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## *Faba beer?*

*Potential of faba bean starch as a brewing adjunct*

Graeme Walker, Jacopo Ianieri,  
Gabriele Palumbo & Martin Moench

Pete Iannetta & Philip White

Fergus Clark & Ken Duncan



Abertay  
University



Science connecting land and people



# Brewing adjuncts?



***Un-malted solids*** – flakes, grits, flour, purified starch

**Commonly:** corn, rice, rye, oats, barley, wheat, cassava, sorghum, millet, triticale

**Uncommon:** legumes - peas , soybeans, lentils

***Liquid adjuncts*** – sucrose syrups (can or beet), grain syrups (corn, rice, wheat),  
priming sugars : maple syrup, honey, molasses, caramel syrup for colour

# Brewing with legumes?



Not new!

- 18<sup>th</sup> Century – new tax laws meant that commercial UK brewing was restricted to malted barley, and brewing with legumes was therefore confined to home-brewing [Article 13 of the Act of Union between Scotland & England (1707) dealt with malt taxation]
- Now confined mainly to Japan (eg. Happoshu) & some European countries (eg. Cotta74)

Peas



Soybean



Lentils



# Faba beans – major agronomic benefits



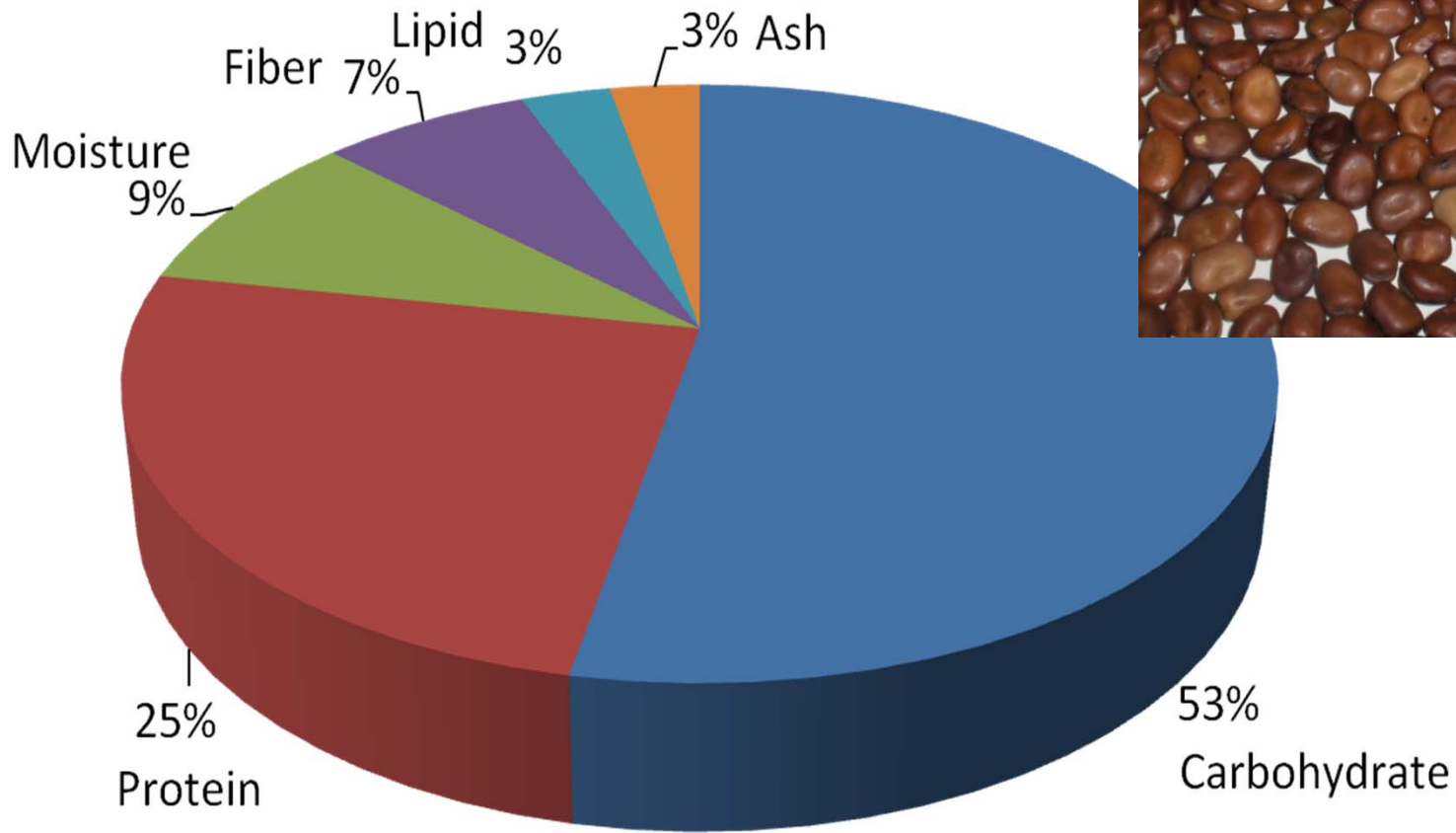
- ✓ Human nutrition (protein, low glycemic index)
- ✓ Decreased GHG emissions (less fertilizers)
- ✓ Decreased fossil energy use
- ✓ Increased C & N assimilation
- ✓ Decreased N losses (leaching / volatilisation)
- ✓ Increased soil fertility (N-fertiliser offset)
- ✓ Better soil structure/soil water retention
- ✓ Increased above and below ground diversity
- ✓ Increased provisions to pollinators/ other beneficial insects
- ✓ **Intercropping with cereals has high potential**



