

Effect of species choice, species proportions and sowing patterns of cereal–legume intercrops on weed control

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Production

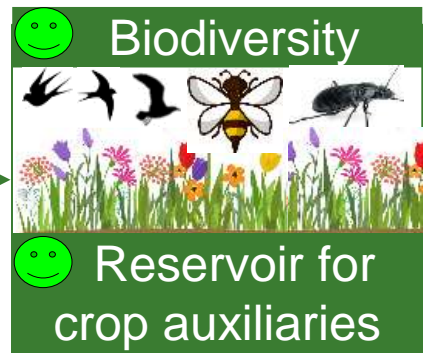
Damage

Biodiversity

Reservoir for crop auxiliaries

New herbicide-sparse cropping systems combining all techniques





New herbicide-sparse cropping systems combining all techniques



Less space & Fewer resources for weeds

Intercropping



New herbicide-sparse cropping systems combining all techniques

- Many possible
- species combinations
 - species proportions
 - sowing patterns



Intercropping

Less space & Fewer resources for weeds

Many factors & interactions + Long term effects

New herbicide-sparse
Objective = Optimise
 combining all techniques

- species combinations
- species proportions
- sowing patterns

Cereal – Legume intercrops



Intercropping

Less space & Fewer resources for weeds

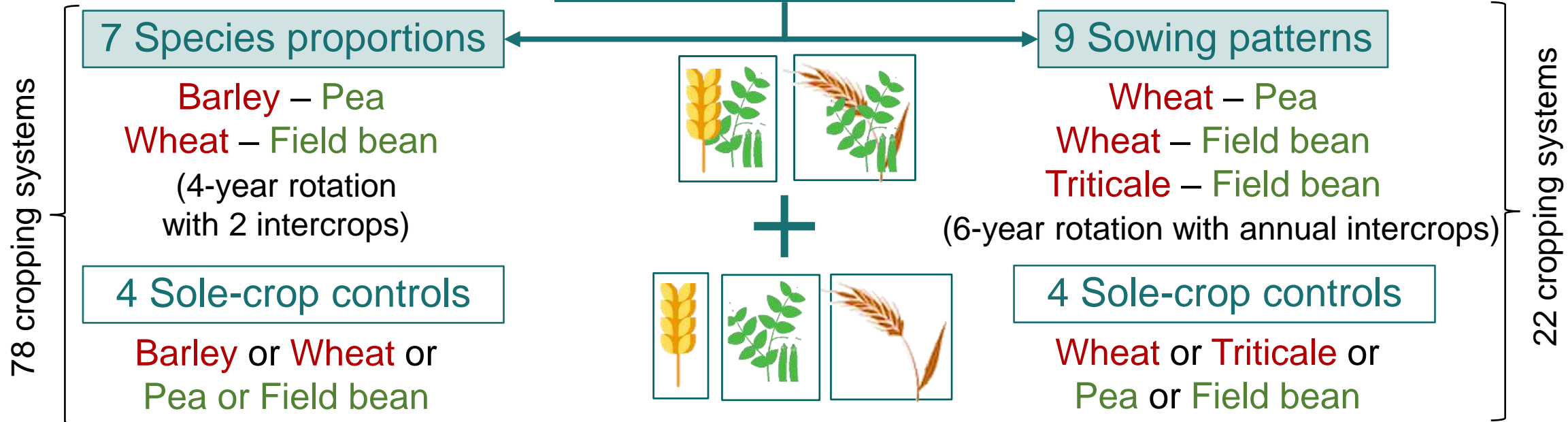


Biodiversity
 Reserv crop auxiliaries



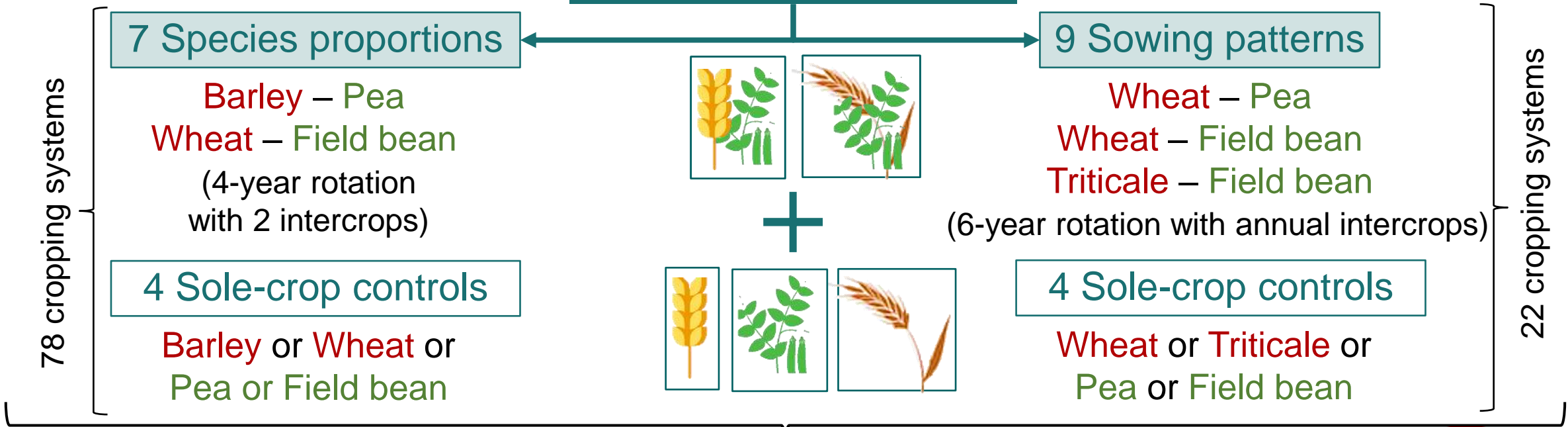


2 experimental designs

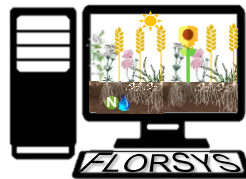




2 experimental designs



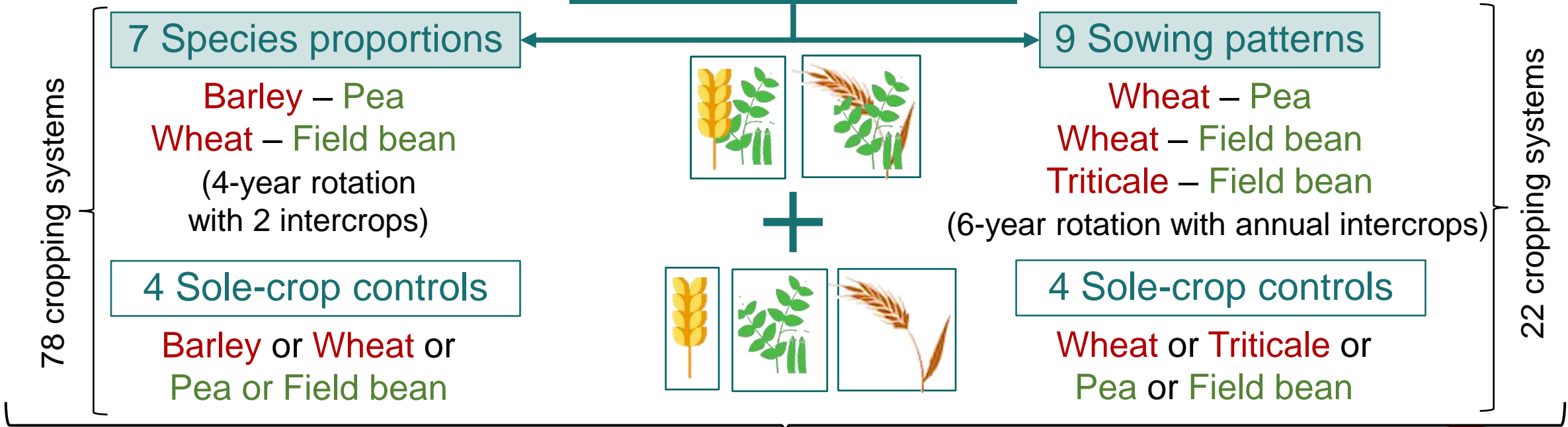
Simulate with weeds



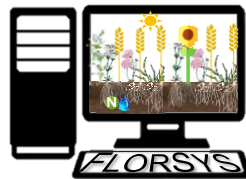
Simulate without weeds



2 experimental designs



Simulate with weeds



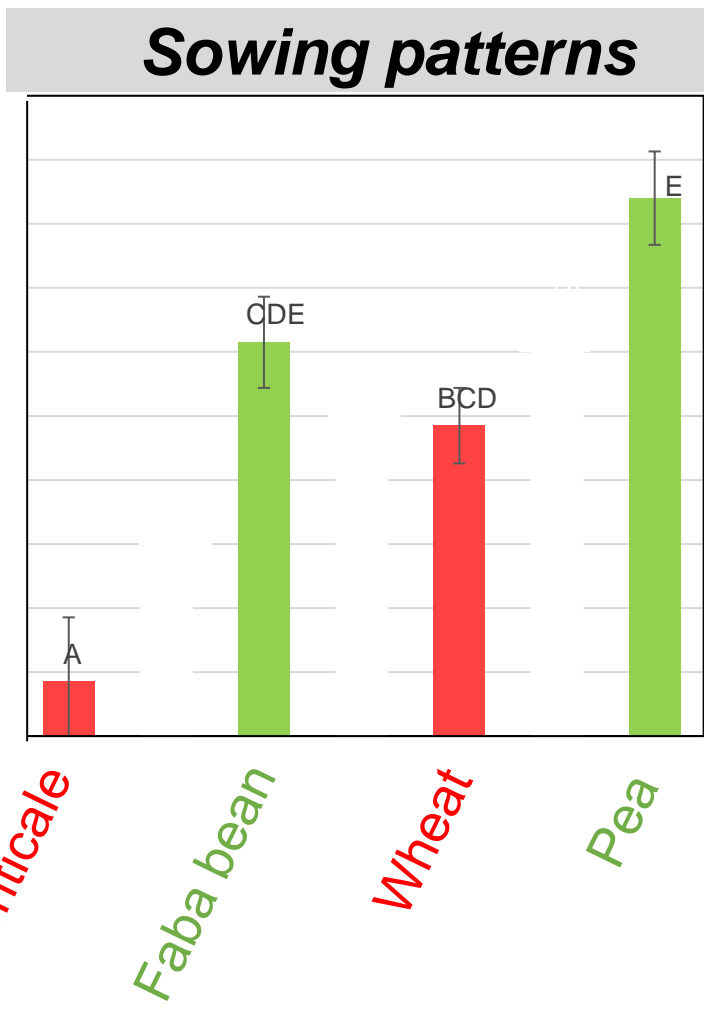
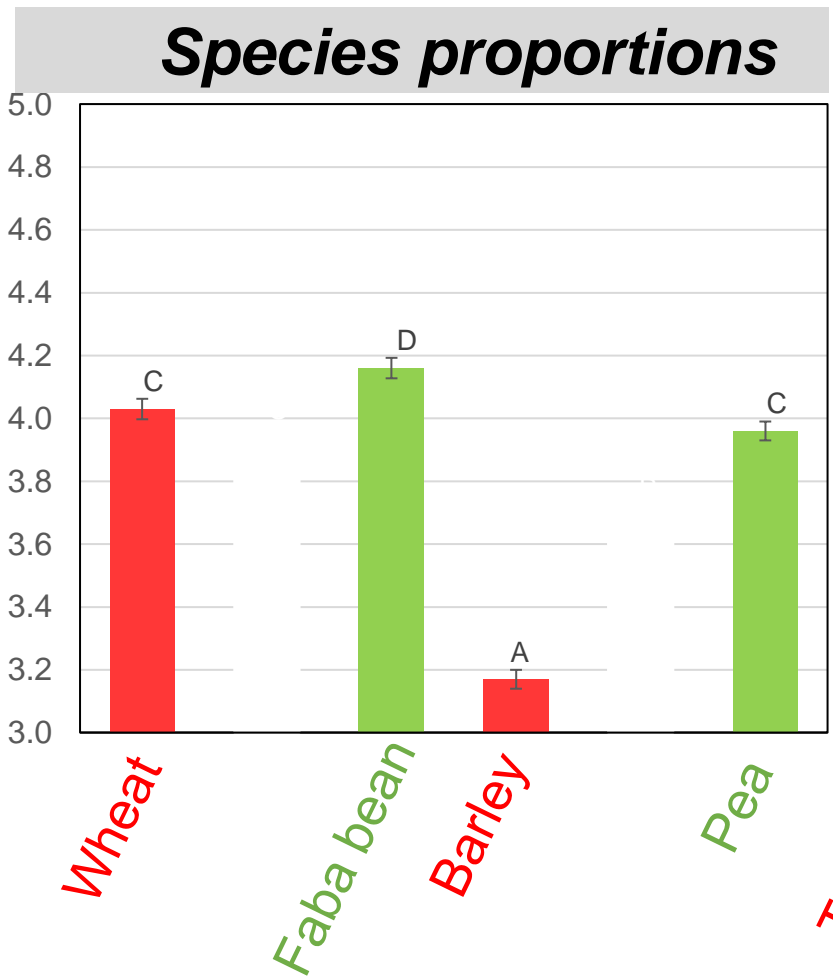
Simulate without weeds



- 30 years
- 10 weather repetitions 



Weed biomass (t DM/ha)

