alfalfa	Beans	Clover	Eggplants	Hops	Melons	Pears	Rice	Sunflower
Almonds	Blueberries	Cocoa beans	Faba beans	Kiwi	Millets	Peas	Rye	Sweet potatoes
Apples	Cabbages	Coconuts	Figs	Leeks	Oats	Pigeonpeas	Sesame	Taro
Apricots	Carrots	Coffee	Garlic	Lemons & limes	Olives	Pineapples	Sorghum	Tea
Artichokes	Cassava	Cottonseed oil	Ginger	Lentils	Onions	Plums	Soybean	Tomatoes
Asparagus	Cherries	Cowpeas	Grapefruit	Lettuce	Oranges	Potatoes	Spinach	Vanilla
Avocados	Chickpeas	Cranberries	Grapes	Maize	Palm oil	Pumpkins	Strawberries	Watermelons
Bananas & plantains	Chillies & peppers	Cucumbers	Groundnut	Mangoes	Papayas	Quinoa	Sugar beet	Wheat
Barley	Cinnamon	Dates	Hazelnuts	Mate	Peaches & nectarines	Rape & mustard seed	Sugarcane	Yams



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13 March 2017



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United States joins pioneering plant genetic resources treaty

Number of countries participating in Treaty on Plant Genetic Resources for Food and Agriculture grows to 143



