ICARDA
Science for resilient livelihoods in dry areas

Pulses for Healthy Gut - Gut Feeling or Logical Truth?

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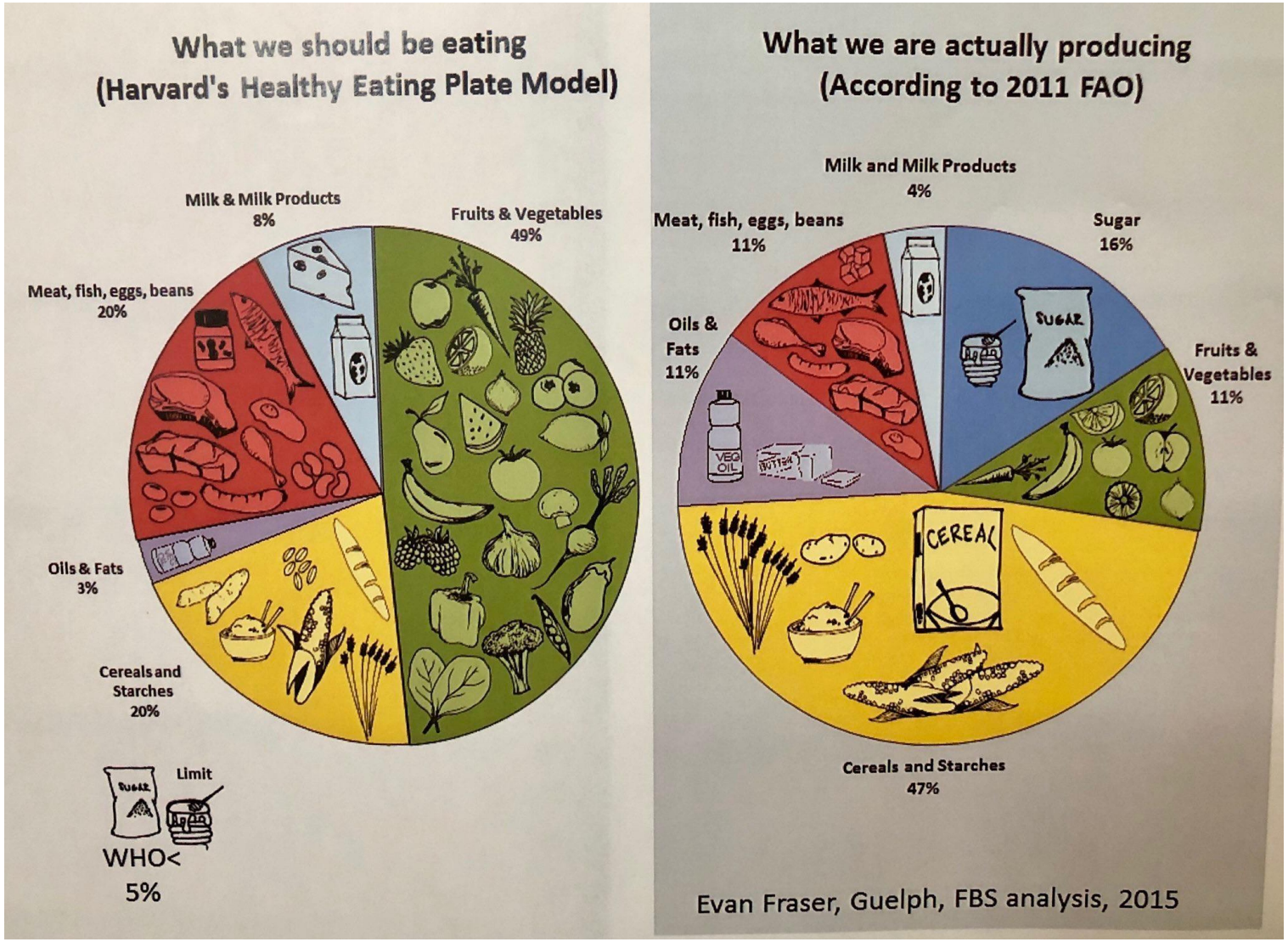
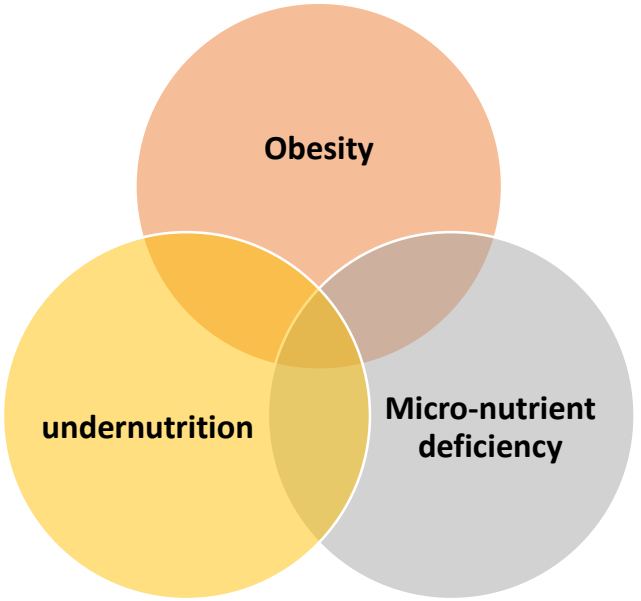
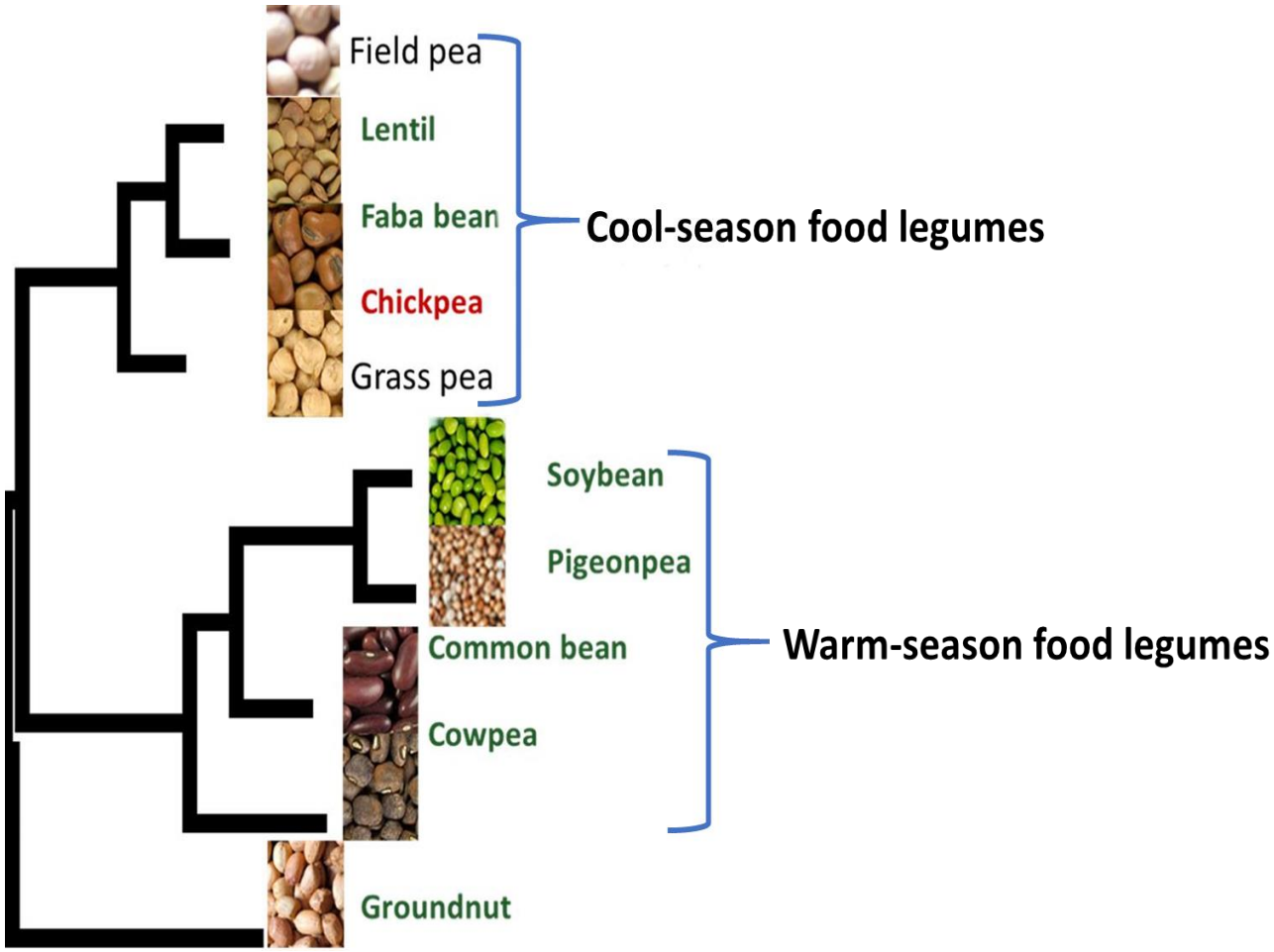
Ideal Consumption vs Current Production