N-fixing root nodules

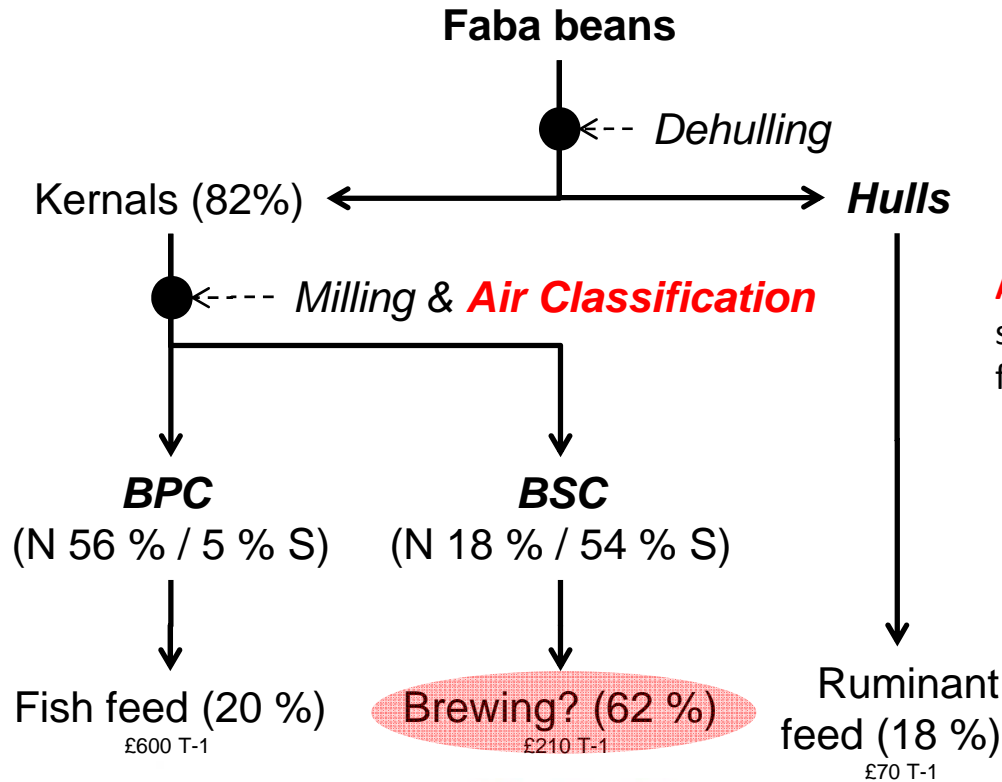


# Faba bean composition



# Faba bean fractionation

- ✓ Bean Protein Concentrate (BPC)
- ✓ Bean Starch Concentrate (BSC)
- ✓ Bean hulls



**Air Classification:** vertical cyclonic air stream separates large/heavy starch granules (that fall) from lighter protein bodies

[www.beans4feeds.net](http://www.beans4feeds.net)