<http://www.fao.org/news/story/en/item/522714/icode/> 13 March 2017

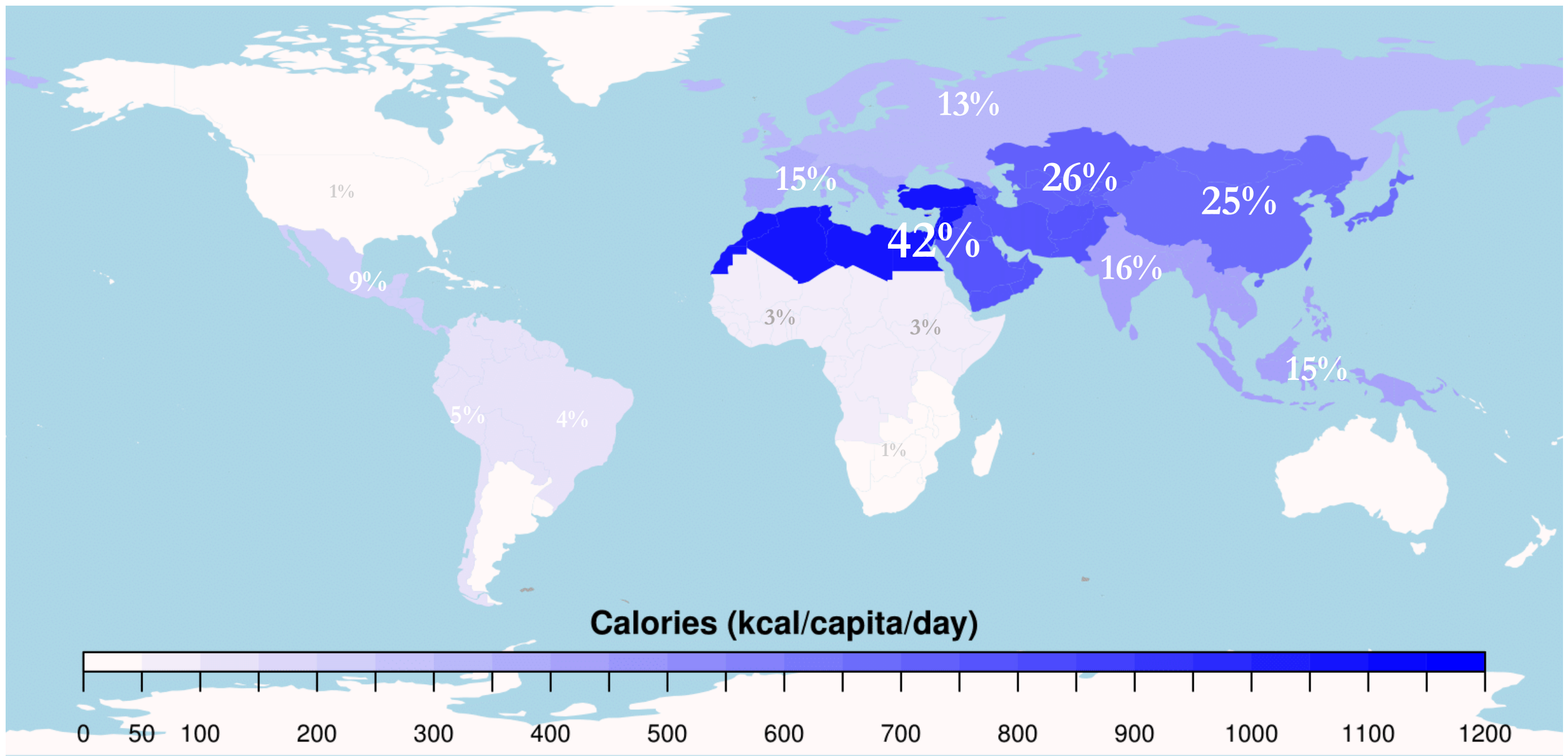
Learn more

- [International Treaty on Plant Genetic Resources for Food and Agriculture](#)
- [More on genetic resources for food and agriculture](#)
- [FAO's work on seed and plant genetic resources](#)



