

Impacts of drought-resistant species on forage yield and nutritive value during the sowing year

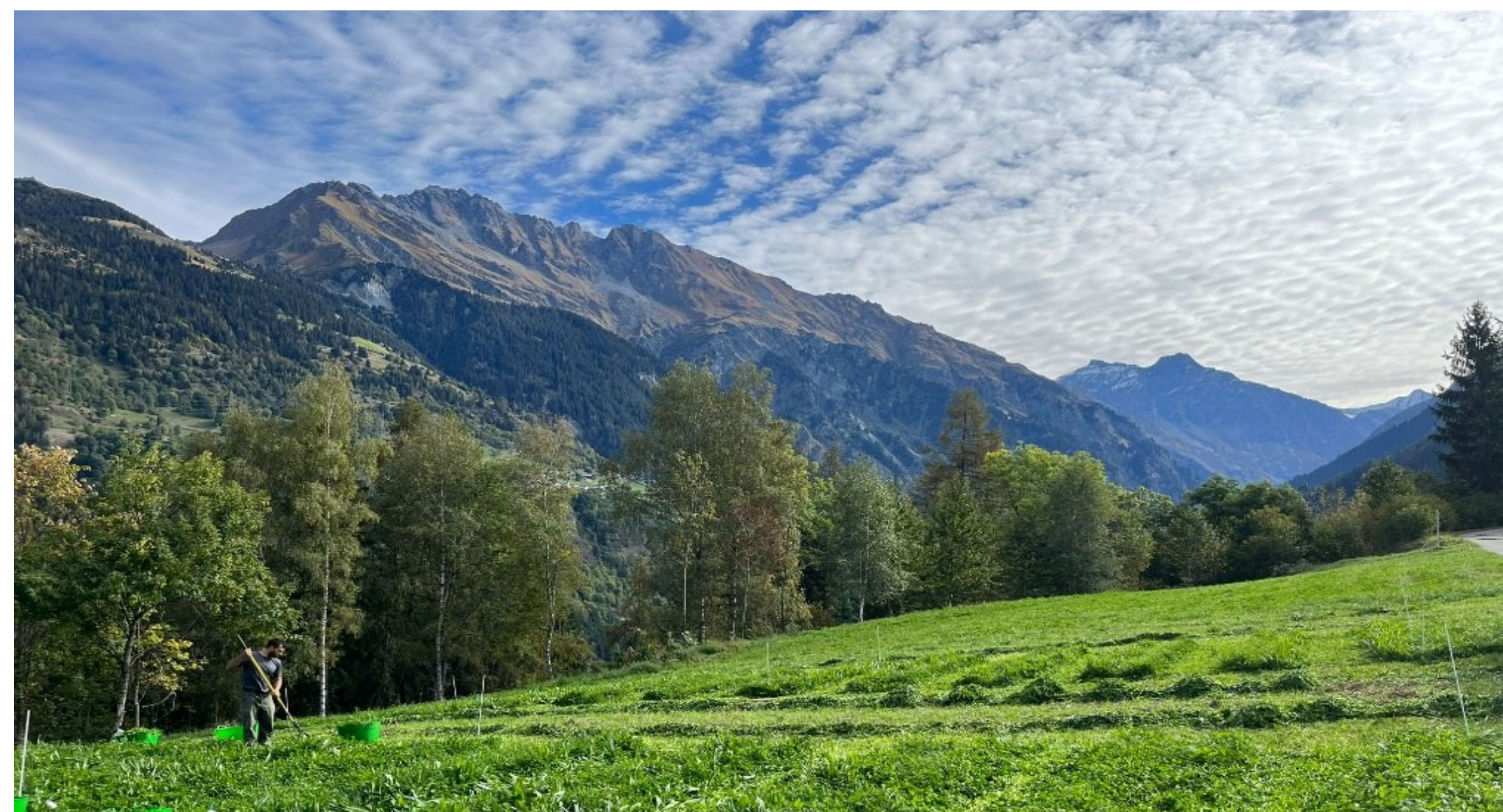