Gavin Ramsay & Ali Karley (co-partners at JHI)



# Faba bean brewing trials

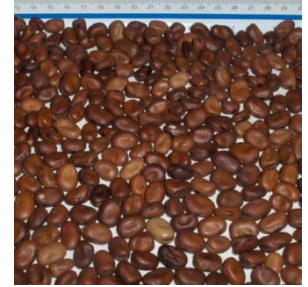


**Malt  
grist**

**Whole  
faba beans**

**Faba  
starch**

[+/- Amylolytic enzymes]



Different combinations

Mashing (65°C/1 hour)

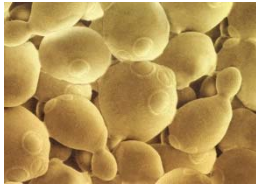
Sweet wort

Hops

Bitter wort

Fermentation

Conditioning

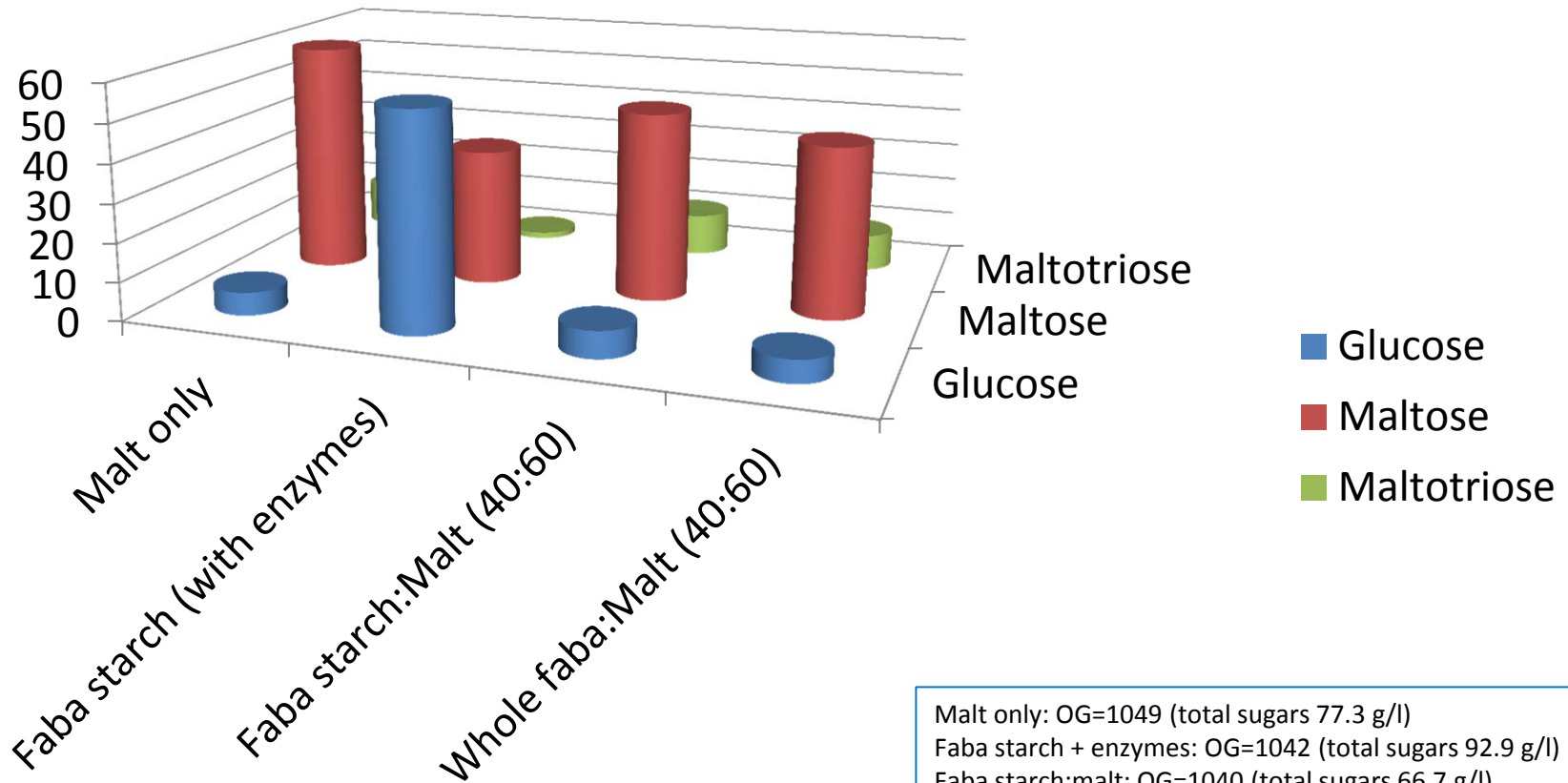


Brewing  
Yeast



**FABA BEER**

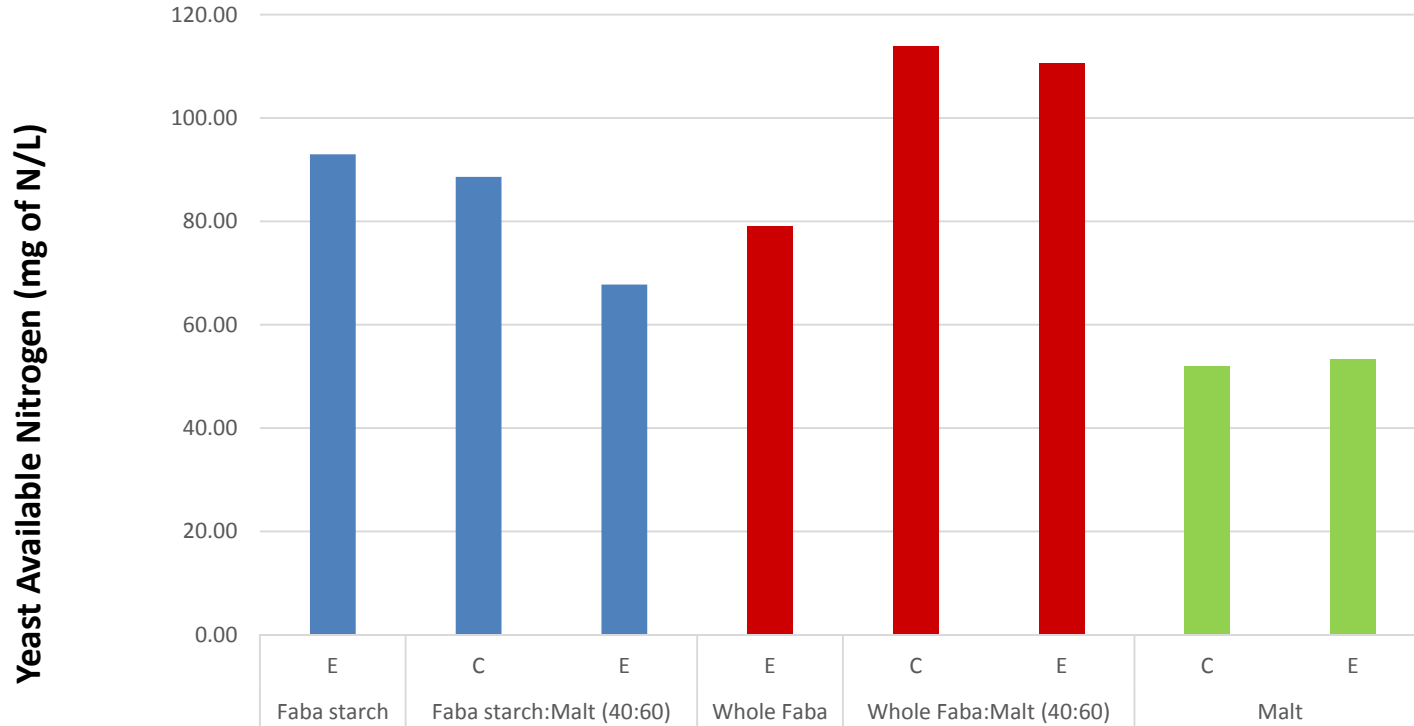
# Wort sugars from faba beans



Malt only: OG=1049 (total sugars 77.3 g/l)  
Faba starch + enzymes: OG=1042 (total sugars 92.9 g/l)  
Faba starch:malt; OG=1040 (total sugars 66.7 g/l)  
Whole faba:malt; OG=1035 (total sugars 59.2 g/l)