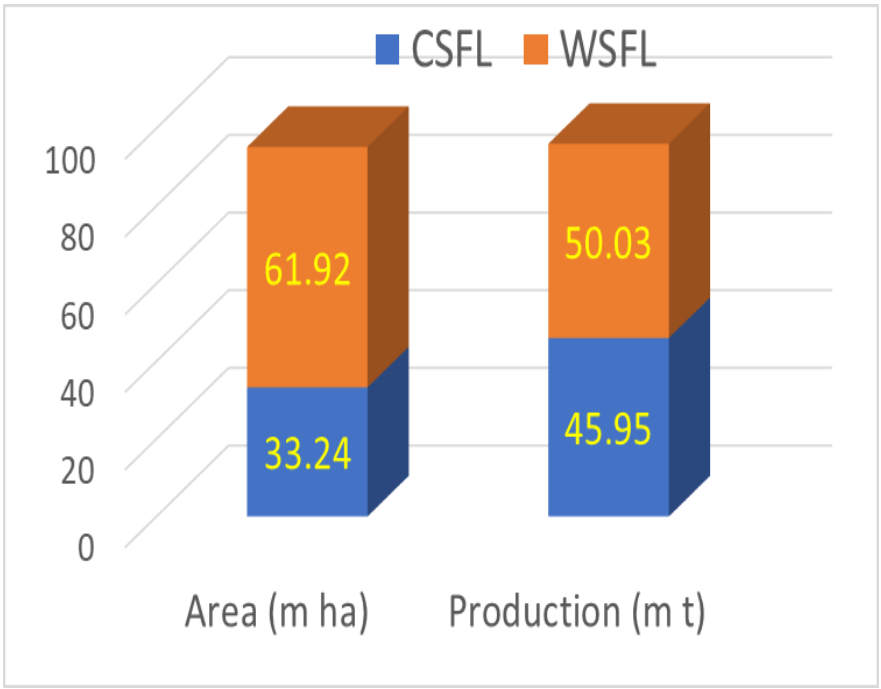


- 20% versus 11% in pulses
- **The present agri-food system - a part of triple burden of malnutrition and climate change problems**