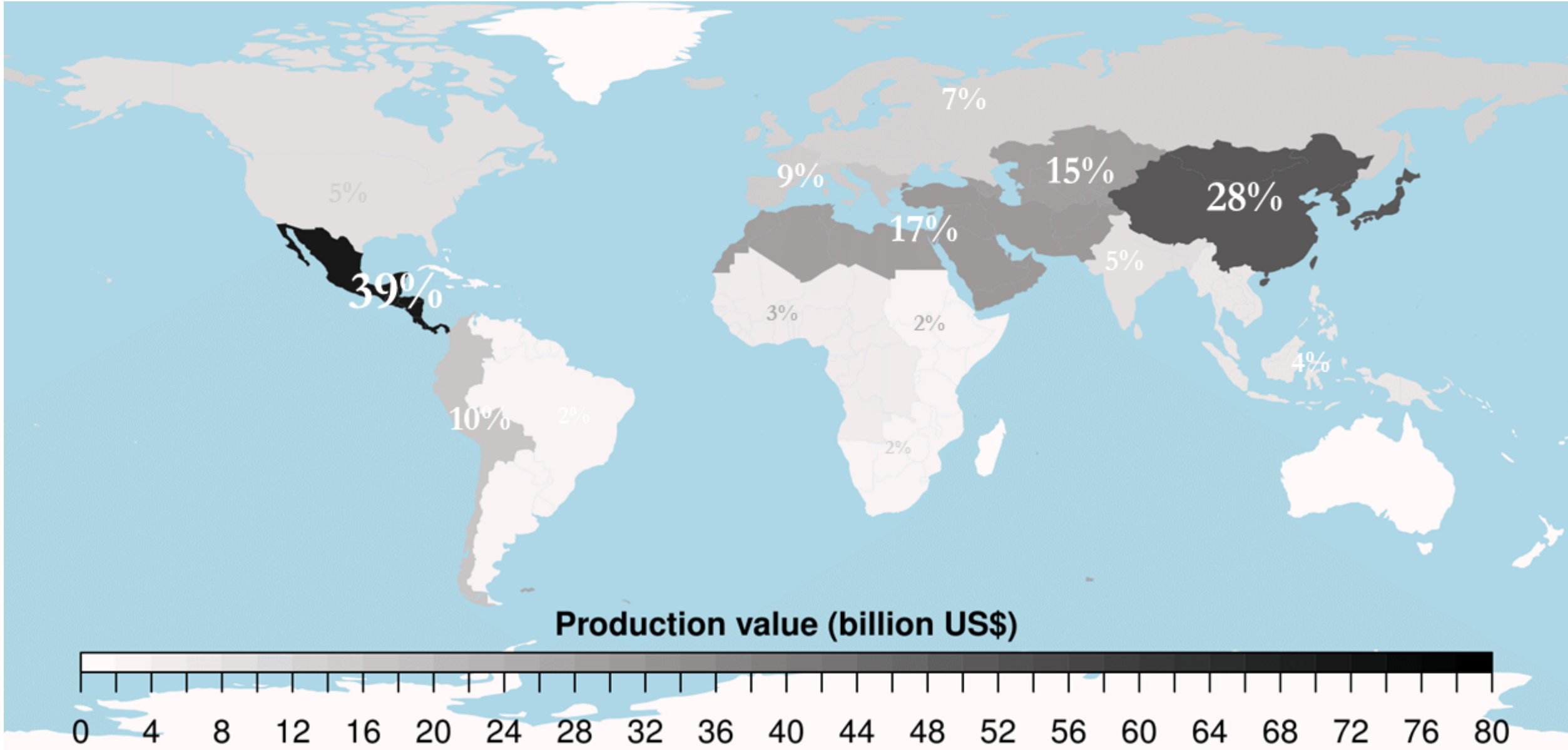
A lab technician at an FAO-

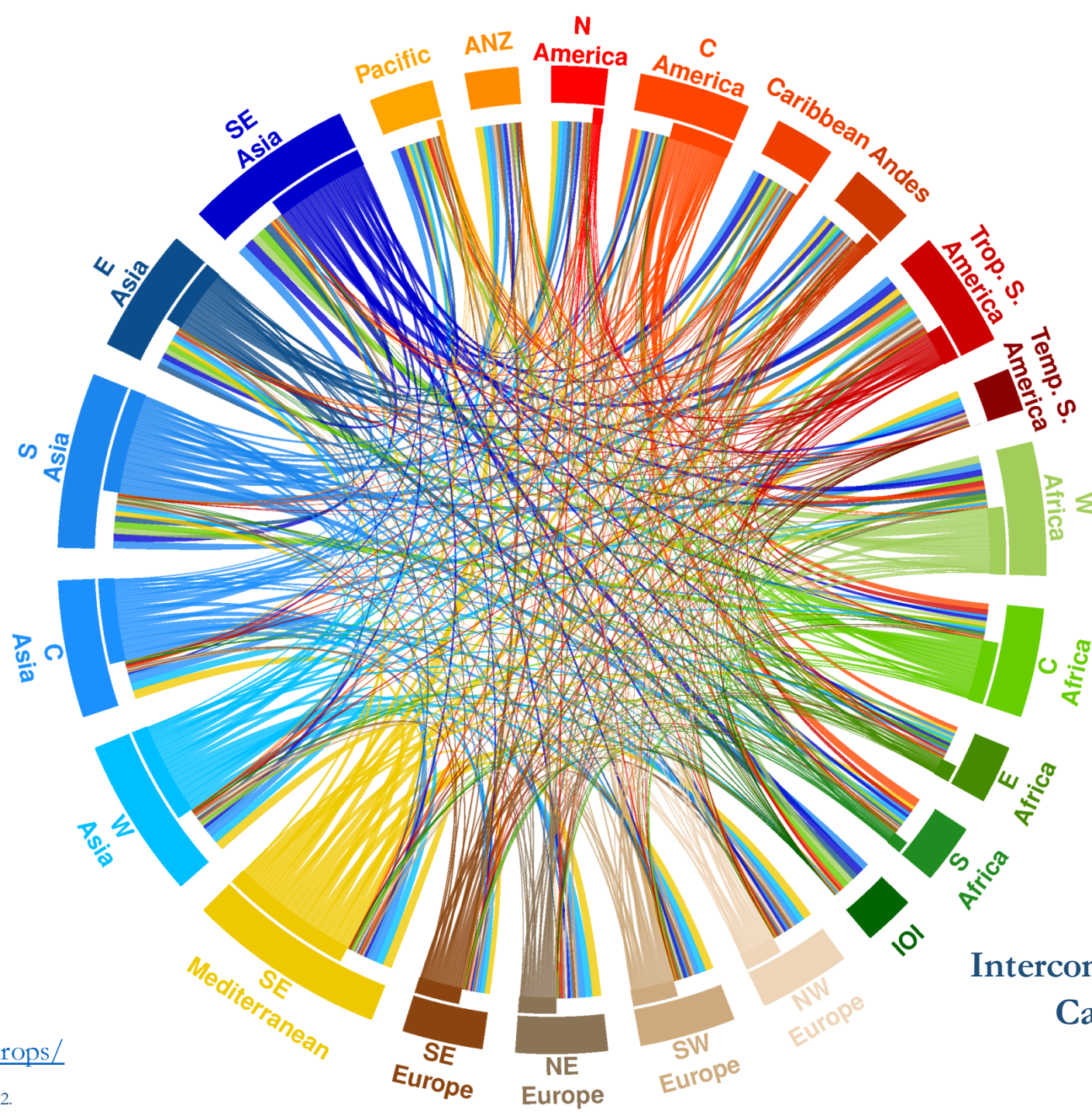
Geographic origins of the average U.S. diet (food supply from plants)