# Yeast *Available Nitrogen* in faba wort

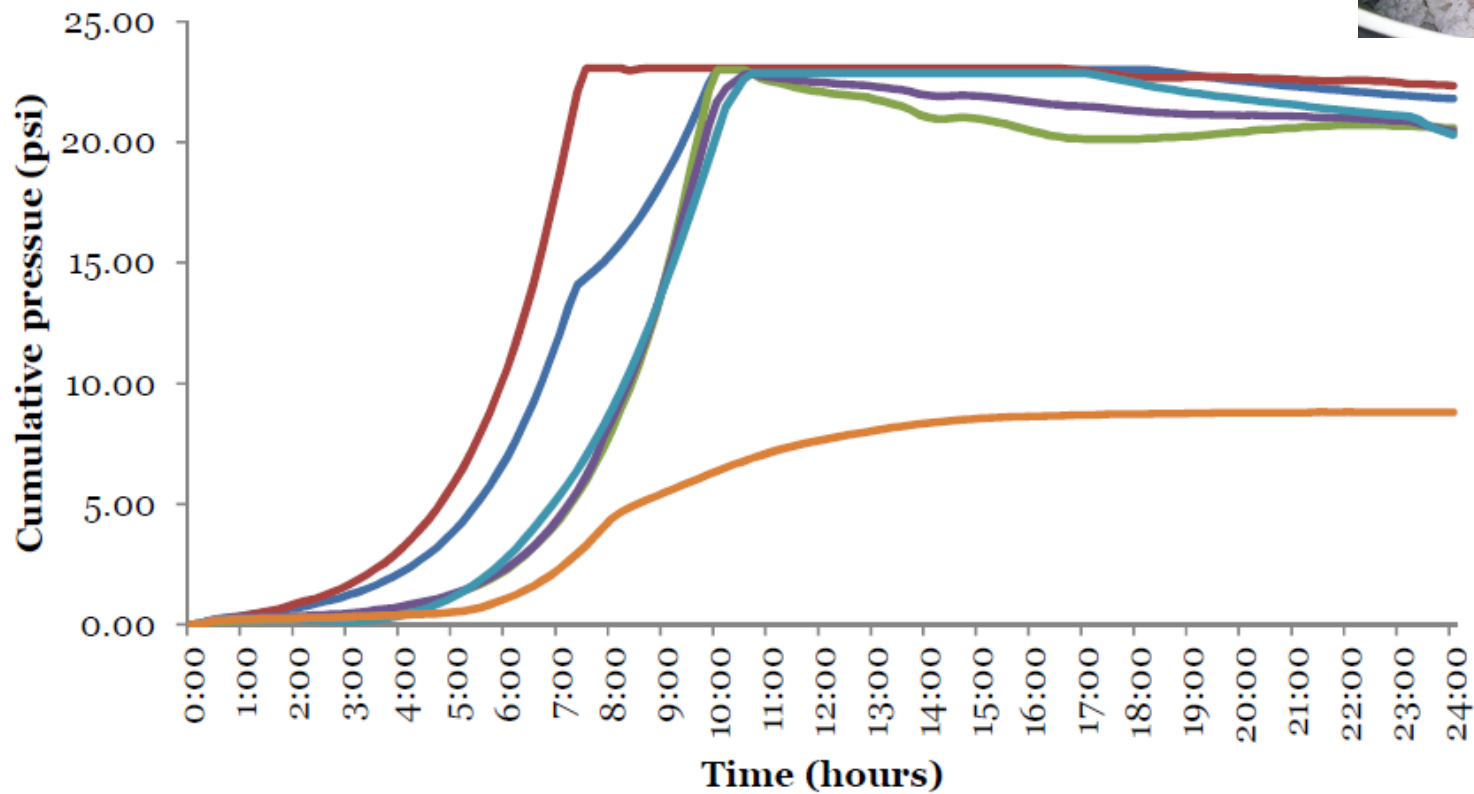


**C = Control mashing with malt**

**E = Mashing with