Pulses - A Group of Diversified Climate Smart Crops

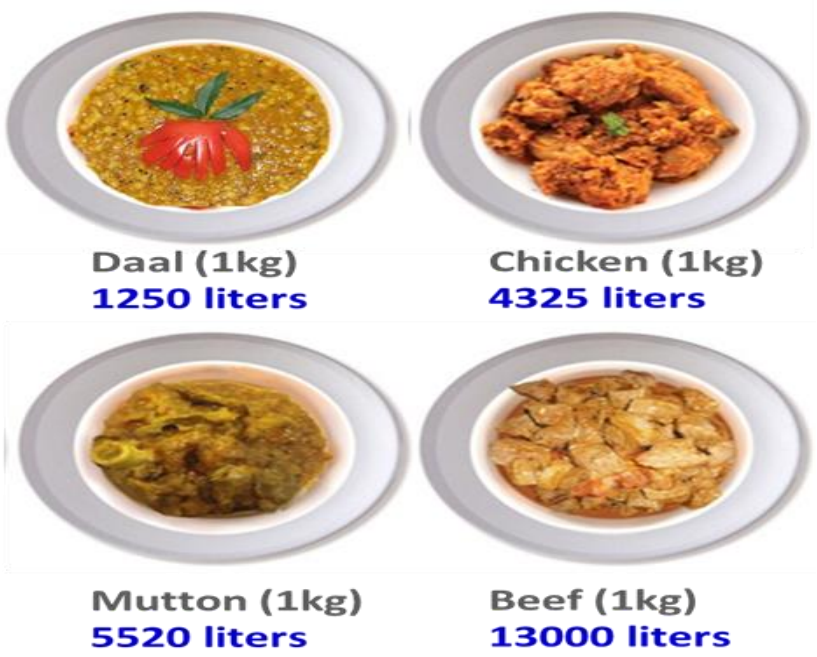




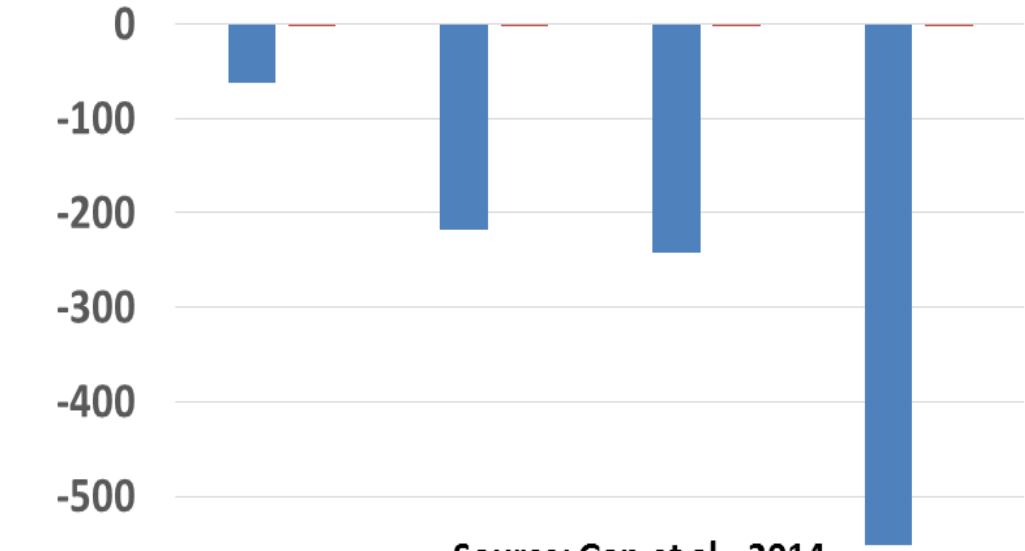
Pulses for Healthy Planet

- Fix 70-210 kg/ha atmospheric nitrogen
- 20-22 million tons N/year
- Lower C:N ratio (17) in pulses residue compared with oilseed (41) and wheat (32)

Lower Water Footprint



Negative Carbon Footprint

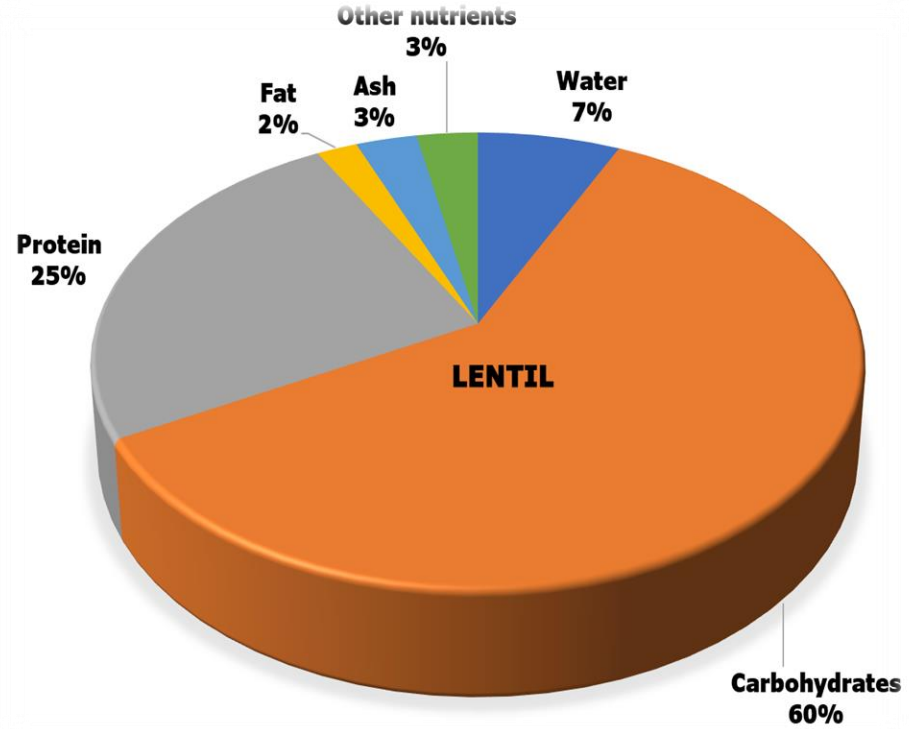


Source: Gan et al., 2014

	FFLxW	FWW	ContW	LentilW	
Per ha	-62	-218	-243	-552	CO_2 eq
Per kg	-0.027	-0.164	-0.151	-0.377	

