Assessing forage yield of drought-resistant grassland mixtures for Swiss mountain areas in the year of sowing

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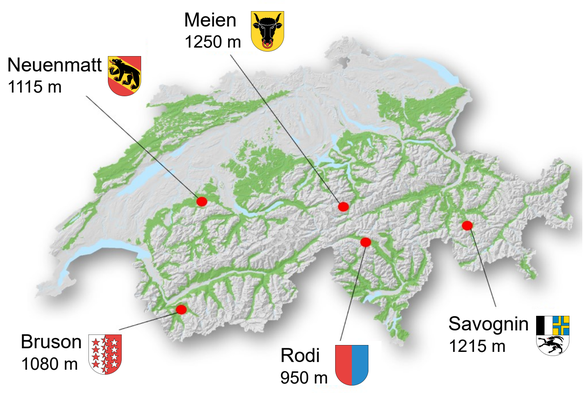
#DryMountProject

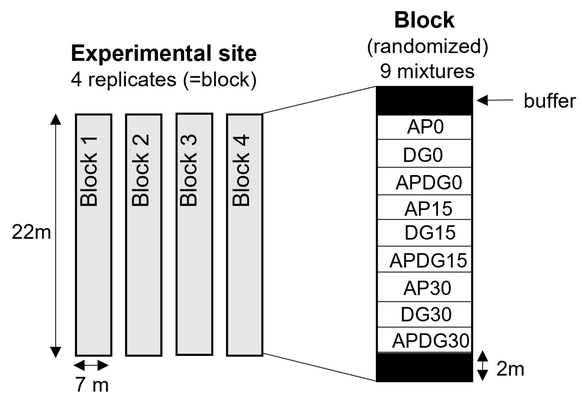
Context

Drought frequency and intensity are expected to increase in the next decades. In Switzerland, precipitation might decrease on average by **25% in summer** towards 2060, with potentially pronounced **losses in forage yield and quality** of grasslands. The aim of the **DryMount project** is to create robust forage mixtures with satisfactory forage yields and quality under **both drought and optimum rainfall conditions**.

Experimental design

Five on-farm sites





Dominant species:

Alopecurus pratensis (AP)
Dactylis glomerata (DG)
Alopecurus/*Dactylis* co-dominance (APDG)

Drought-resistant species (DRsp):

Agrostis capillaris
Festuca rubra
Lotus corniculatus
Plantago lanceolata

Drought-resistant species abundance:

0 → 0%
15 → 15%
30 → 30 %

Set of common species:

Lolium perenne
Phleum pratense
Poa pratensis
Trifolium pratense
Trifolium repens

30% DRsp mixture

Two harvests in 2023:

1st → Summer (Aug/Sept)
2nd → Autumn (Oct)

Nine mixtures have been created and correspond to the different combinations of **dominant species** (3 levels) and **abundance of drought-resistant species** (DRsp, 3 levels).

Validation of the experimental mixtures (example of the Meien site)

DRsp abundance	
Expected (%)	Observed (%) (mean ± SE)
15	18.3 ± 1.1
30	28.2 ± 1.5

Observed DRsp abundances in the field are close to the expected abundances, with *Plantago lanceolata* and *Lotus corniculatus* being the most abundant DRsp.

Discussion

Dominant species identity → no impact on the yield of the different mixtures.

Abundance of drought-resistant species → forage yield increase for ¾ of the sites at the 1st harvest and ½ of the sites at the 2nd harvest in the first year of the trial.

Yield increase of DRsp mixtures → effect more pronounced with the 30% DRsp mixtures than the 15% DRsp mixtures.

