SUPPLEMENTARY DATA

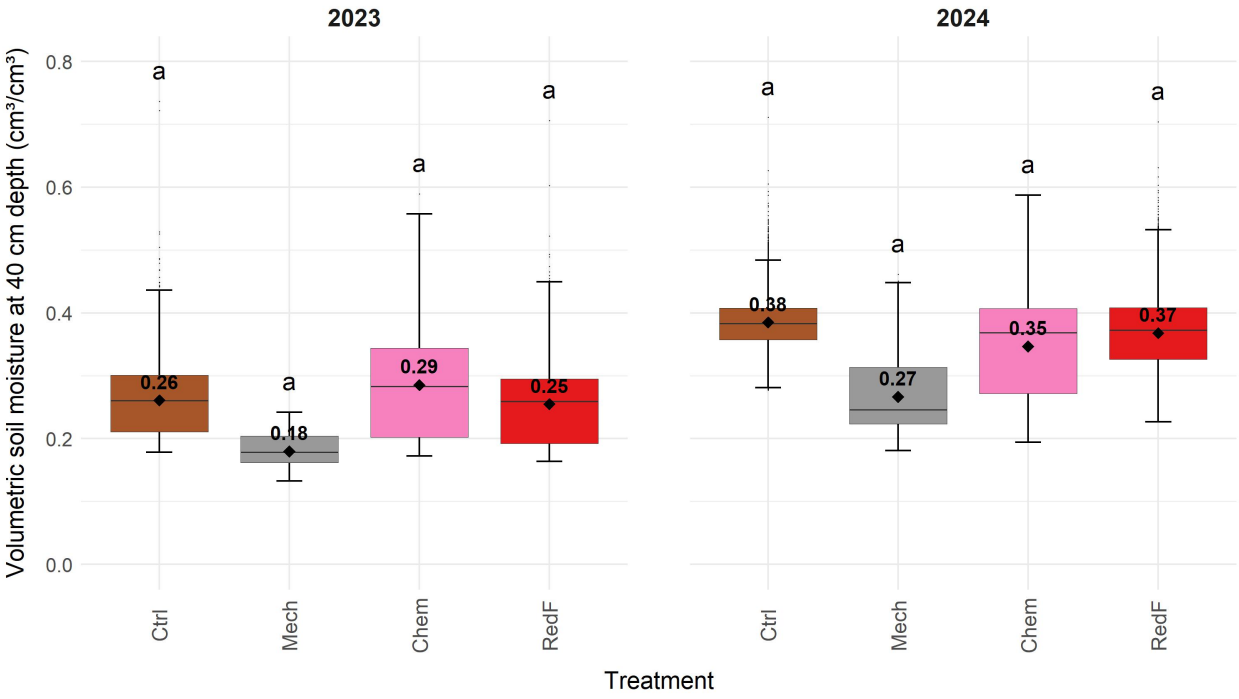


Figure S1. Volumetric soil moisture (cm^3/cm^3) at a depth of 40 cm of different ground management treatments: control (Ctrl), mechanical tillage (Mech), chemical treatment (Chem), and red fescue (RedF) in the years 2023 and 2024 during vegetation period (May till September). Different letters above the bars indicate significant differences between treatments within each year, based on Tukey's HSD test ($p < 0.05$, n = 4, approximately 58,800 observations per treatment and year). Error bars indicate standard deviation (SD). Mean values are displayed inside the boxes. Outliers are displayed as dots.

Table S1. Composition of the herb mixture (HMix), a commercially available seed mixture called "Rebzeilenbegrünung" by Saaten Zeller GmbH & Co. KG. Proportions are given as weight percent.