enzymes (alpha-amylase and glucoamylase)**

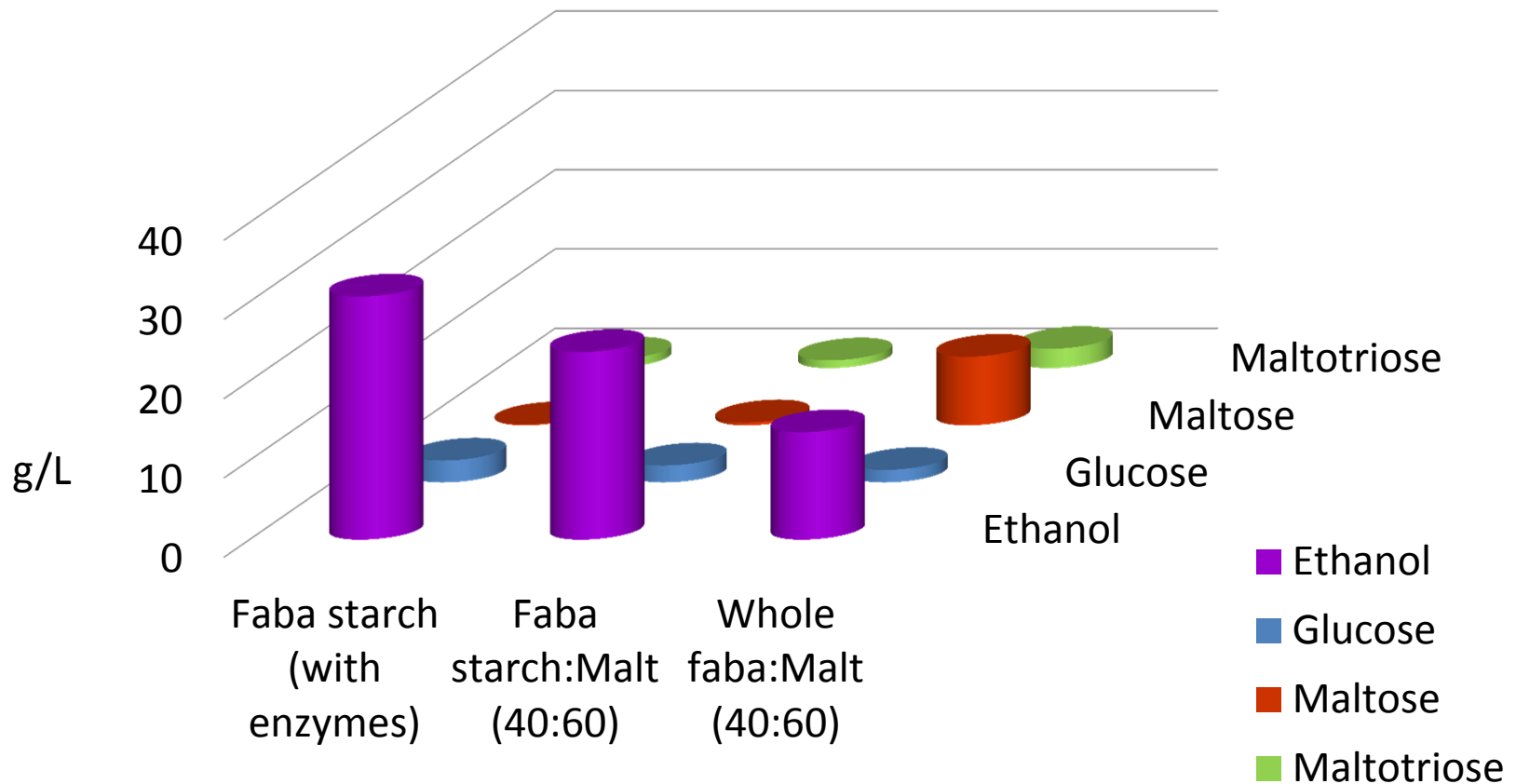
# Faba brewing fermentations

(CO<sub>2</sub> accumulation)