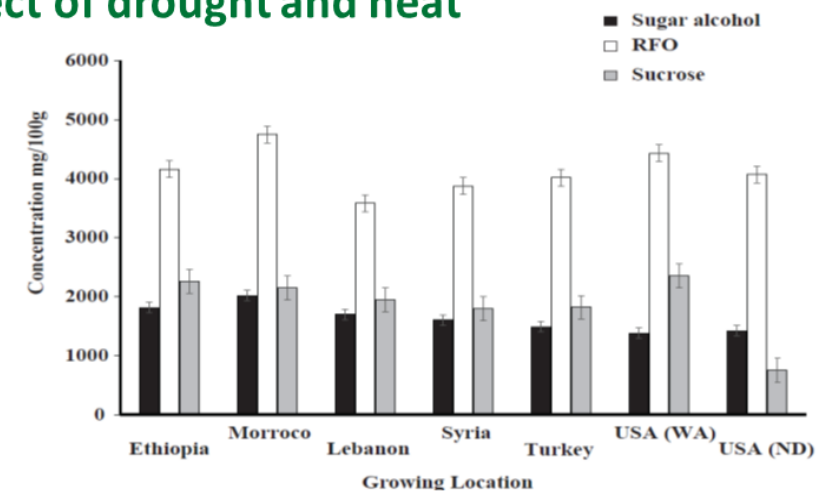
Pulses - A Rich Source of Nutrition

- 2-3 times more protein, micronutrients and **dietary fibres** than cereals
- Complementary amino acid profile

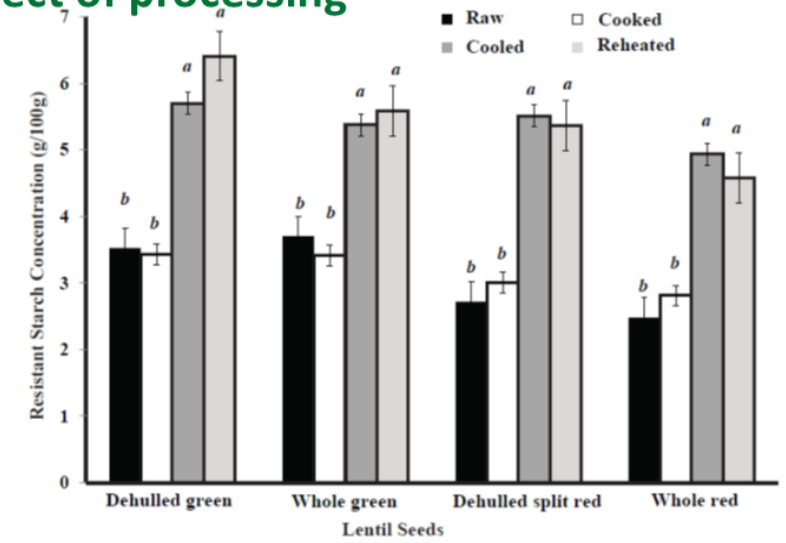


Prebiotic Carbohy
Sugar alcohols
Sorbitol
Mannitol
Total sugar alcoh
Raffinose family c
Stachoyse+Raffi
Verbascose
Total RFOs
Resistant Starch
Total prebiotic ca

Effect of drought and heat



Effect of processing



Can Pulses based Diet reduce Obesity?

- **Prebiotic carbohydrates**
  - **RFO**
  - **FOS**
  - **RS**
  - **Sugar alcohols**
  - **Other fibers**

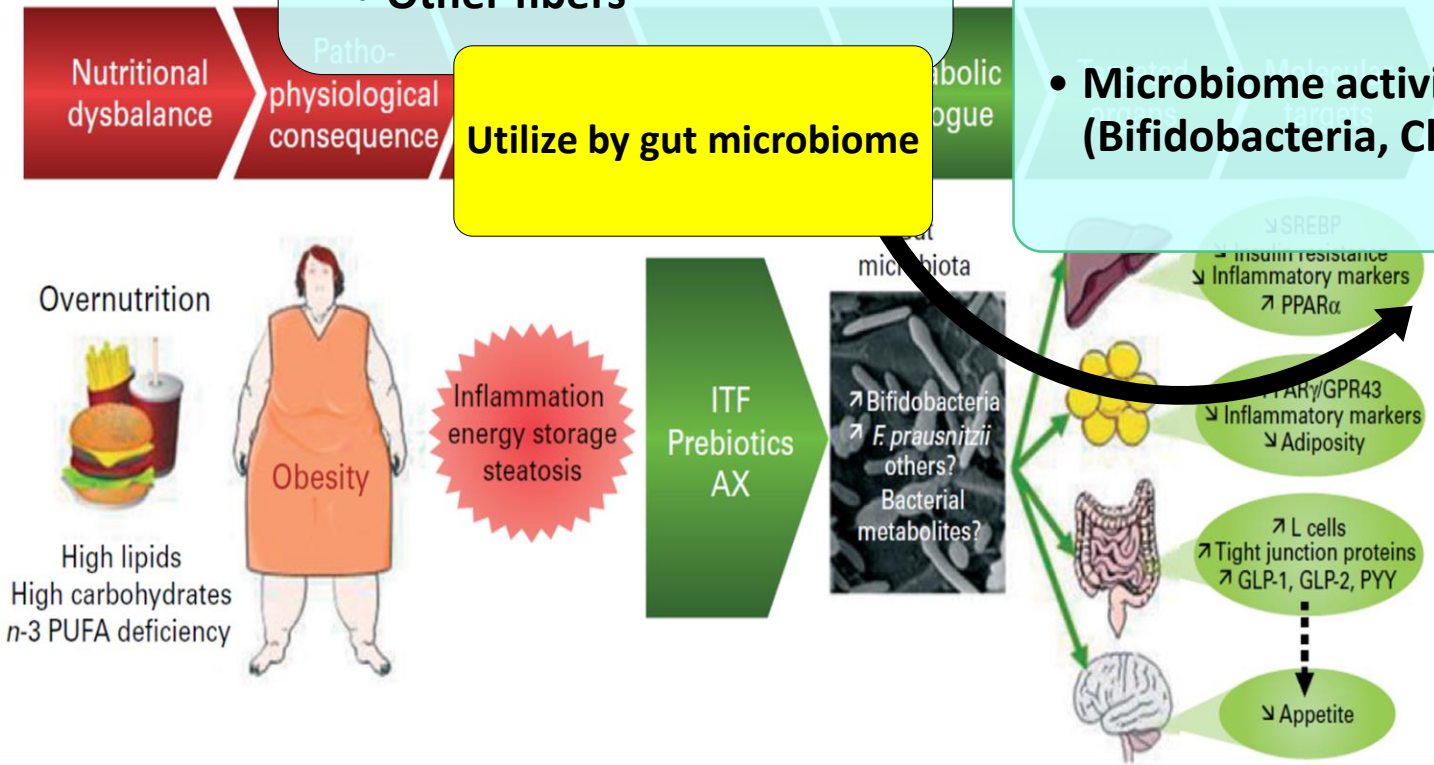
Utilize by gut microbiome

- **Microbiome activity will change (Bifidobacteria, Clostridium)**

Healthy gut microbiomes and GI tract activity

- **Changes in**
  - **Energy acquisition**
  - **Fat storage**
  - **Insulin resistance**
  - **Inflammatory state**