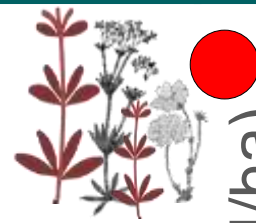


Competitiveness

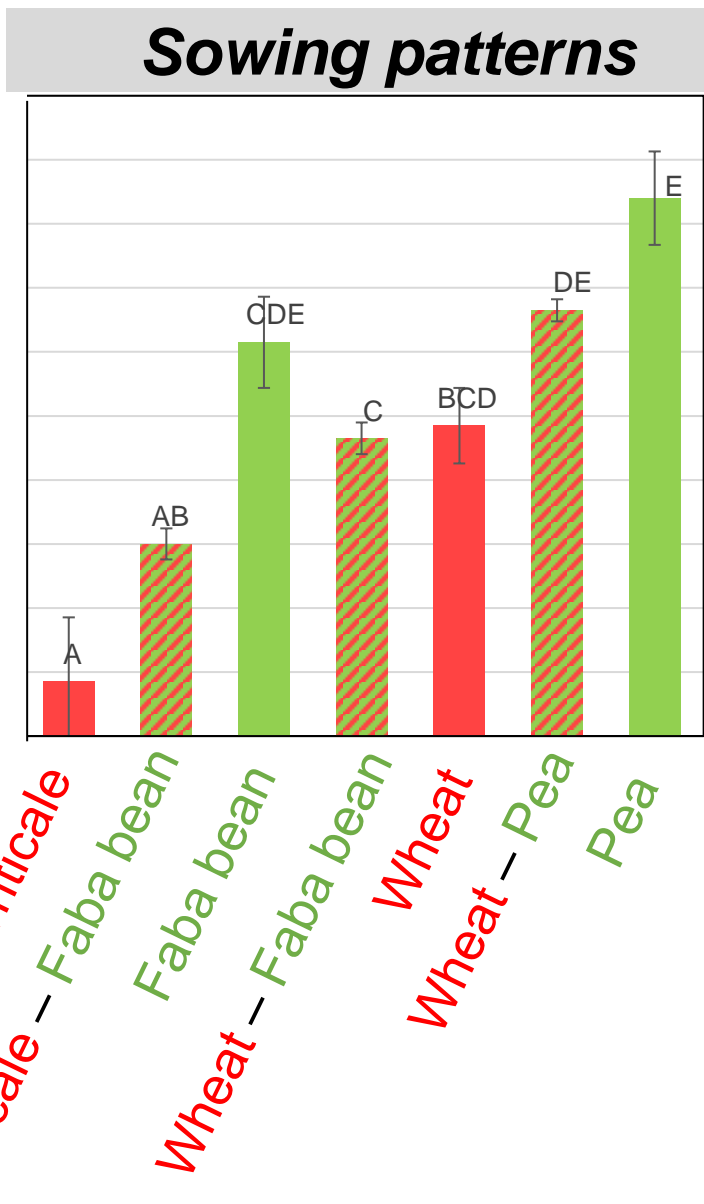
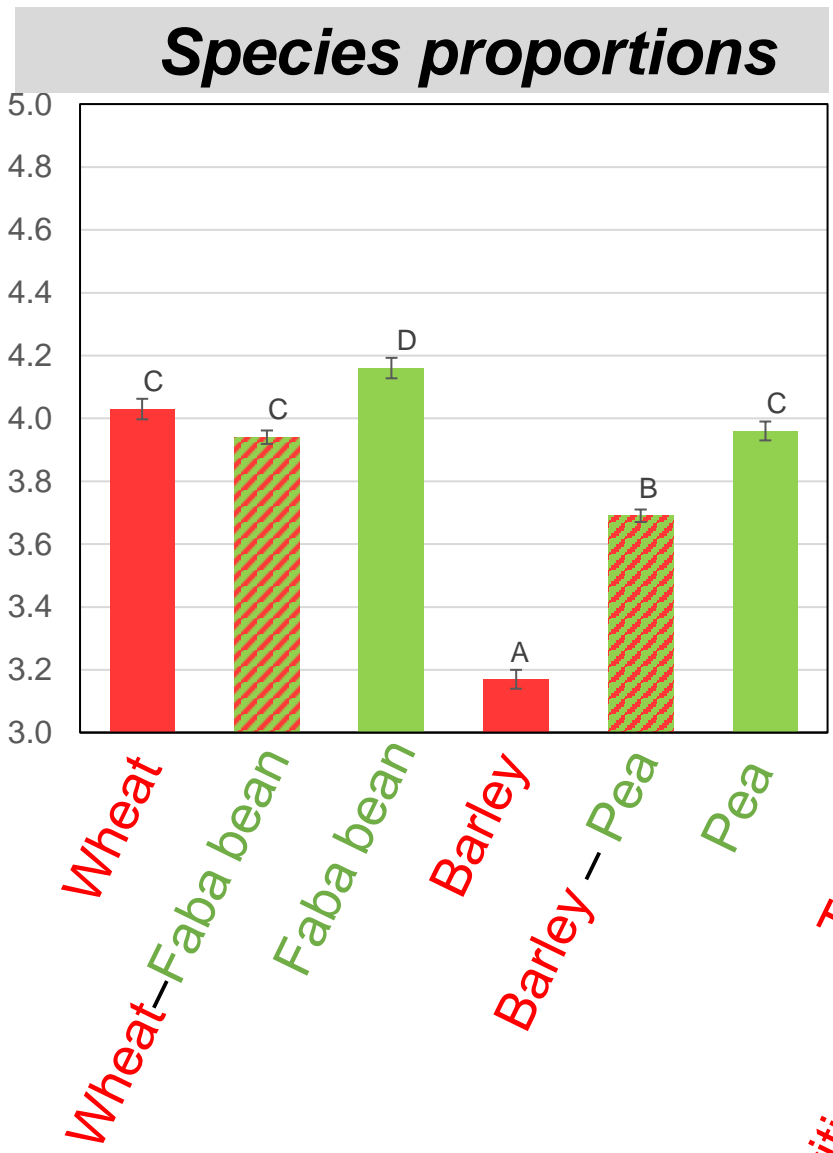
Barley ~ Triticale > Wheat
 ≥ Faba bean > Pea



Cereals =
 more competitive



Weed biomass (t DM/ha)