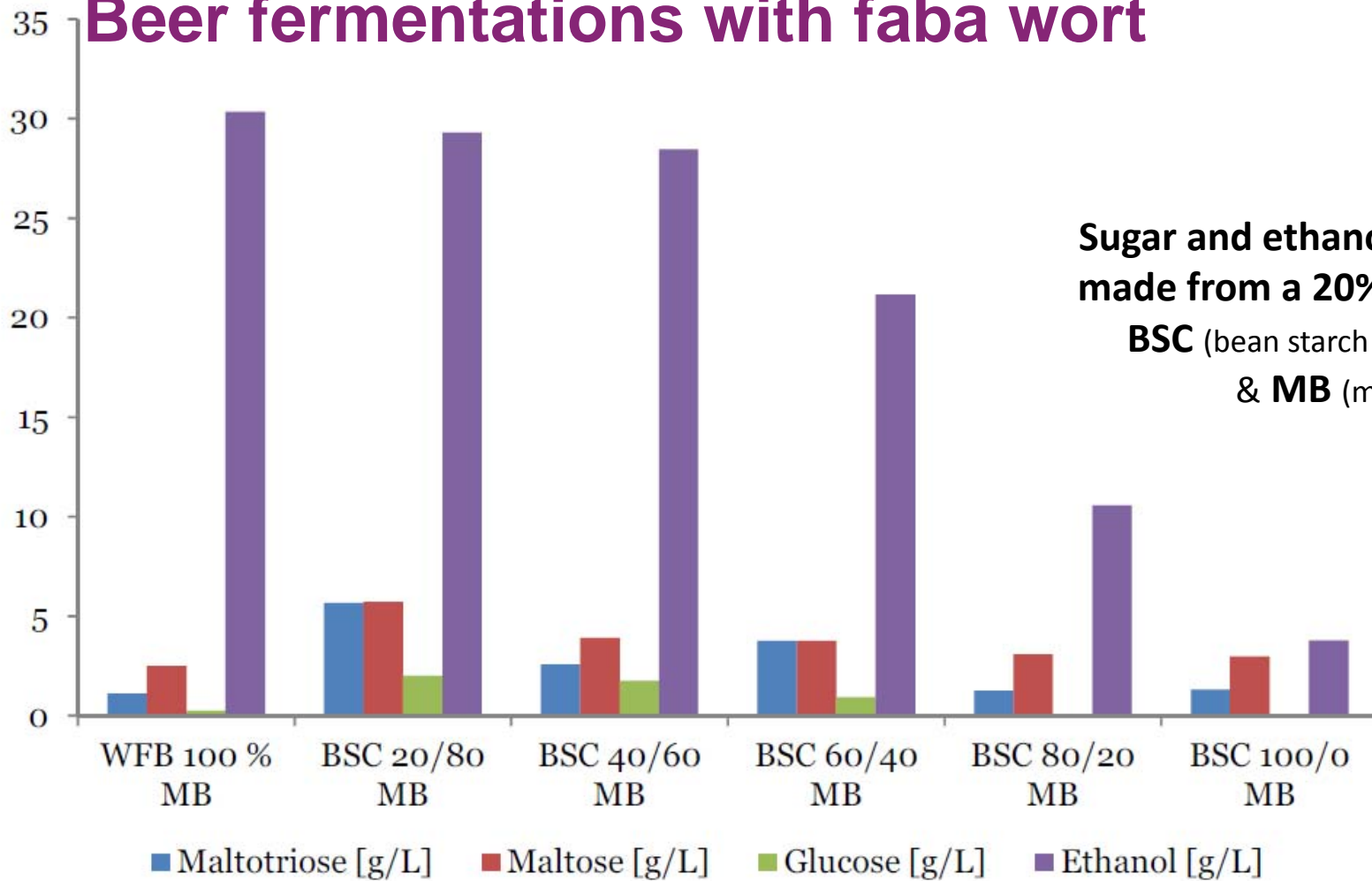


— 100 % MB      — WFB 20/80 MB      — WFB 40/60 MB  
— WFB 60/40 MB      — WFB 80/20 MB      — WFB 100/0 MB

# Ethanol & residual sugars from faba fermented wort



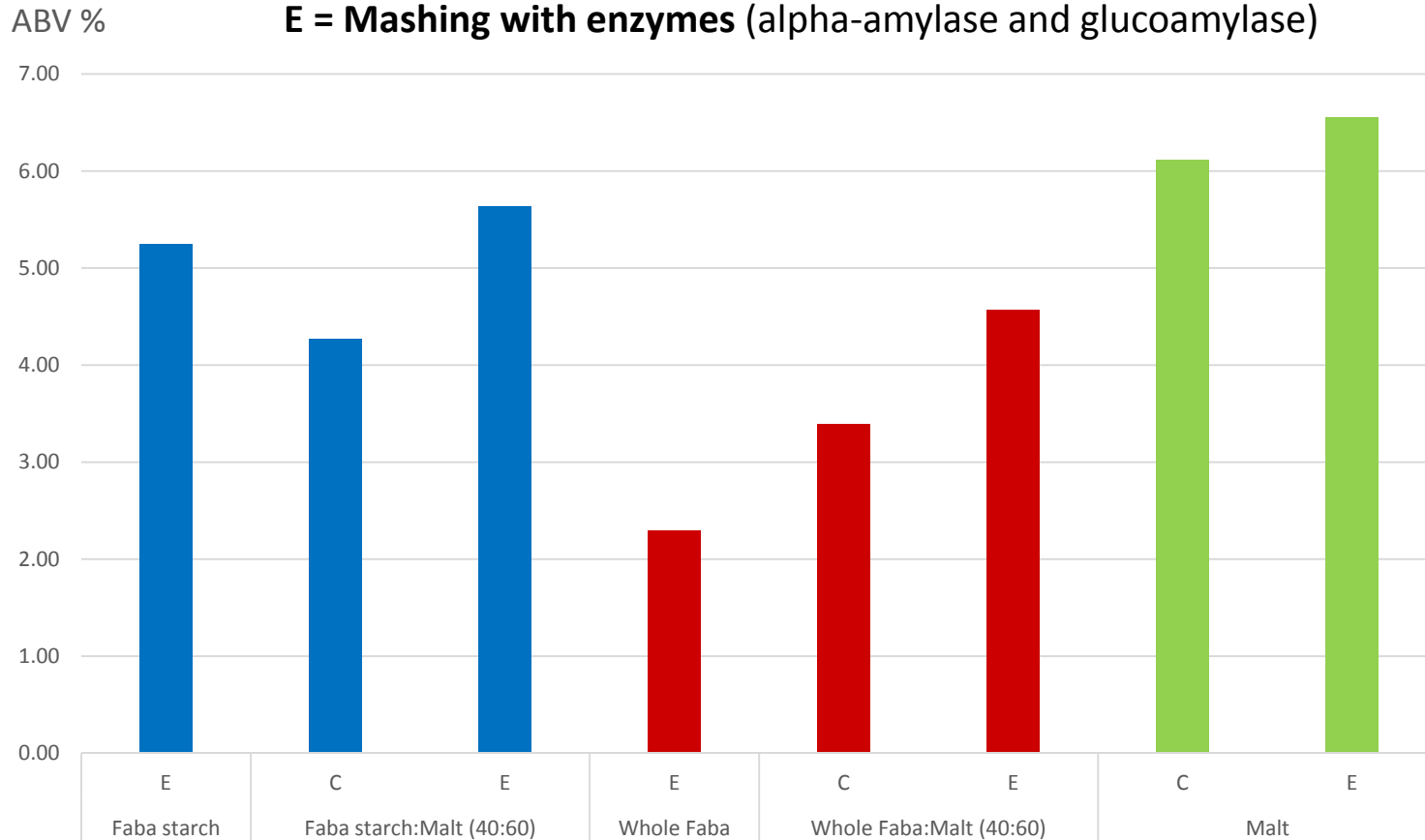
# Beer fermentations with faba wort



# ABV % in beers brewed with higher gravity faba wort

**C = Control mashing with malt**

**E = Mashing with enzymes (alpha-amylase and glucoamylase)**



# Conclusion – benefits of faba brewing

## Agronomic/Sustainability benefits

- There is varietal diversity among faba beans, and they grow widely
- Faba beans require no man-made fertilisers (N-fixing root nodules)
- Soil N left after legume harvest can be used by cereals, reducing fertiliser requirement
  - Planting faba beans in a rotation with wheat could reduce the fertiliser requirements by at least 60 kg N ha<sup>-1</sup> ]
  - Yield of the non-legume which follows faba bean in the rotation is increased – up to 25% higher!



## Brewing benefits



- Faba can provide useful FAN as well as fermentable sugars to brewers wort
- Legumes often have greater mineral contents (Ca, Mg, Zn) than cereals
  - may benefit fermentation (& beer quality)
- Faba/malt beer has no flavour defects, has good head retention
- Brewing with faba can expand beer diversity



# Acknowledgements



Abertay  
University



The James  
Hutton  
Institute

*Science connecting land and people*



The Institute of Brewing & Distilling  
Scottish Section



# *Thank you!*