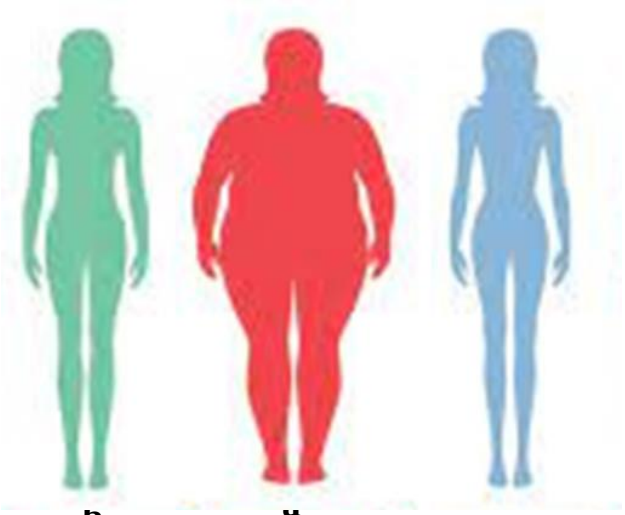
Obesity will be reduced

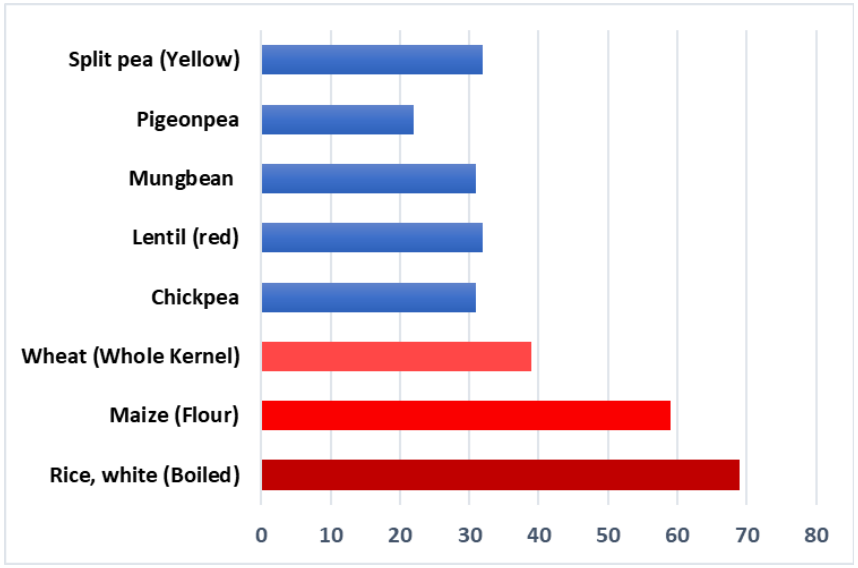


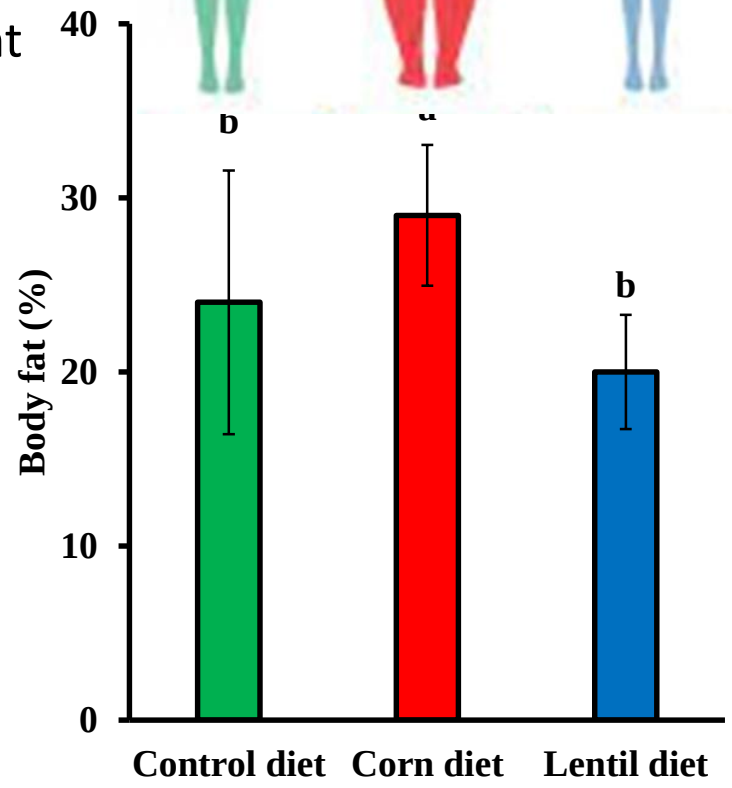
British Journal of Nutrition (2013), **109**, S81–S85