Buckwheat	*Fagopyrum esculentum*	15.0 %
Small burnet	*Sanguisorba minor*	15.0 %
Kidney vetch	*Anthyllis vulneraria*	12.0 %
Sand sainfoin	*Onobrychis arenaria*	11.0 %
Yellow bedstraw	*Galium verum*	6.0 %
Common yarrow	*Achillea millefolium*	5.0 %
Yellow chamomile	*Anthemis tinctoria*	4.0 %
Garden cress	*Lepidium sativum*	4.0 %
Lentil	*Lens culinaris*	3.0 %
Perennial flax	*Linum perenne*	3.0 %
Ribwort plantain	*Plantago lanceolata*	3.0 %
Black medic	*Medicago lupulina*	3.0 %
Oxeye daisy	*Leucanthemum ircutianum*	2.5 %
Corn poppy	*Papaver rhoeas*	2.0 %
Hoary plantain	*Plantago media*	2.0 %
Meadow clary	*Salvia pratensis*	2.0 %
Purple clover	*Trifolium rubrum*	2.0 %
Bladder campion	*Silene vulgaris*	2.0 %
Flatweed	*Hypochaeris radicata*	1.0 %
Oregano	*Origanum vulgare*	1.0 %
Carthusian pink	*Dianthus carthusianorum*	1.0 %
Eurasian campion	*Silene nutans*	0.5 %

Table S2. Effects of ground management treatments (control (Ctrl), mechanical tillage (Mech), chemical treatment (Chem), red fescue (RedF), wild thyme (Thym), black medic (BlaM), and herb mixture (HMix)) on soil coverage (including coverage of weeds, cover crops, and dead plants), grape quality (bending degree of rachis for cluster looseness, botrytis cinerea bunch rot incidence and severity, must sugar content and total acidity), and grape quantity parameters (yield per vine and berry weight) across three growing seasons (2022–2024). Mean values ± standard deviation (n = 4) are presented for each treatment and year. Letters indicate significant differences ($p \leq 0.05$) within each column, determined by Tukey's HSD test.

	Soil coverage (%)							**Bending degree of rachis (°)**					
	2022		**2023**		**2024**			**2022**		**2023**		**2024**	
Ctrl	71.4 ± 6.6	ab	96.0 ± 2.4	a	94.4 ± 4.5	a		9.0 ± 1.1	b	101.9 ± 10.1	a	19.8 ± 6.2	ab
Mech	29.1 ± 2.3	c	51.1 ± 9.1	c	64.7 ± 8.0	b		19.7 ± 4.7	a	55.8 ± 2.4	c	20.8 ± 4.0	ab
Chem	NA		77.6 ± 8.1	b	40.0 ± 4.7	c		NA		54.6 ± 10.2	c	11.9 ± 2.2	b
RedF	79.2 ± 3.5	a	99.3 ± 0.6	a	98.7 ± 0.0	a		16.2 ± 2.2	ab	81.5 ± 11.1	ab	26.5 ± 9.3	a
Thym	68.8 ± 7.0	b	96.4 ± 3.0	a	97.6 ± 0.4	a		17.0 ± 5.7	ab	86.9 ± 13.3	ab	31.4 ± 1.7	a
BlaM	78.3 ± 2.5	ab	96.7 ± 1.9	a	NA			16.3 ± 4.1	ab	71.5 ± 13.4	bc	NA	
HMix	75.6 ± 3.1	ab	96.8 ± 2.0	a	98.3 ± 1.9	a		21.2 ± 6.8	a	88.5 ± 8.5	ab	28.3 ± 4.7	a
	***Botrytis cinerea* bunch rot incidence (%)**							***Botrytis cinerea* bunch rot severity (%)**					
	2022		**2023**		**2024**			**2022**		**2023**		**2024**	
Ctrl	64.4 ± 7.7	a	48.2 ± 7.5	a	59.0 ± 5.3	b		5.0 ± 0.8	a	2.5 ± 1.3	a	6.1 ± 0.9	b
Mech	43.7 ± 20.7	ab	59.1 ± 4.0	a	63.8 ± 0.5	ab		1.9 ± 0.8	a	3.4 ± 1.1	a	8.4 ± 1.4	ab
Chem	NA		63.0 ± 13.8	a	81.0 ± 6.2	a		NA		2.4 ± 1.1	a	14.4 ± 3.5	a
RedF	30.9 ± 13.3	b	59.8 ± 2.8	a	55.0 ± 12.5	b		1.9 ± 1.6	a	2.0 ± 0.3	a	7.6 ± 4.8	b
Thym	41.1 ± 13.5	ab	47.9 ± 7.0	a	59.0 ± 17.3	b		2.9 ± 2.3	a	2.0 ± 0.8	a	7.7 ± 0.8	b
BlaM	37.3 ± 11.8	ab	47.3 ± 10.4	a	NA			2.7 ± 0.9	a	1.8 ± 0.6	a	NA	
HMix	37.5 ± 16.3	ab	47.2 ± 5.0	a	60.5 ± 6.8	ab		2.2 ± 1.4	a	1.6 ± 0.5	a	7.3 ± 2.3	b
	Must sugar content (°Oe)							**Total acidity (g/L)**					
	2022		**2023**		**2024**			**2022**		**2023**		**2024**	
Ctrl	83.8 ± 3.7	a	89.1 ± 2.6	a	76.9 ± 6.0	a		9.5 ± 0.6	a	8.7 ± 0.4	a	12.8 ± 1.0	a
Mech	83.1 ± 2.6	a	87.8 ± 2.6	a	77.6 ± 5.2	a		9.4 ± 0.6	a	8.8 ± 0.3	a	12.7 ± 0.8	a
Chem	NA		87.4 ± 1.3	a	77.5 ± 5.7	a		NA		8.7 ± 0.3	a	12.3 ± 1.1	a
RedF	82.2 ± 5.1	a	88.9 ± 1.6	a	79.4 ± 0.9	a		9.7 ± 0.3	a	8.7 ± 0.5	a	12.4 ± 0.9	a
Thym	84.6 ± 5.5	a	89.9 ± 2.0	a	80.5 ± 3.5	a		9.2 ± 0.3	a	8.7 ± 0.2	a	11.9 ± 0.5	a