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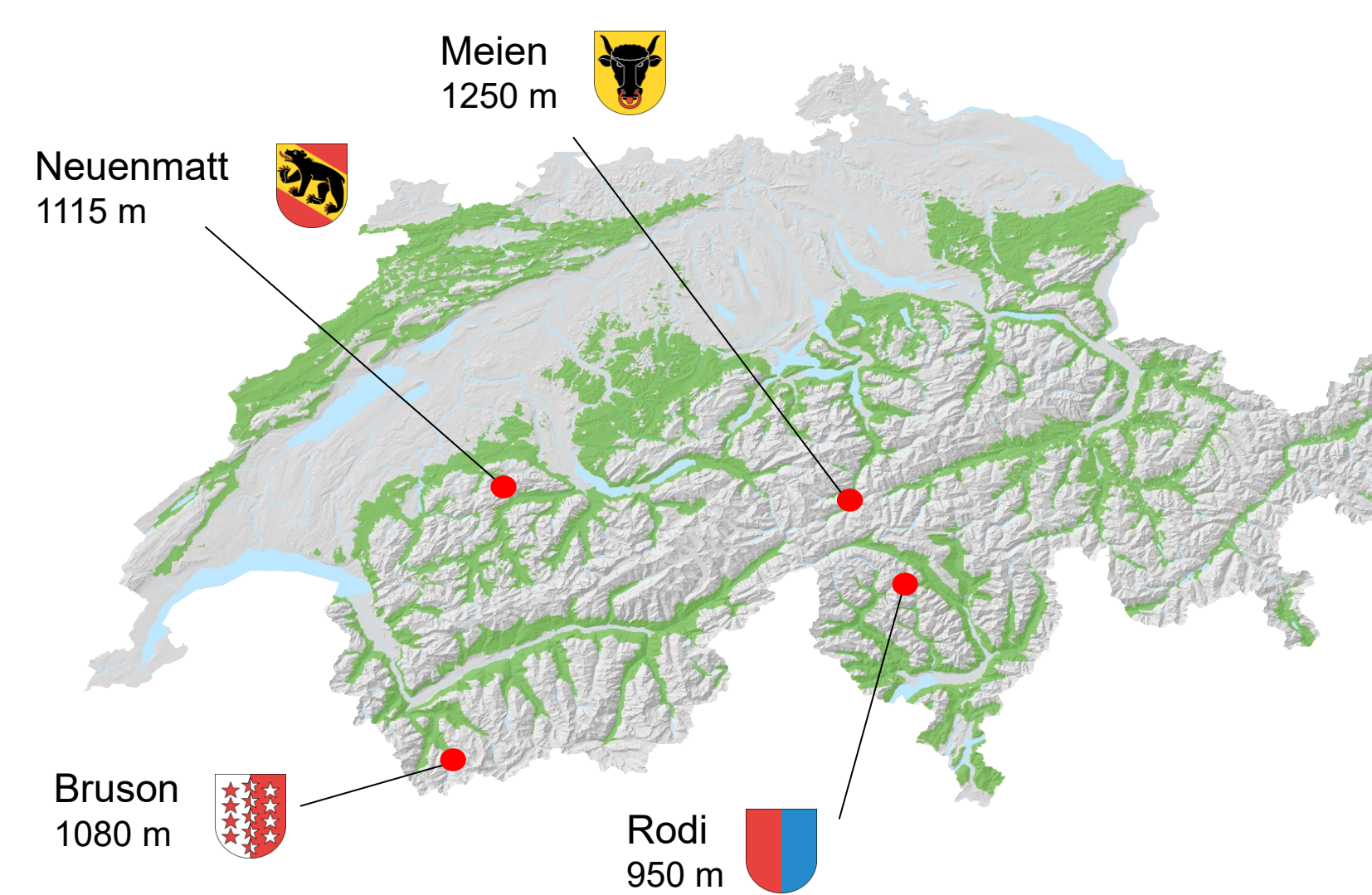
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Context