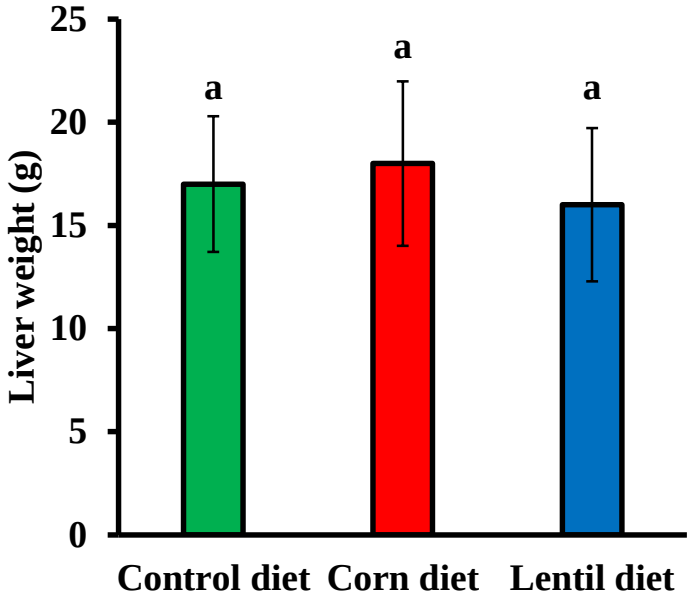
Pulses and Body Weight

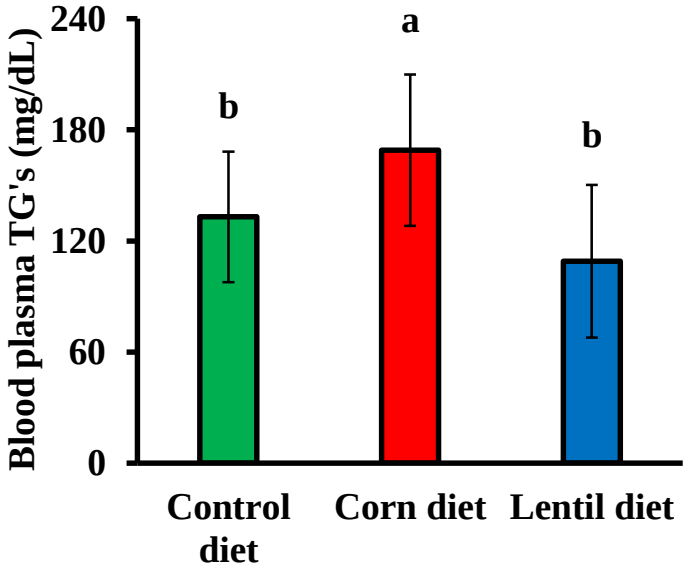
- Pulses rich diet reduces the risk of obesity - 3-fold increase in bacterial count
- Change in body composition (body fat, liver weight and blood plasma triglycerides)
- Low GI values ranging from 28-52 due to non-starch polysaccharides and resistant starch









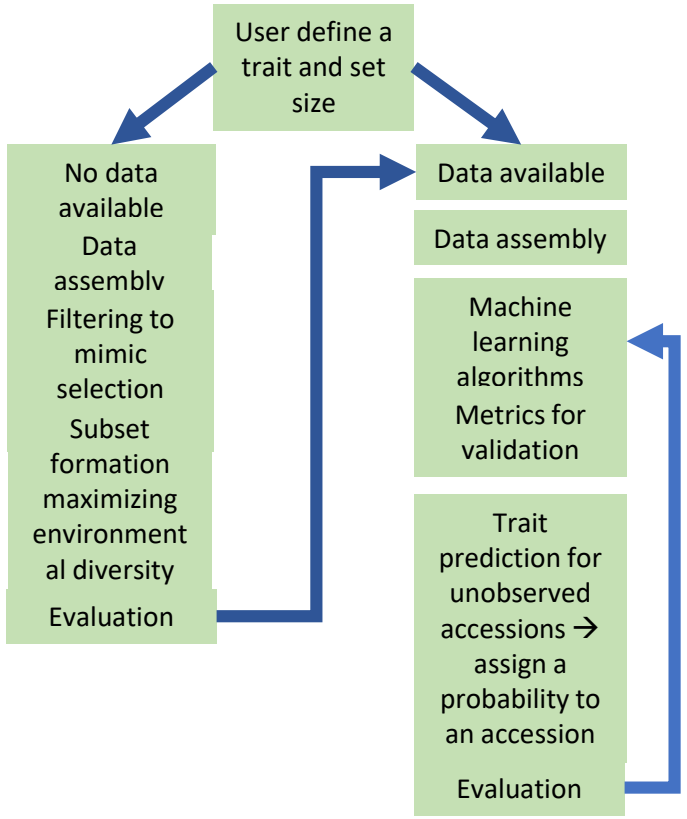


Efficient Mining and Use of Genetic Resources

Crop	No of accs.	Crop	No of accs.
Barley	30,225	***Pisum* spp.**	**6,131**
Bread wheat	15,088	***Trifolium* spp.**	**5,933**
Durum wheat	20,540	***Vicia* spp.**	**6,556**
Primitive wheat	1,214	**Faba bean**	**10,034**
Aegilops spp.	5,155	**Chickpea**	**15,195**
Wild *Triticum*	1871	**Lentil**	**13,980**
Wild *Hordeum*	2,563	**Wild *Cicer***	**554**
Other cereals	182	**Wild *Lens***	**617**
***Lathyrus* spp.**	**4,458**	Range & Pasture	7,404
***Medicago* spp**	**9,160**	Others	50
Total			**156,910**

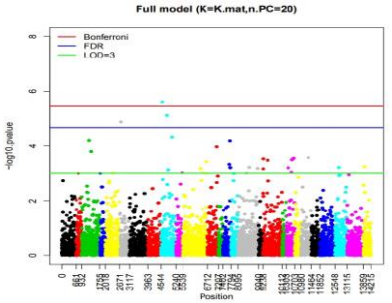
Large and unique collections rich in landraces and wild relatives for ICARDA crops

Use of Focused Identification of Germplasm (FIGS) for selecting best bet subsets



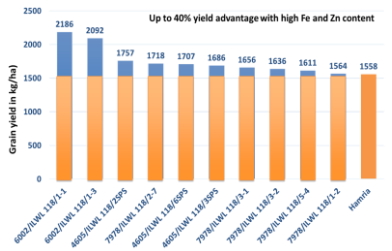
Fourier-transform infrared spectroscopy (FTIR)