Khoury *et al.* (2016). *Proc. Royal. Soc. B* 283(1832): 20160792.

Geographic origins of U.S. agricultural production of crops





Interconnectedness
Calories

International agricultural research priorities



The Changing Composition of the Global Diet: Implications for CGIAR Research

Colin K. Khoury and Andy Jarvis

In the five decades during which CGIAR has worked to reduce poverty and hunger through agricultural research, very substantial changes have occurred in human diets worldwide and in the production systems that sustain them. National diets around the world have become increasingly similar, gaining in calories, protein, and fat, as animal-derived foods and high-calorie plant foods (oils and sugars) have risen in importance. The proportion of diets consisting of major cereals and oil crops has increased, while regionally and locally important cereals, root crops, and oil crops have generally become further marginalized. Developing countries show the most significant shifts in diets over this period.

These changes have been driven by globalization, urbanization, and economic development, including agricultural research. While this "nutrition transition" has enhanced food security by making macronutrients more readily available worldwide, it has had mixed effects on micronutrient sufficiency, and the over-consumption of macronutrients has contributed to a global surge in diet-related non-communicable diseases. Dietary change is also linked with greater homogeneity in farmers' fields and the associated commodity trading systems, thus heightening concerns about genetic vulnerability to biotic and abiotic stresses as well as food system vulnerability to climatic and political instability. This policy brief provides an overview of the key results from a recent study published by the International Center for Tropical Agriculture (CIAT) and CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) (Khoury et al., 2014), which has important implications for CGIAR research priorities.

Key messages

- The results of a recent CIAT/CCAFS study reveal three major trends in the roles that various crop species play in global diets: (1) a steady increase in the importance of major cereals, (2) the growing importance of oil crops, and (3) a decline in regionally important crops.
- CGIAR research on three global staples – wheat, rice and maize – continues to be critical because of their increasing importance for the global food system.
- The rising global significance of oil crops creates new opportunities to benefit farmers in parts of the developing world but also poses major agro-ecological challenges.
- Increased investment in developing and promoting nutrient-rich, stress-tolerant varieties of crops that are becoming relatively marginalized (e.g., sorghum, millets, cassava, and yams) offers a means to diversify the global food system and enhance long-term food security.
- Agricultural research should pursue a systems approach aimed at enhancing the nutrition of an increasingly urban world population, while conserving natural resources.