In mountain grasslands, more frequent and intense summer droughts reduce forage yield and have variable effects on forage nutritive value. This study aims to assess how the inclusion of drought-resistant species in commonly used productive grasslands mixtures affect forage yield and nutritive value across contrasting climatic conditions in mountain areas.



Experimental design



Three species-rich mixtures differing in their expected proportion of **drought-resistant species (DRsp)** were seeded in strips in 2023 at four on-farm sites across Switzerland with four replicates per site (four blocks) and were **harvested twice** during the year of sowing. Nutritive value was assessed at the **first harvest**.

DRsp included *Agrostis capillaris*, *Festuca rubra*, *Lotus corniculatus*, *Plantago lanceolata*.

Mixtures included **0%, 15% or 30%** of DRsp.

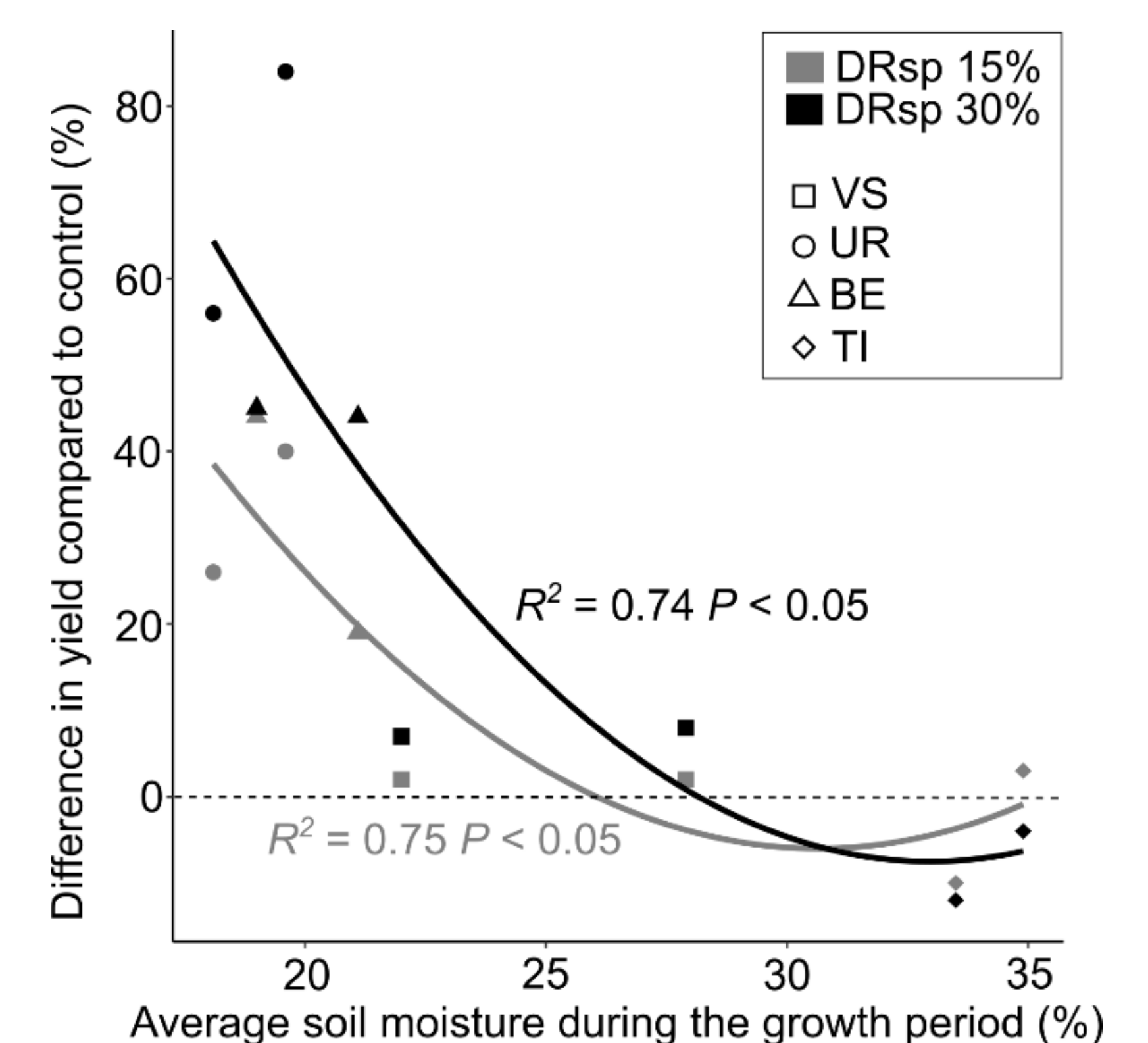
Mixtures were co-dominated by *Alopecurus pratensis* and *Dactylis glomerata*. Other species included *Lolium perenne*, *Phleum pratense*, *Poa pratensis*, *Trifolium pratense* and *Trifolium repens*.