Precision phenotyping for sought traits



Genotyping for allelic variation

Pre-breeding using wild relatives

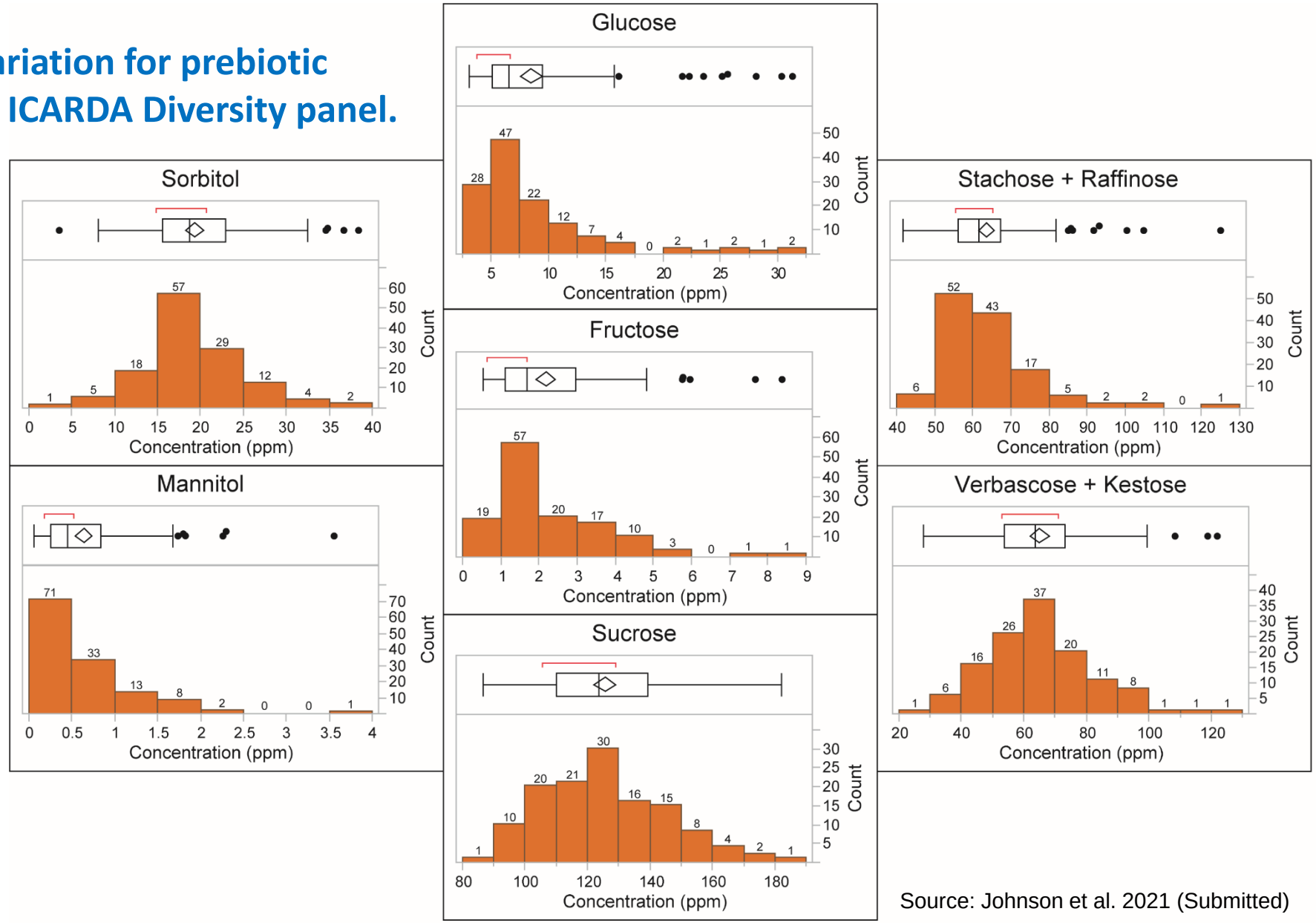


Derived lines performance

Breeding for Prebiotic Carbohydrates

- **Significant genetic variation for prebiotic carbohydrates in the ICARDA Diversity panel.**

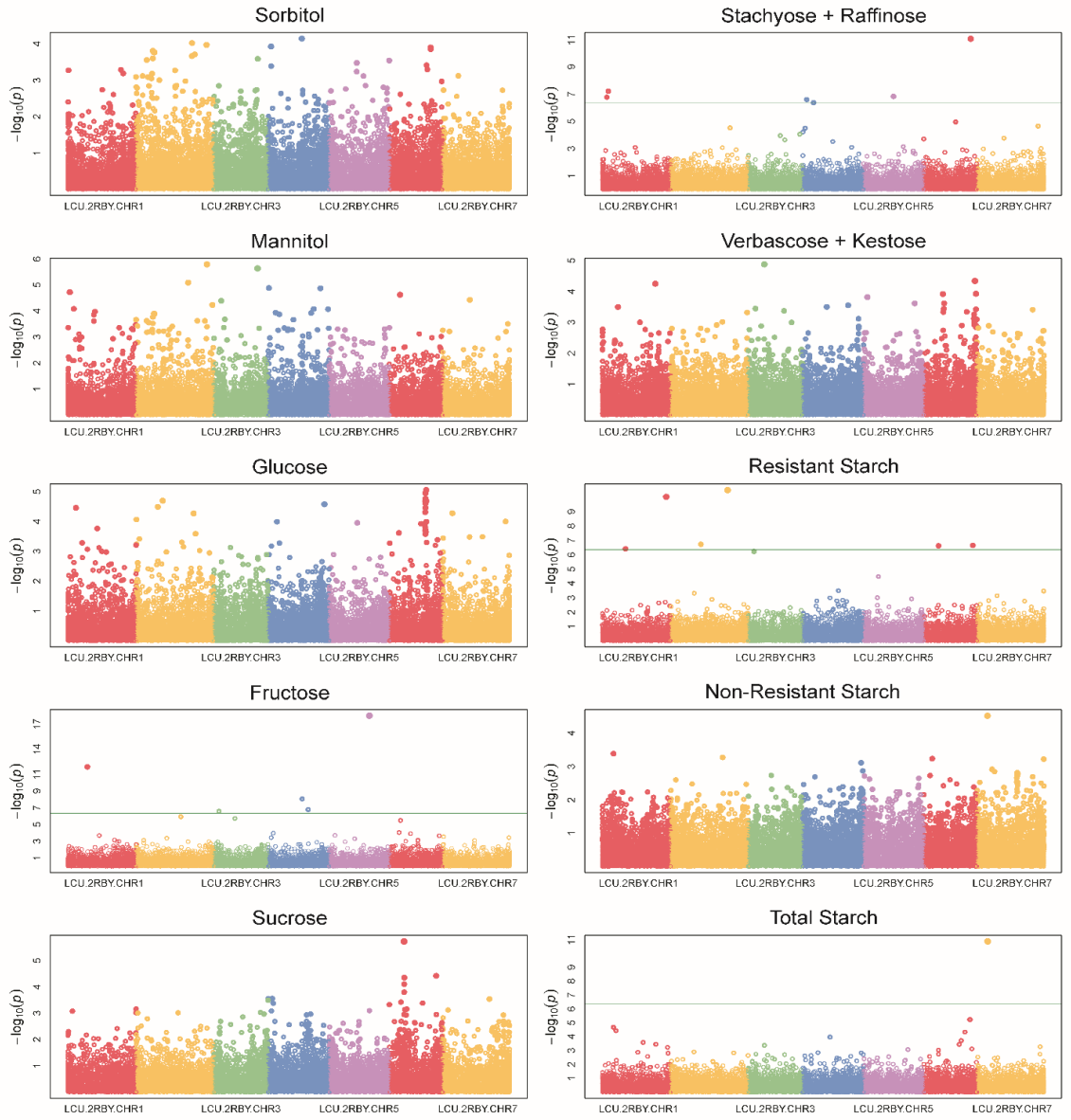
- **2-9% of RDA for Sugar alcohols, 7-31% RFOs, 51-111% RS, and 57-116% total prebiotic carbohydrates**