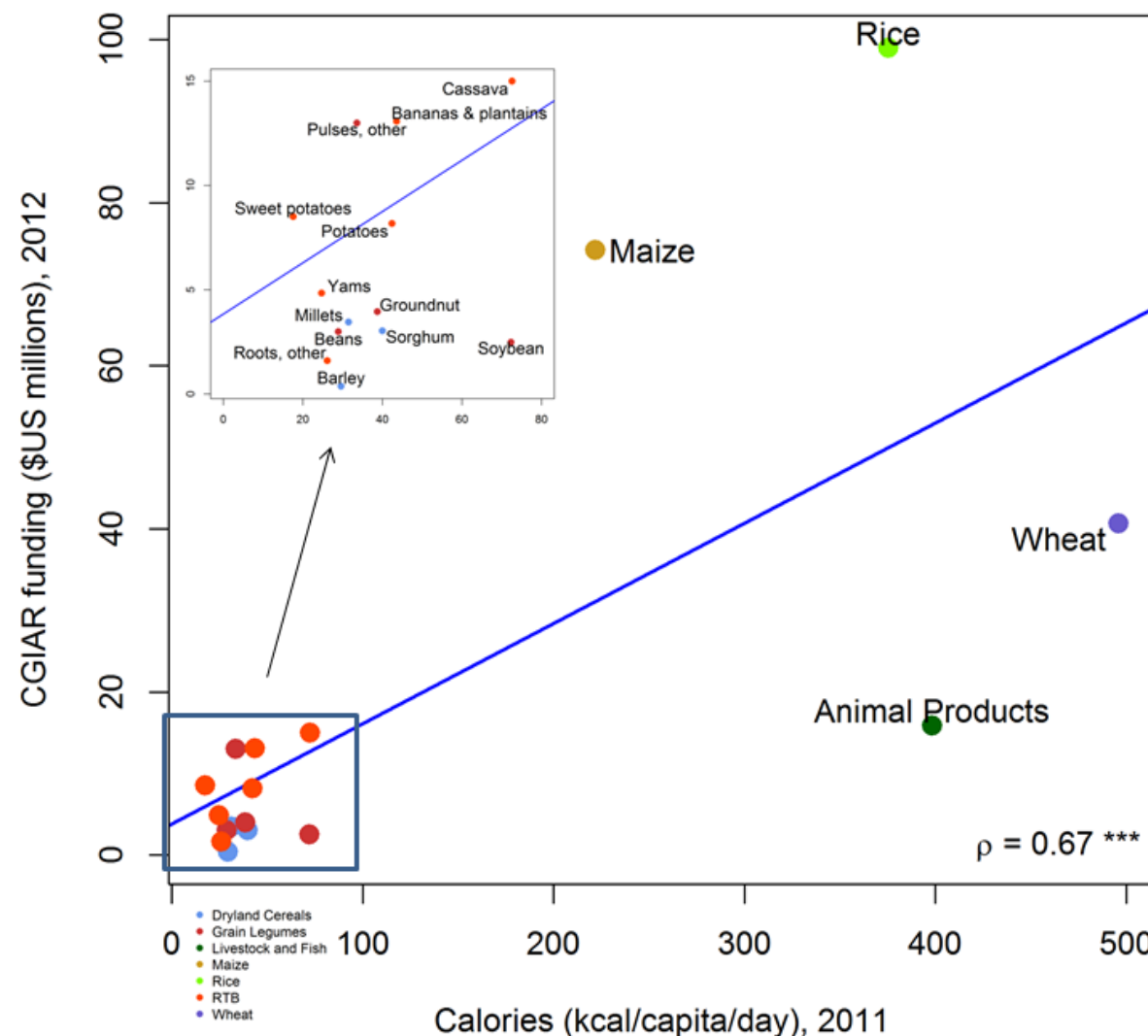
Since the creation of CGIAR, global diets have undergone significant changes, which are reflected in three main crop trends:

- The major cereals – wheat, rice, and maize – remain primary calorie and protein sources for the developing countries of Africa, Asia, and Latin America and the Caribbean. These crops have gained importance in diets outside their regions of origin, and their overall relative contribution to diets in developing countries has gradually expanded.
- A number of oil crops have emerged from relatively minor positions to assume very significant roles as sources of calories and fat worldwide. Soybean and oil palm in particular have figured importantly in plant oil commodity development, providing the world with cheap cooking oil, which otherwise may have come from animal food products.