BlaM	83.5 ± 6.3	a	89.3 ± 1.1	a	NA			9.5 ± 0.7	a	8.7 ± 0.3	a	NA	
HMix	84.4 ± 2.9	a	87.9 ± 0.7	a	81.7 ± 1.8	a		9.2 ± 0.2	a	8.8 ± 0.3	a	11.6 ± 0.5	a
	Yield per vine (kg)							**Berry weight (g)**					
	2022		**2023**		**2024**			**2022**		**2023**		**2024**	
Ctrl	2.6 ± 0.2	a	1.7 ± 0.3	a	4.1 ± 0.4	ab		1.5 ± 0.1	a	1.1 ± 0.1	a	1.7 ± 0.1	a
Mech	2.9 ± 0.2	a	1.6 ± 0.1	a	4.1 ± 0.5	ab		1.5 ± 0.1	a	1.2 ± 0.1	a	1.7 ± 0.1	a
Chem	NA		1.9 ± 0.3	a	4.4 ± 0.5	a		NA		1.2 ± 0.1	a	1.7 ± 0.1	a
RedF	2.9 ± 0.2	a	1.7 ± 0.2	a	3.8 ± 0.1	ab		1.5 ± 0.1	a	1.1 ± 0.1	a	1.7 ± 0.2	a
Thym	2.6 ± 0.3	a	1.5 ± 0.3	a	3.4 ± 0.4	b		1.5 ± 0.1	a	1.1 ± 0.1	a	1.7 ± 0.1	a
BlaM	2.8 ± 0.4	a	1.6 ± 0.4	a	NA			1.5 ± 0.1	a	1.1 ± 0.2	a	NA	
HMix	2.7 ± 0.6	a	1.5 ± 0.5	a	3.7 ± 0.2	ab		1.4 ± 0.1	a	1.1 ± 0.1	a	1.7 ± 0.1	a