Crude protein (CP), neutral detergent fibers (NDF), acid detergent lignin (ADL) and water soluble carbohydrates (WSC) were measured as indices of forage nutritive value.

Results & Discussion

Sites	DRsp (%)	Yield (t ha ⁻¹)			Nutritive value (g kg ⁻¹)			
		1 st harvest	2 nd harvest	Annual yield	CP	NDF	ADL	WSC
Bruson	0	3.0 ± 0.2	1.6 ± 0.1	4.6 ± 0.2	211 ± 4	307 ± 10	35 ± 2	52 ± 2
	15	3.1 ± 0.1	1.6 ± 0.1	4.6 ± 0.1	194 ± 7	319 ± 11	38 ± 1	57 ± 4
	30	3.3 ± 0.2	1.7 ± 0.1	4.9 ± 0.3	204 ± 12	204 ± 6	42 ± 1	56 ± 5
Meien	0	1.6 ± 0.5a	0.8 ± 0.1a	2.4 ± 0.6a	178 ± 3	392 ± 11	59 ± 9	67 ± 3a
	15	2.3 ± 0.3ab	1.0 ± 0.2ab	3.3 ± 0.4ab	171 ± 8	382 ± 11	47 ± 5	70 ± 2a
	30	3.0 ± 0.1b	1.3 ± 0.1b	4.2 ± 0.2b	168 ± 4	364 ± 10	52 ± 3	77 ± 1b
Neuenmatt	0	2.8 ± 0.4a	2.0 ± 0.1a	4.8 ± 0.4a	169 ± 13	395 ± 15	25 ± 7a	60 ± 5
	15	3.3 ± 0.2ab	2.9 ± 0.1b	6.2 ± 0.2b	181 ± 10	355 ± 5	30 ± 2a	59 ± 3
	30	4.0 ± 0.3b	2.9 ± 0.1b	6.9 ± 0.4b	162 ± 3	343 ± 13	54 ± 7b	69 ± 6
Rodi	0	3.4 ± 0.08a	2.1 ± 0.1	5.4 ± 0.1	155 ± 3	452 ± 8a	40 ± 1a	60 ± 2
	15	3.0 ± 0.17ab	2.1 ± 0.2	5.1 ± 0.3	145 ± 6	437 ± 6a	53 ± 2b	67 ± 3
	30	2.9 ± 0.19b	2.0 ± 0.2	4.9 ± 0.6	142 ± 4	414 ± 4b	63 ± 4c	67 ± 2

Linear mixed-effects models with 'block' as random factor. Different letters within site indicate significant differences among DRsp mixtures ($P < 0.05$)



Forage yield

- increases with increasing DRsp abundance at the 1st and 2nd harvest in the UR and BE sites
- tend to increase with increasing DRsp at the VS site and to decrease at the TI site (non significant)

Nutritive value

- CP content is satisfactory for all mixtures (>140 g kg⁻¹)
- NDF content decreases with increasing DRsp abundance (only significant at TI)
- WSC content increases with increasing DRsp abundance (only significant at UR)
- ADL content increases with increasing DRsp abundance (significant at BE and TI)

Soil moisture impacts on DRsp mixtures yield

- Mixtures with DRsp outperformed control mixtures (0% DRsp) under drier conditions, while yield differences diminished under wetter conditions.
- 30% DRsp mixtures showed greater yield gain than 15% DRsp mixtures in drier conditions.

Conclusions

During the sowing year, the inclusion of drought-resistant species **increased yield under lower soil moisture without compromising yield under wetter conditions** → suitability across a range of climatic conditions. Overall, the presence and increasing abundance of DRsp **did not reduce forage nutritive value** (increase in ADL content only at some sites).

Preliminary findings highlights the potential of mixtures with high abundance of drought-resistant species for use in mountain areas exposed to dry conditions. A precise assessment of the botanical composition of the mixtures and their persistence over time is under evaluation for the following years, as well as a drought simulation experiment.