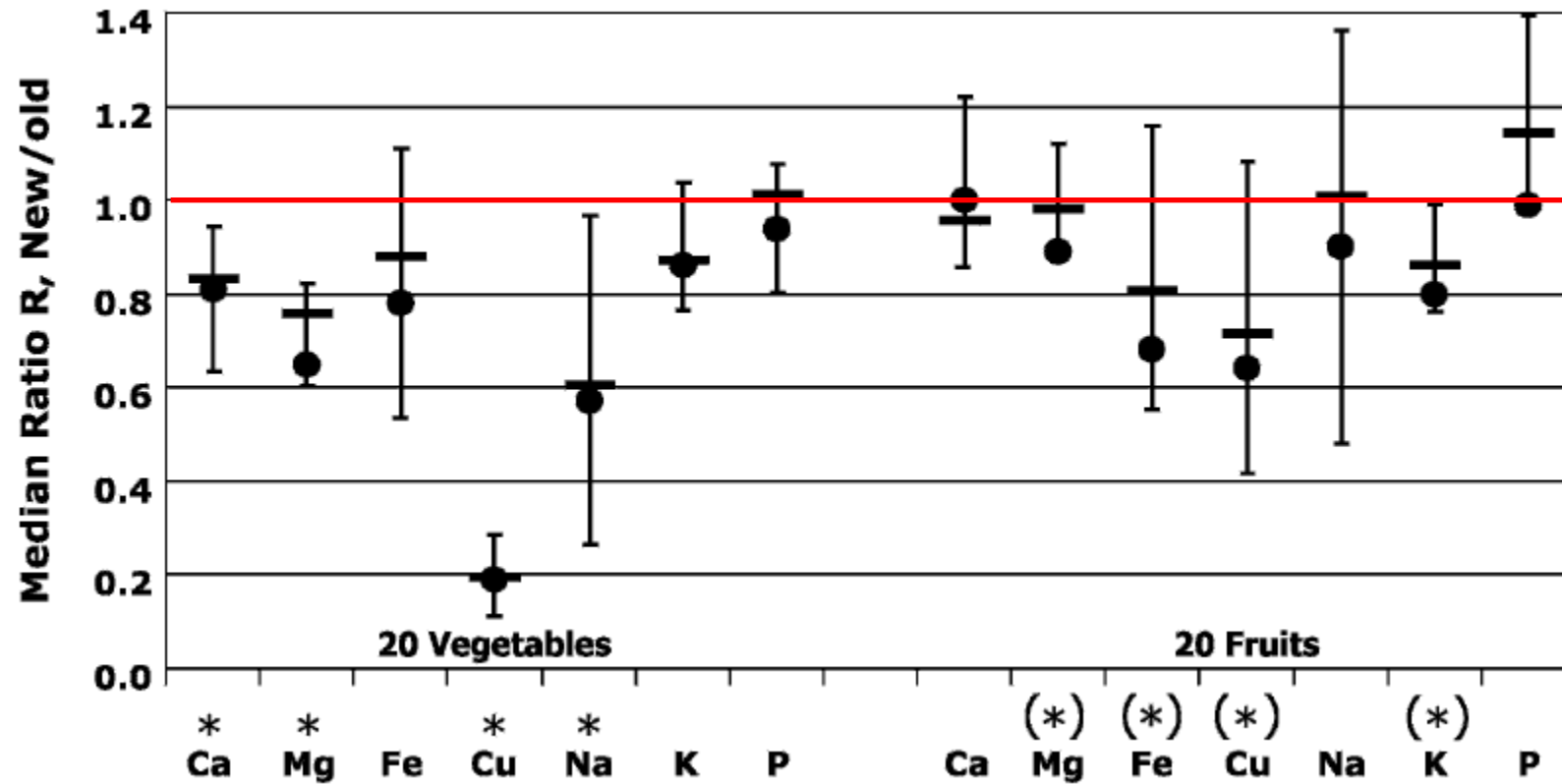
- Regionally important cereals, root crops, and oil crops have either remained static or declined in relative importance as sources of calories, protein, and/or fat in national diets. Crops such as sorghum, millets, sweet potato, cassava, yam, bananas and plantains, beans, Old World pulses, coconut, and groundnut, while in some cases expanding into new regions, have as a whole played reduced roles in global diets during recent decades, as major cereal and oil crops have increased in significance.

