



Article

The Effect of Sowing Density and Different Harvesting Stages on Yield and Some Forage Quality Characters of the White Sweet Clover (*Melilotus albus*)

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Table S1a. Plant measurements, yield and chemical composition of white sweet clover, mean values for interaction seeding density (S) x harvesting stage (H).

Seeding density [pcs.m ⁻²]	Harvesting stage	Plant population after emergence [pcs.m ⁻²]	Plant height [cm]	Green matter yield [kg m ⁻²]	Dry matter yield [kg m ⁻²]	Share of leaves [%]	Total protein [% DM]	Crude fat [% DM]	Fiber [% DM]	Ash [% DM]
500	A	341.78 ^a	46.79 ^a	0.90 ^a	0.13 ^a	40.82 ^c	22.16 ^b	2.30 ^a	33.33 ^a	12.46 ^a
	B	334.04 ^a	69.53 ^a	1.35 ^a	0.25 ^a	32.11 ^{bc}	17.62 ^{abc}	2.14 ^a	37.83 ^a	11.00 ^a
	C	324.20 ^a	157.98 ^b	2.74 ^{ab}	0.70 ^{bcd}	19.56 ^a	14.65 ^a	1.73 ^a	44.41 ^a	8.52 ^a
1000	A	538.77 ^b	46.68 ^a	1.15 ^a	0.18 ^a	40.68 ^c	20.59 ^{bc}	2.37 ^a	35.15 ^a	11.83 ^a
	B	522.87 ^b	69.83 ^a	1.66 ^{ab}	0.31 ^{ab}	30.73 ^b	17.60 ^{abc}	1.99 ^a	40.78 ^a	11.18 ^a
	C	512.67 ^b	154.48 ^b	2.92 ^{ab}	0.78 ^{cd}	19.73 ^a	14.82 ^a	1.75 ^a	43.19 ^a	8.34 ^a
1500	A	743.12 ^c	47.24 ^a	1.29 ^a	0.22 ^a	40.69 ^c	22.42 ^b	2.57 ^a	35.17 ^a	12.06 ^a
	B	739.64 ^c	67.45 ^a	2.05 ^{ab}	0.40 ^{abc}	31.10 ^b	16.02 ^{ab}	2.12 ^a	42.19 ^a	10.98 ^a
	C	727.08 ^c	148.33 ^b	3.52 ^b	0.95 ^d	19.13 ^a	14.96 ^a	1.65 ^a	40.92 ^a	8.45 ^a
SxH	p-value	0.9962	0.9856	0.9841	0.9139	0.9963	0.5739	0.9703	0.6268	0.9949
	F	0.0428	0.0862	0.0909	0.2367	0.042	0.745	0.1280	0.661	0.050
	df	4	4	4	4	4	4	4	4	4

Harvesting Stages : A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Sx H - ANOVA p-value for interactions between independent variables (S- seeding density and H harvesting stage), F—the F-test, df- the degrees of freedom.

Table S1b. The content of macro- and microelements of white sweet clover, mean values for interaction seeding density (S) x harvesting stage (H).

Seeding density [pcs. m ⁻²]	Harvesting stage	Ca [mg g ⁻¹]	K [mg g ⁻¹]	Mg [mg g ⁻¹]	P [m g ⁻¹]	S [mg g ⁻¹]	Fe [mg kg ⁻¹]	Mn [mg kg ⁻¹]	Mo [mg kg ⁻¹]	Cu [mg kg ⁻¹]	Zn [mg kg ⁻¹]
500	A	13.91 ^a	26.01 ^c	2.65 ^a	4.58 ^a	3.55 ^a	151.32 ^c	17.91 ^a	2.73 ^a	8.61 ^c	18.18 ^a
	B	11.65 ^a	24.12 ^b	2.86 ^a	4.12 ^a	3.23 ^a	95.97 ^b	15.45 ^a	3.64 ^a	7.79 ^d	17.91 ^a
	C	10.90 ^a	14.24 ^a	2.96 ^a	3.19 ^a	2.55 ^a	63.15 ^a	12.31 ^a	1.92 ^a	4.93 ^a	17.01 ^a
1000	A	13.63 ^a	24.60 ^b	2.55 ^a	4.20 ^a	3.65 ^a	118.51 ^c	16.67 ^a	3.60 ^a	6.88 ^{cd}	16.62 ^a
	B	12.71 ^a	24.62 ^b	3.14 ^a	4.15 ^a	3.36 ^a	107.83 ^b	17.01 ^a	3.67 ^a	7.55 ^d	16.59 ^a
	C	10.06 ^a	14.67 ^a	3.02 ^a	3.61 ^a	2.55 ^a	53.47 ^a	11.32 ^a	1.97 ^a	4.95 ^a	16.62 ^a
1500	A	13.00 ^a	24.24 ^b	2.86 ^a	4.29 ^a	3.42 ^a	132.23 ^c	18.81 ^a	3.72 ^a	6.61 ^{bc}	17.01 ^a
	B	12.45 ^a	24.21 ^b	2.75 ^a	4.43 ^a	3.34 ^a	92.15 ^b	14.66 ^a	3.45 ^a	5.71 ^{ab}	18.34 ^a
	C	10.06 ^a	16.33 ^a	3.15 ^a	3.84 ^a	2.60 ^a	61.55 ^a	12.99 ^a	2.48 ^a	5.18 ^a	17.96 ^a
	p-value	0.9098	0.9358	0.8624	0.9533	0.9922	0.8810	0.7723	0.9771	0.2209	0.9161
SxH	F	0.2435	0.1986	0.3176	0.1651	0.0624	0.2894	0.4483	0.1110	1.5863	0.233
	df	4	4	4	4	4	4	4	4	4	4

Harvesting stage: A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Sx H - ANOVA p-value for interactions between independent variables (S- seeding density and H harvesting stage), F—the F-test, df- the degrees of freedom.