Competitiveness

Barley ~ Triticale > Wheat
 ≥ Faba bean > Pea



Cereals =
 more competitive

Weed biomass

Legume > Intercrop
 Intercrop ≥ Cereals

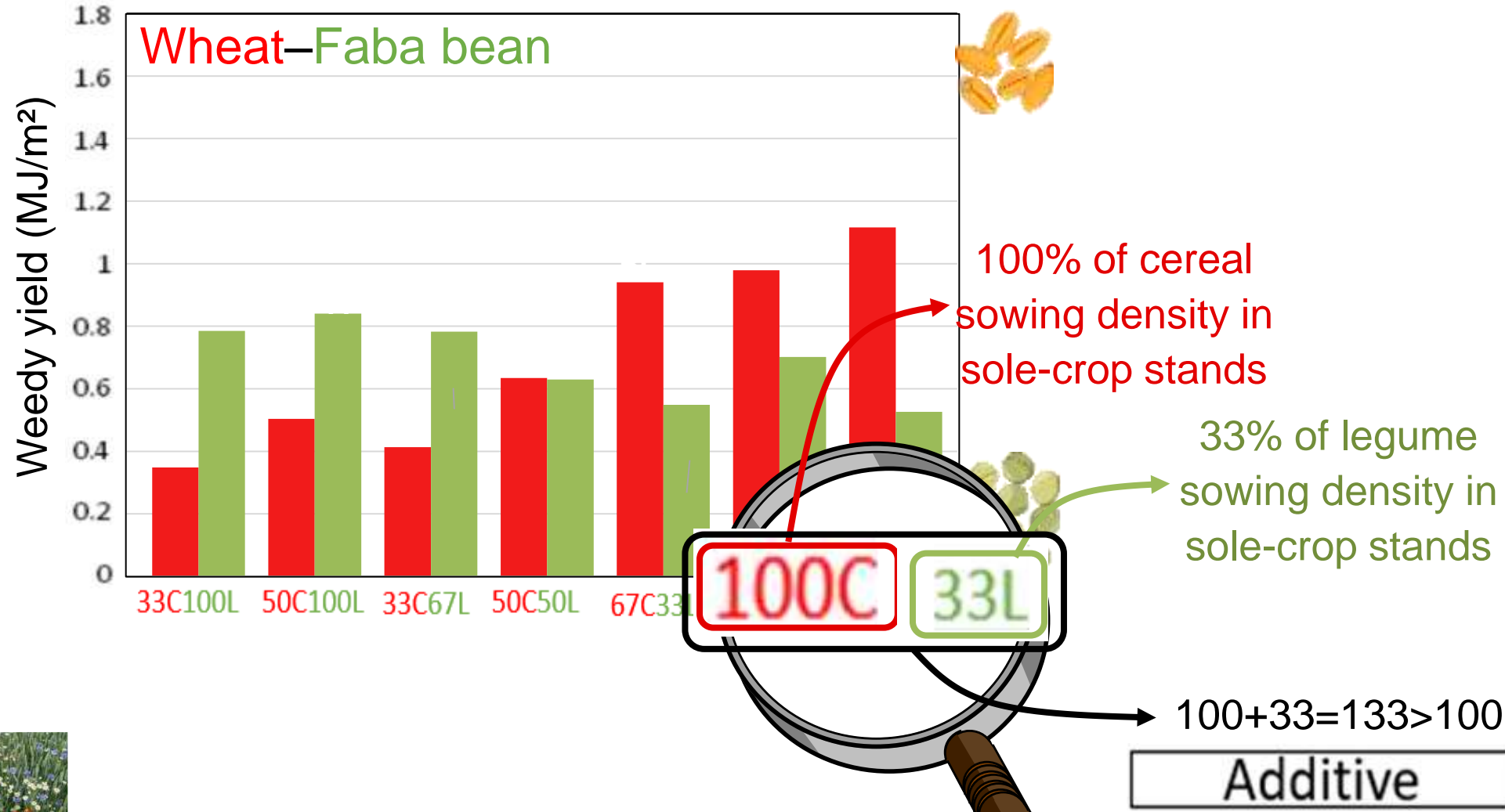


Intercrops protect
 legumes vs weeds

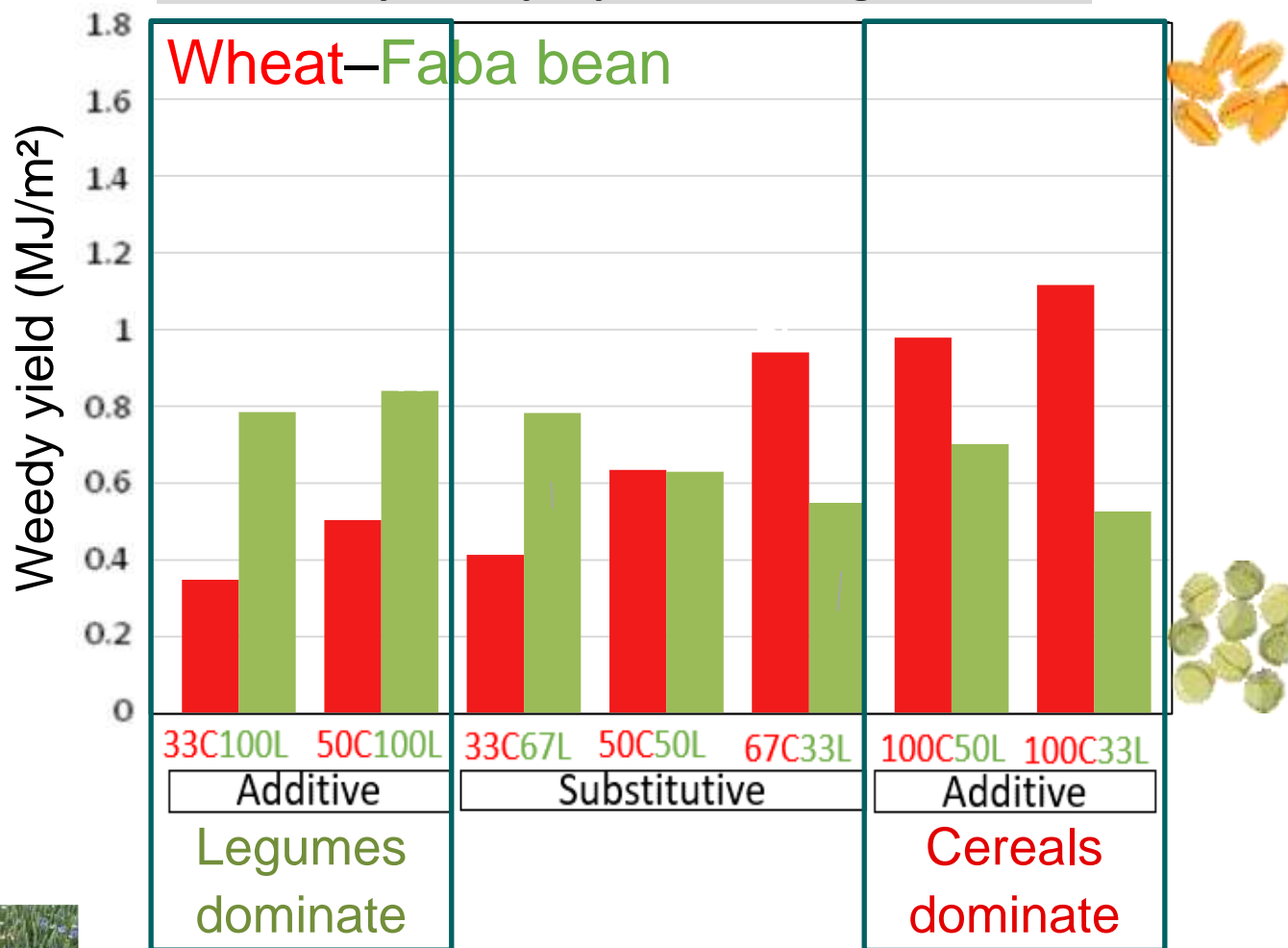


Legume yield loss due to
 weeds lower in intercrops

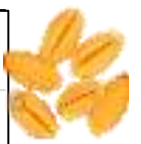
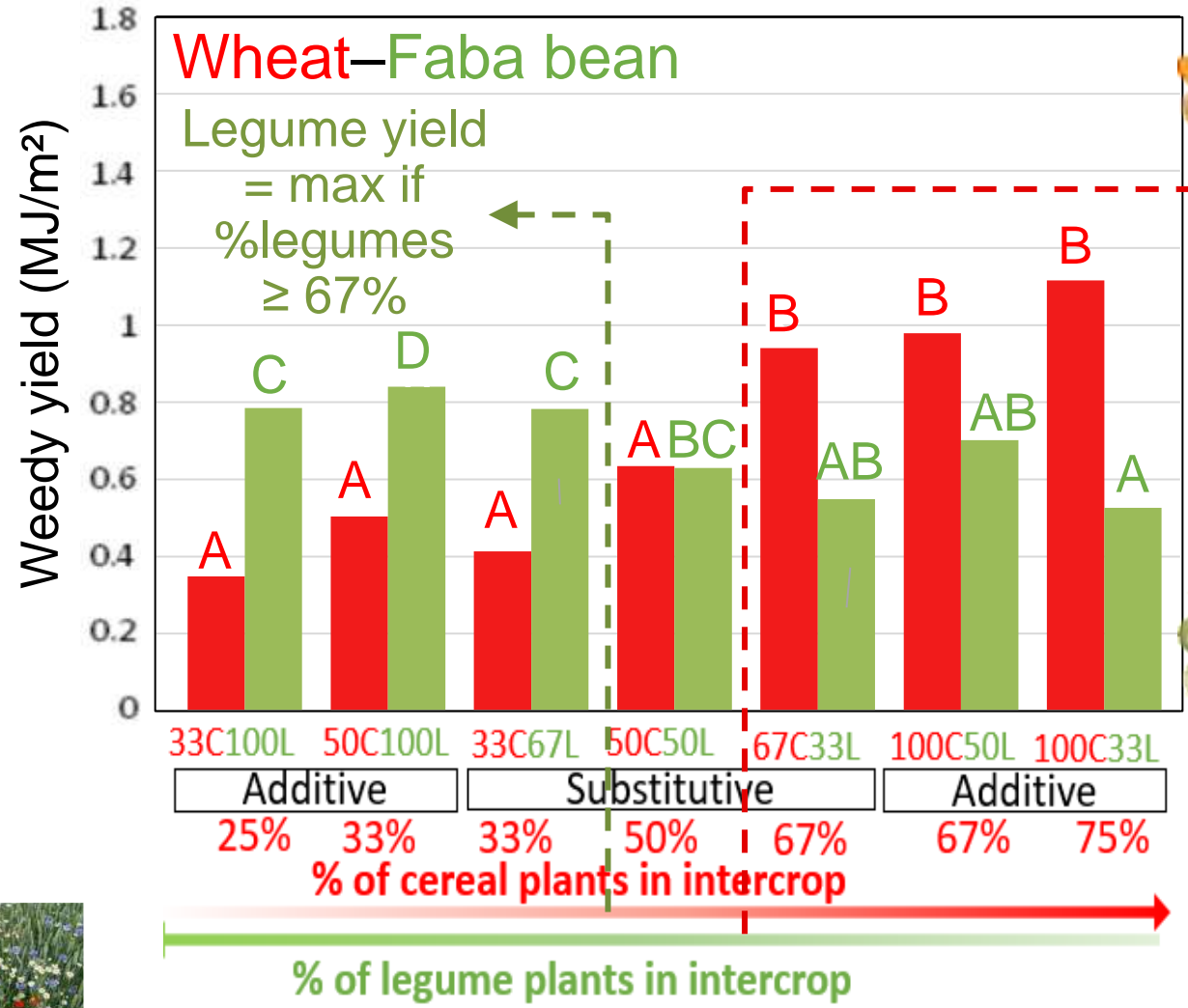
Species proportion design