What are the implications of these changes in global diets for CGIAR research? Are the current mandate crops still relevant for alleviating poverty? Is CGIAR neglecting non-mandate crops that are important for improving diets and incomes, particularly as developing countries urbanize? Which crops should receive primary emphasis in research, as policy makers seek to promote healthier and more sustainable food systems?

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When life gives you lemons



Pomelo (*Citrus maxima*) - SE Asia

X



Mandarin (*Citrus reticulata*) - SE Asia

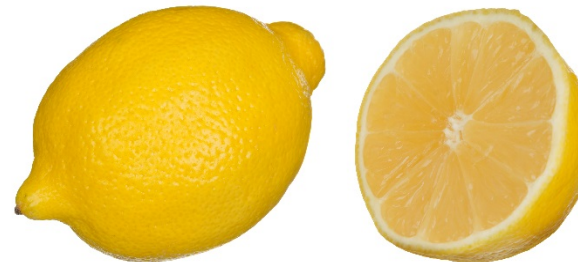


Bitter orange (*Citrus aurantium*) China

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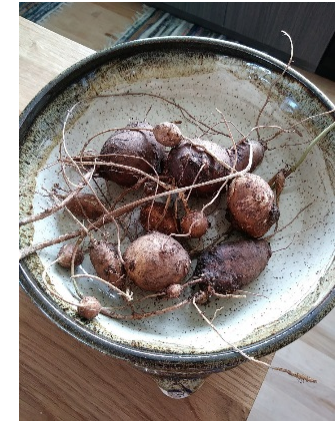
Citron (*Citrus medica*) India



Lemon (*Citrus limon*) China? India?

Thank you!

Colin Khoury - c.khoury@cgiar.org colin.khoury@ars.usda.gov



- Greene, Williams, **Khoury et al.** (2018) *North American Crop Wild Relatives: Volume 1: Conservation Strategies and Volume 2: Important Species*. Springer. In press.
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- Castañeda-Álvarez and **Khoury et al.** (2016) Global conservation priorities for crop wild relatives. *Nature Plants* 2(4): 16022.
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- **Khoury et al.** (2015). Crop wild relatives of pigeonpea [*Cajanus cajan* (L.) Millsp.]: distributions, *ex situ* conservation status, and potential genetic resources for abiotic stress tolerance. *Biological Conservation* 184: 259-270.
- **Khoury et al.** (2015). Distributions, *ex situ* conservation priorities, and genetic resource potential of crop wild relatives of sweetpotato [*Ipomoea batatas* (L.) Lam., *I. series Batatas*]. *Frontiers in Plant Science* 6: 251.
- **Khoury et al.** (2014) Increasing homogeneity in global food supplies and the implications for food security. *PNAS* 111(11): 4001-4006.
- **Khoury & Jarvis** (2014) The Changing Composition of the Global Diet: Implications for CGIAR Research. CIAT Policy Brief No. 18. Centro Internacional de Agricultura Tropical. 6 p.
- **Khoury et al.** (2013) An inventory of crop wild relatives of the United States. *Crop Science* 53(4): 1496.