Source: Johnson et al. 2021 (Submitted)

GWAS for Prebiotic Carbohydrates in Lentil

- Heritability ranges 0.22 to 0.44.
- Significant SNPs and associated genes/QTLs identified.
- Potential of marker-assisted breeding for prebiotic carbohydrates

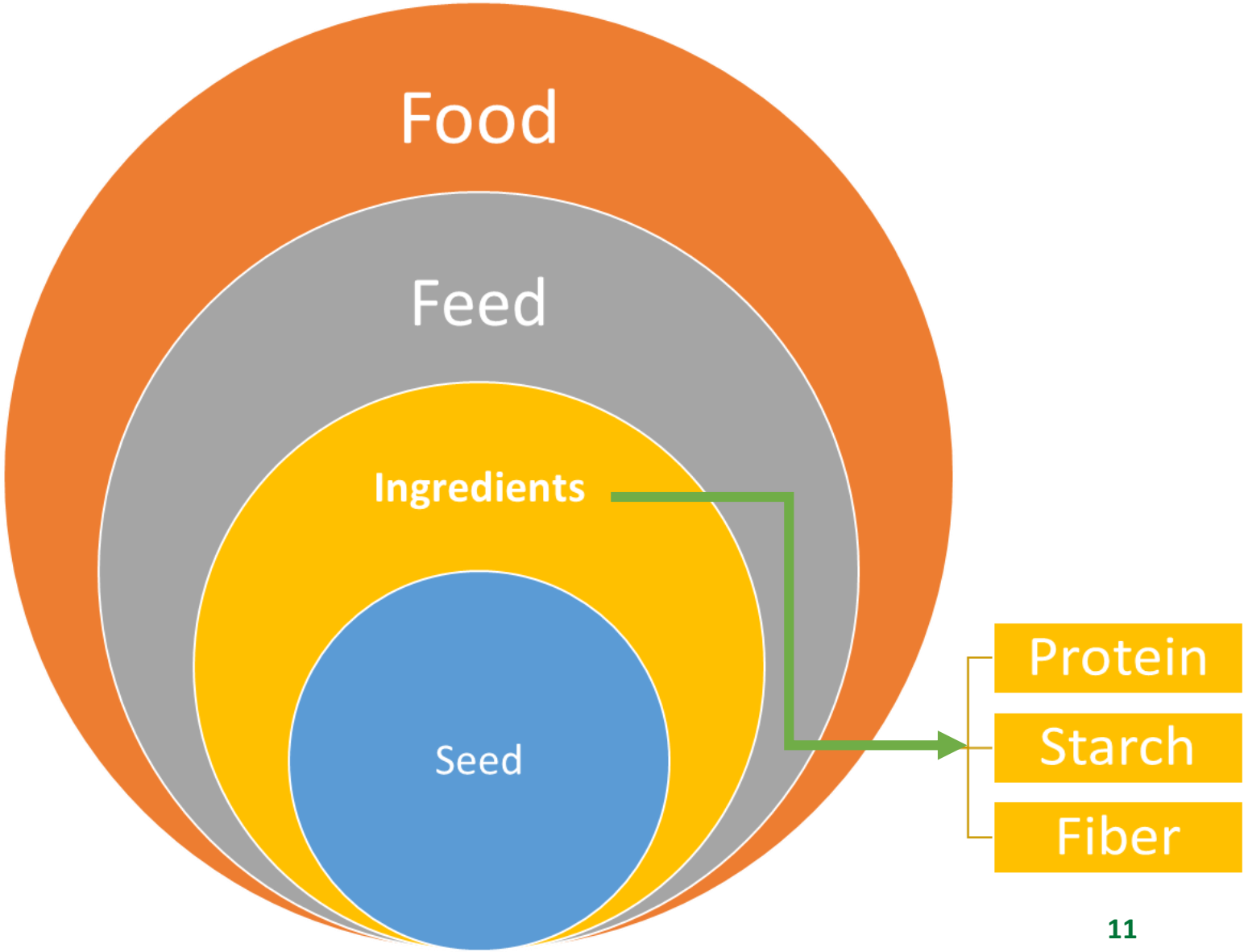


Source: Johnson et al. 2021 (Unpublished Data)

Global Pulse Markets

16% of the global production is included in the World trade

- Pulse ingredients market - USD 17.4 billion in 2018
- Projected to grow at a CAGR of 4.5%, to reach USD 21.6 billion by 2023



Thanks