Species proportion design



Species proportion design

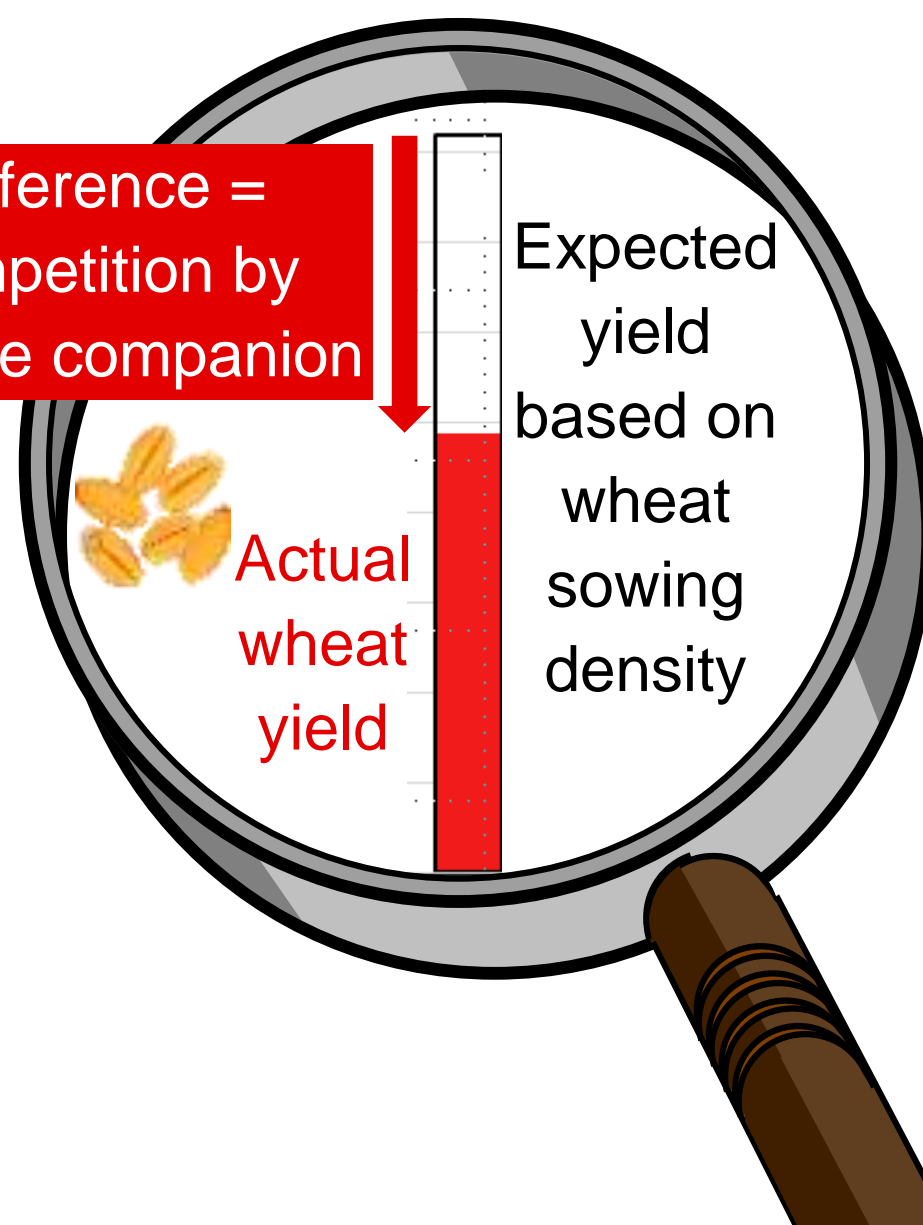
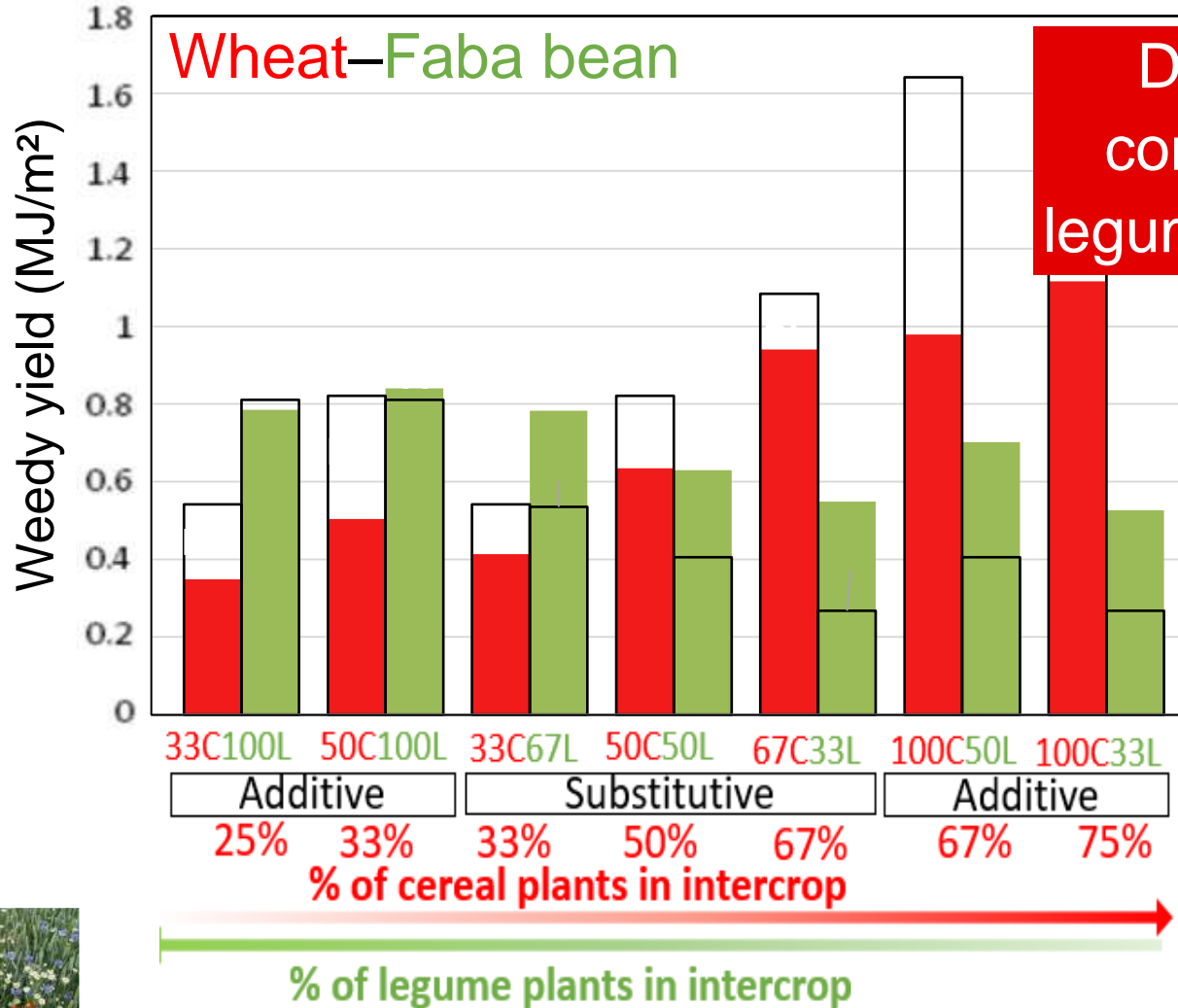