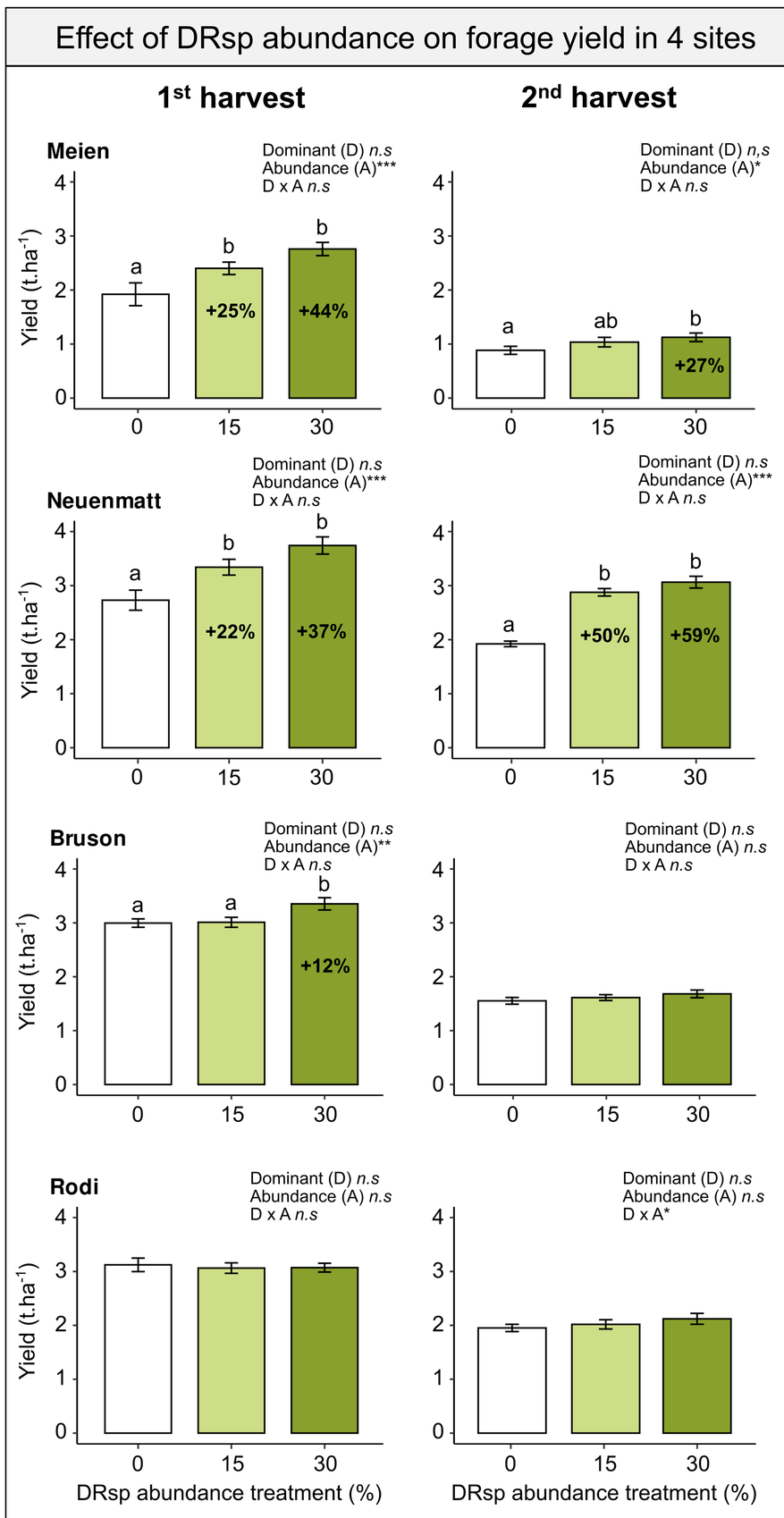
Impact of soil moisture → in drier conditions, DRsp mixtures have higher yields than controls (0% DRsp) whereas in wetter conditions, they have similar yield than the controls. Dry season in 2023 : 20% less rainfall on average than in the last 30 years (except in Rodi).

Conclusions

The **presence of drought-resistant species** induced **higher forage yield** under lower soil moisture but did not reduce yield under higher soil moisture, which validates the **satisfactory performance** under both drought and optimal rainfall conditions. During the next two years, drought will be simulated at one site using rainout shelters to better assess the drought resistance of mixtures. We will continue **forage yield** measurements, assess **forage quality** and measure **plant functional traits** (SLA, LDMC, SRL) to better understand the underlying agro-ecological mechanisms of drought resistance.

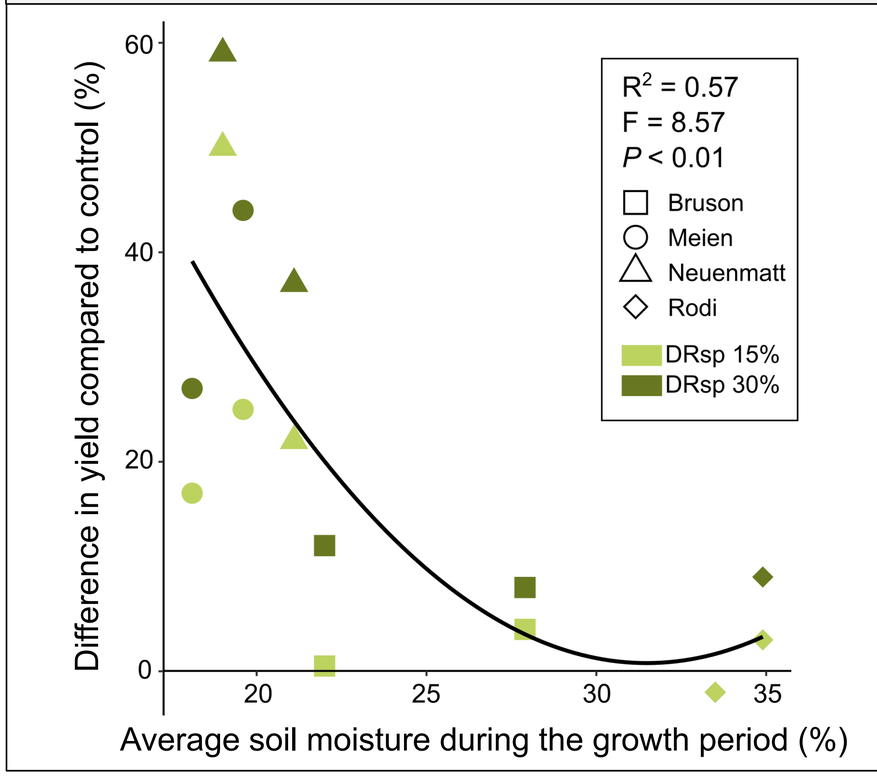
Results

Effect of DRsp abundance on forage yield in 4 sites



Percents on bars represent the significant yield increased by comparison to control mixtures (0% DRsp).
n.s $P > 0.05$; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$

Soil moisture impacts on the forage yield response of drought-resistant mixtures



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