

Effects of irrigation on phosphorus in soil, soil microbes and plants

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Objective

Assess the mid-term effects of irrigation on soil P availability, the size of the soil microbial P pool and plant P nutrition in semi-dry grasslands.

Hypothesis

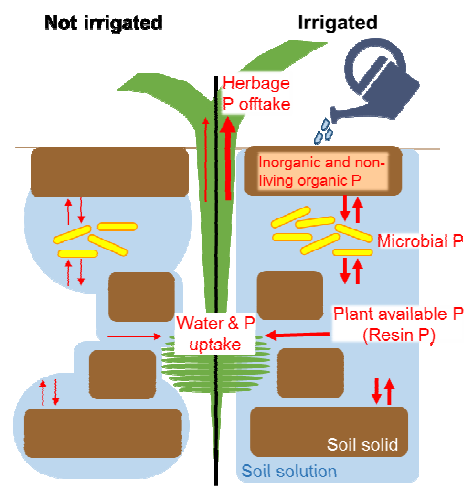


Fig. 1. Expected irrigation effect on P turnover in the soil-plant system: Greater P exchange and plant uptake.

Methods: Factorial field experiment

Treatments:	Not fertilized	Fertilized
Not Irrigated	I ₀ F ₀	I ₀ F ₁
Irrigated	I ₁ F ₀	I ₁ F ₁

- **5 years** of contrasted irrigation and fertilisation
- **11 hay meadows** in an inner-alpine valley
- **Fertilization:** liquefied **organic manure**
- **Irrigation:** 20 mm weekly sprinkler irrigation from May to mid-September



Fig. 2. Irrigation promoted herbage growth in summer.

Results

Table 1. Effect of irrigation and fertilization on biomass, plant P content, P nutrition index (PNI), resin extractable P and soil microbial P content in spring succeeding 5 years of contrasted treatments.

Treatment / Effect	Biomass (t DM ha ⁻¹)	Plant P (g kg ⁻¹ DM)	PNI	Resin P (mg kg ⁻¹ soil)	Microbial P (mg kg ⁻¹ soil)
I ₀ F ₀	1.36	2.2	51	1.5	88
I ₁ F ₀	1.40	2.3	51	1.4	95
I ₀ F ₁	2.03	3.1	78	7.4	88
I ₁ F ₁	1.74	3.0	79	5.2	94
Mean SD	0.48	0.5	13	2.3	18
Irrigation Effect	ns	ns	ns	ns	ns
Fertilization Effect	***	***	***	***	ns

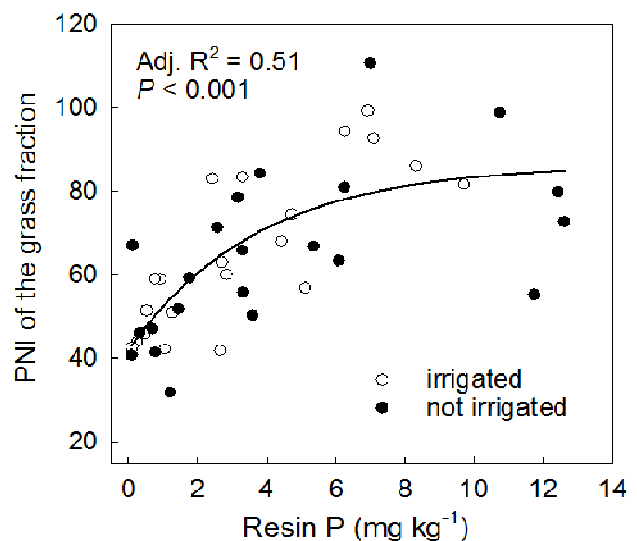


Fig. 3. Relationship between the P nutrition index of the grass fraction and the resin P in the topsoil layer (0-5 cm) after 5 years of contrasted irrigation and fertilization.

Conclusions

In the mid-term, **irrigation** during the drier season **did not affect soil P availability**, the size of the soil microbial P pool, **nor plant P nutrition** in semi-dry mountain grasslands.

➔ **No correction factor** necessary for irrigated compared to not irrigated grassland to estimate **P fertilization** requirement per unit of **herbage yield**