Cereal yield = max if %cereals ≥ 67%

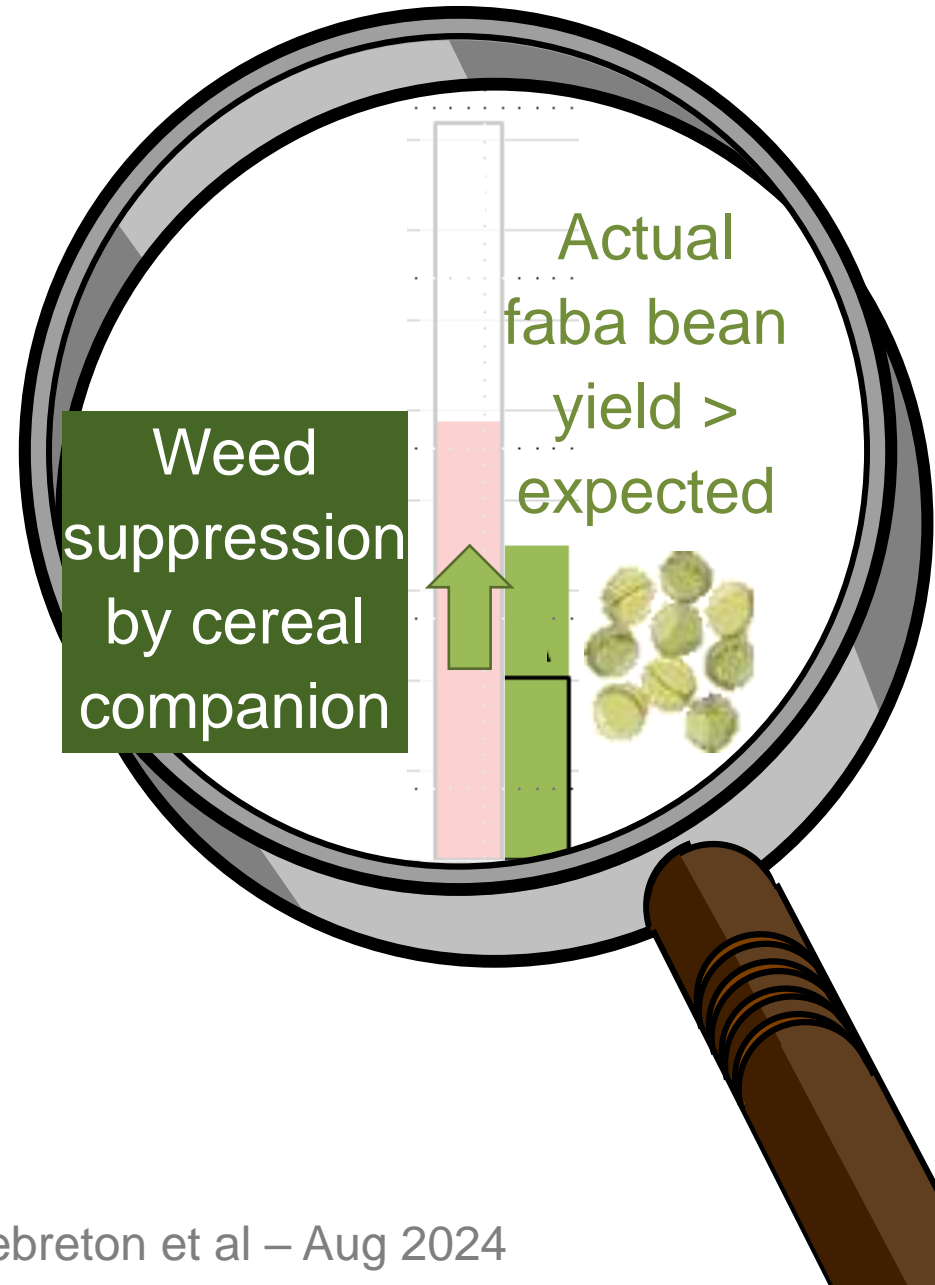
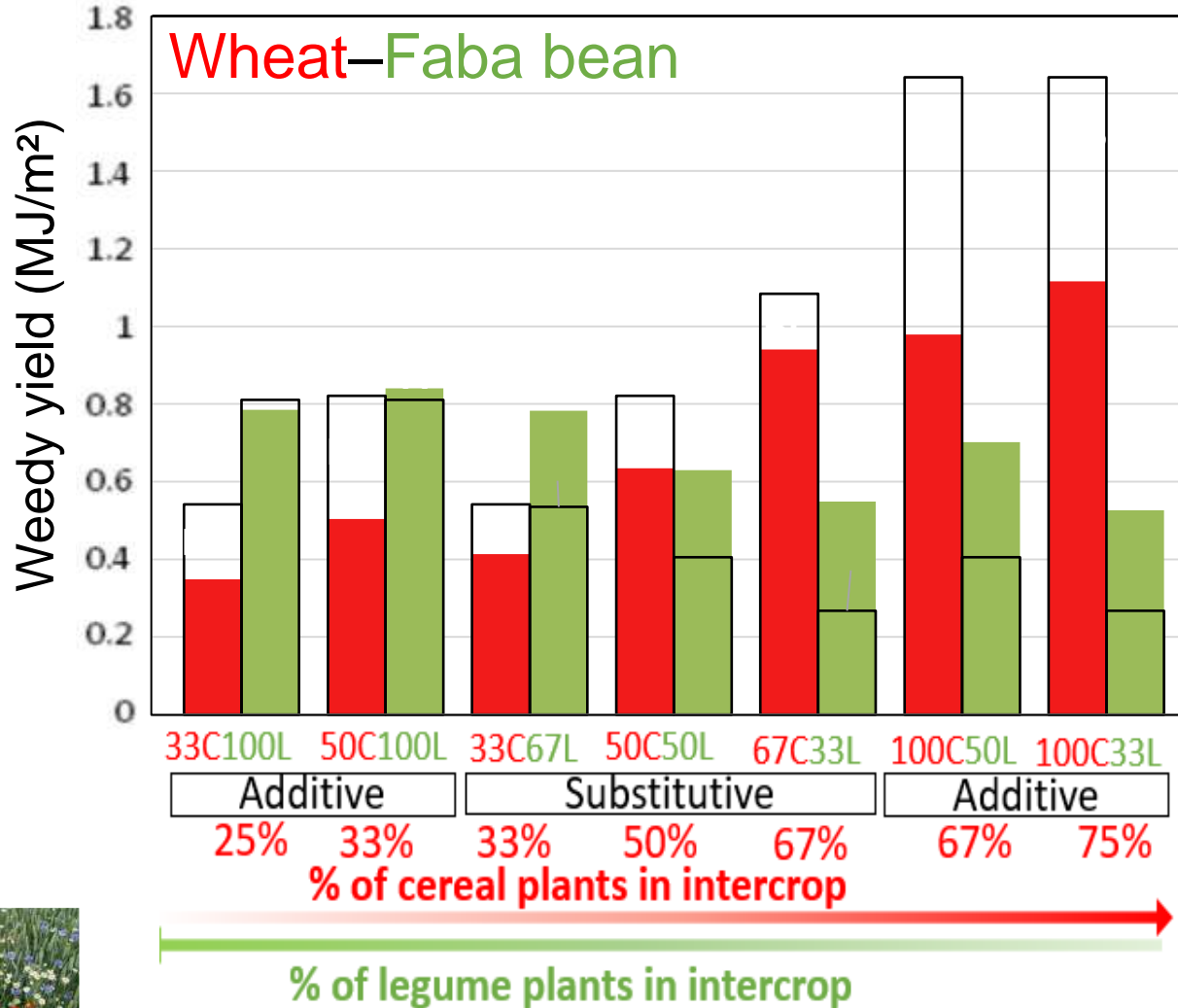
Trade-off between cereal and legume production

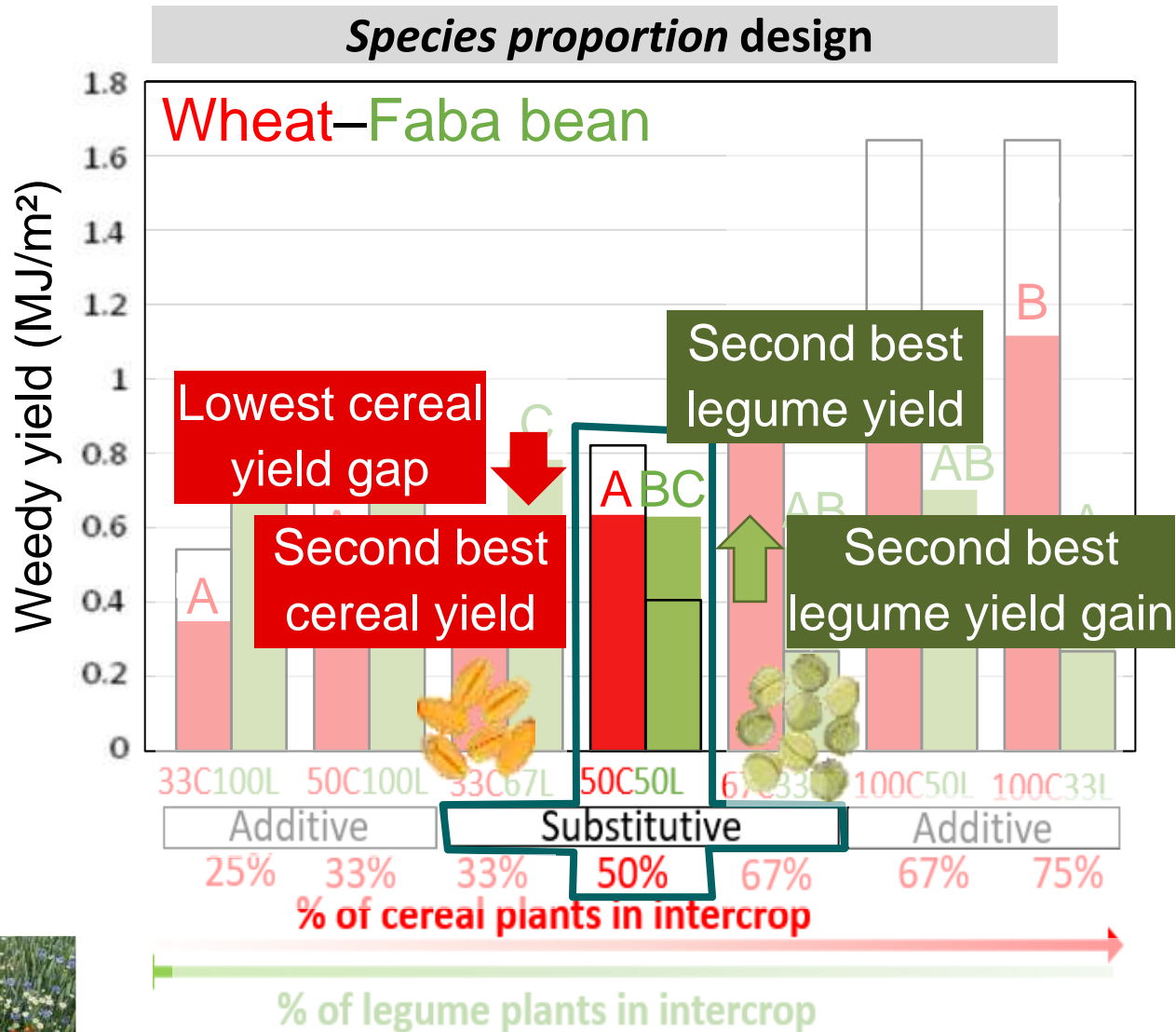


Species proportion design



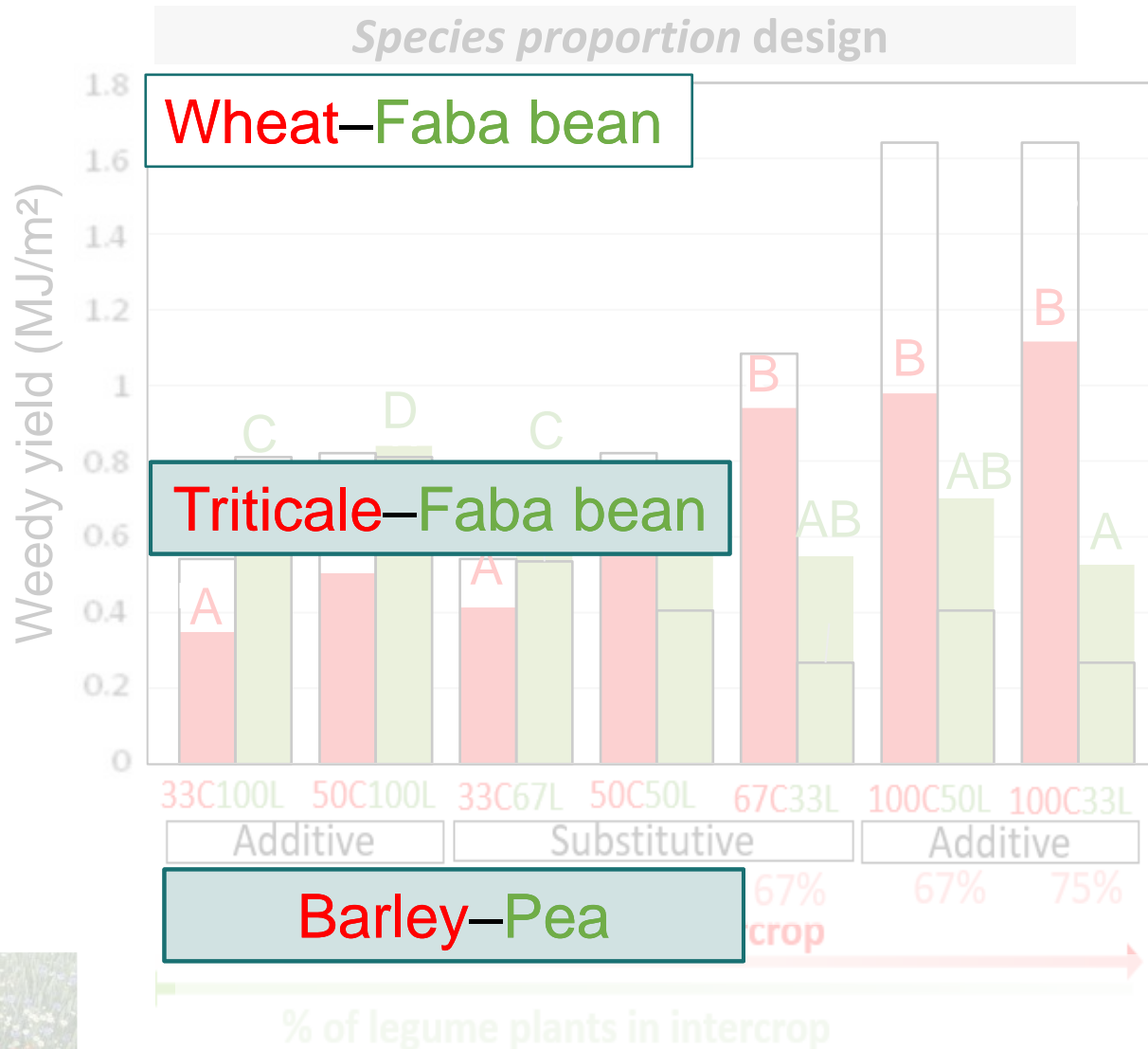
Species proportion design



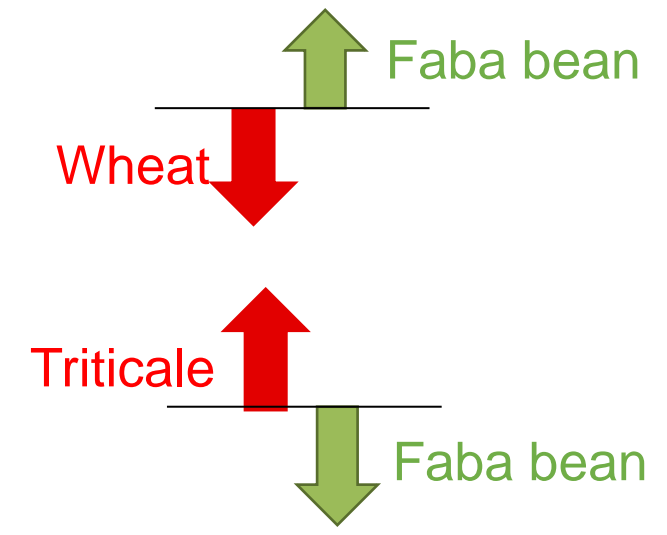


Good compromise





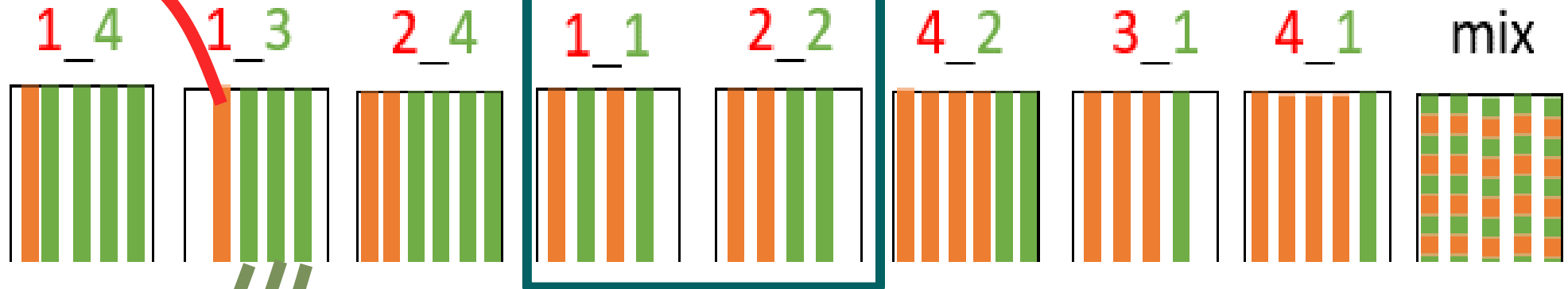
Asymmetrical competition



Strong competition detrimental to both species



Cereal rows

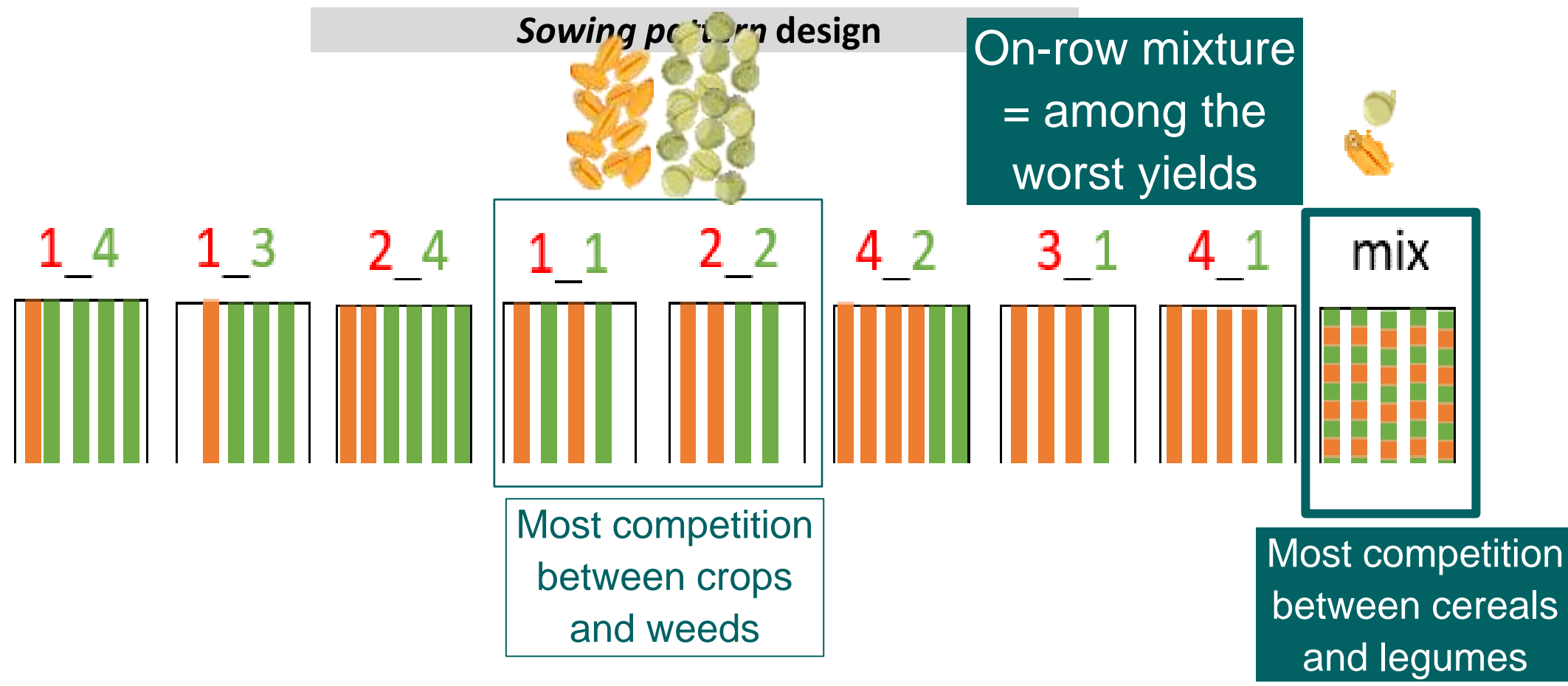


Legume rows

Sowing pattern
 Optimum pattern = equal number of rows of cereals and legumes

Most competition between crops and weeds

! Same sowing density in all patterns



• Implications for weed management in intercrops

- Best yields & weed suppression if:
 - Complementary morphology
→ Better light interception
 - ~ 50/50 species proportions or sowing rows
(but depends on species)
 - Separate rows
→ Cereals compete against weeds rather than legumes
 - Good & fast emergence
→ Occupy space before weeds



• Perspectives

- Repeat simulations with N & water stress & climate change



Thank you for your attention – Merci beaucoup!

The most important references

Colbach et al (2021) The FLORSYS crop-weed canopy model, a tool to investigate and promote agroecological weed management. *Field Crops Res* 261, 108006, doi: 10.1016/j.fcr.2020.108006

Lebreton, P., Bedoussac, L., Bonnet, C., Journet, E.-P., Justes, E., Colbach, N. (2024) Optimal species proportions, traits and sowing patterns for agroecological weed management in legume-cereal intercrops. *European Journal of Agronomy* 159, 127266 in press. <https://doi.org/10.1016/j.eja.2024.127266>

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