Table S2a. Plant measurements, yield and chemical composition of white sweet clover, mean values for interaction seeding density (S) × years (Y)

Seeding density [pcs.m ⁻²]	Years	Plant population after emergence [pcs. m ⁻²]	Plant height [cm]	Green matter yield [kg m ⁻²]	Dry matter yield [kg m ⁻²]	Share of leaves [%]	Total protein [% DM]	Crude fat [% DM]	Fiber [% DM]	Ash [% DM]
500	2018	352.56 ^a	95.24 ^a	1.85 ^a	0.38 ^a	32.10 ^a	18.11 ^a	2.21 ^a	35.55 ^a	11.99 ^a
	2019	332.56 ^a	98.88 ^a	1.39 ^a	0.37 ^a	28.05 ^a	17.51 ^a	1.58 ^a	38.94 ^a	9.73 ^a
	2020	314.89 ^a	80.18 ^a	1.75 ^a	0.34 ^a	32.34 ^a	18.81 ^a	2.38 ^a	41.08 ^a	10.26 ^a
1000	2018	543.21 ^b	89.41 ^a	1.90 ^a	0.37 ^a	31.20 ^a	18.17 ^a	1.89 ^a	36.42 ^a	11.90 ^a
	2019	523.22 ^b	100.15 ^a	1.32 ^a	0.37 ^a	28.83 ^a	16.81 ^a	1.63 ^a	42.80 ^a	9.08 ^a
	2020	507.88 ^b	81.43 ^a	2.51 ^a	0.51 ^a	30.76 ^a	18.04 ^a	2.59 ^a	39.90 ^a	10.36 ^a
1500	2018	767.22 ^c	84.68 ^a	2.03 ^a	0.43 ^a	31.37 ^a	18.69 ^a	2.33 ^a	35.85 ^a	12.44 ^a
	2019	734.67 ^c	98.83 ^a	1.81 ^a	0.51 ^a	29.01 ^a	15.34 ^a	1.65 ^a	42.49 ^a	9.06 ^a
	2020	708.00 ^c	79.50 ^a	3.03 ^a	0.62 ^a	30.54 ^a	19.37 ^a	2.35 ^a	39.95 ^a	9.99 ^a
S×Y	p-vaule	0.9963	0.9999	0.9188	0.9817	0.9996	0.9529	0.7872	0.9293	0.9860
	F	0.0098	0.0082	0.2286	0.0981	0.0143	0.1659	0.4270	0.210	0.0851
	df	4	4	4	4	4	4	4	4	4

Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Sx Y - ANOVA p-value for interactions between independent variables (S- seeding density and Y years), F— the F-test, df- the degrees of freedom.

Table S2b. – The content of macro- and microelements of white sweet clover, mean values for interaction seeding density (S) x years (Y)

Seeding density [pcs. m ⁻²]	Years	Ca [mg g ⁻¹]	K [mg g ⁻¹]	Mg [mg g ⁻¹]	P [mg g ⁻¹]	S [mg g ⁻¹]	Fe [mg kg ⁻¹]	Mn [mg kg ⁻¹]	Mo [mg kg ⁻¹]	Cu [mg kg ⁻¹]	Zn [mg kg ⁻¹]
500	2018	12.55 ^a	23.98 ^a	3.36 ^a	2.72 ^a	2.86 ^a	81.02 ^a	18.28 ^a	2.90 ^{abc}	7.89 ^a	15.79 ^a
	2019	10.61 ^a	20.53 ^a	2.85 ^a	4.39 ^{abc}	2.75 ^a	84.60 ^a	11.37 ^a	4.33 ^{bc}	6.30 ^a	19.10 ^a
	2020	13.30 ^a	19.87 ^a	2.24 ^a	4.78 ^{bc}	3.72 ^a	144.82 ^b	16.02 ^a	1.05 ^a	7.15 ^a	18.73 ^a
1000	2018	11.25 ^a	25.81 ^a	3.35 ^a	2.91 ^a	2.92 ^a	64.67 ^a	15.60 ^a	3.65 ^{abc}	6.23 ^a	13.07 ^a
	2019	11.33 ^a	19.55 ^a	3.00 ^a	4.28 ^{abc}	2.88 ^a	99.01 ^{ab}	13.15 ^a	4.17 ^{abc}	6.68 ^a	18.17 ^a
	2020	13.82 ^a	18.53 ^a	2.35 ^a	4.77 ^{bc}	3.77 ^a	116.08 ^b	16.25 ^a	1.42 ^{ab}	6.47 ^a	18.58 ^a
1500	2018	12.02 ^a	25.04 ^a	3.35 ^a	3.09 ^{ab}	3.05 ^a	67.90 ^a	18.38 ^a	4.71 ^c	4.83 ^a	15.40 ^a
	2019	9.50 ^a	19.75 ^a	2.99 ^a	4.33 ^{abc}	2.60 ^a	101.54 ^b	11.70 ^a	3.67 ^{abc}	5.90 ^a	18.18 ^a
	2020	13.99 ^a	19.98 ^a	2.42 ^a	5.15 ^c	3.72 ^a	116.50 ^b	16.38 ^a	1.27 ^{ab}	6.65 ^a	19.73 ^a
p-vaule		0.7228	0.9907	0.9464	0.9572	0.9768	0.9064	0.7614	0.4275	0.5732	0.8523
SxY		0.519	0.0682	0.1788	0.1570	0.1116	0.2491	0.4638	1.0117	0.7461	0.3327
df		4	4	4	4	4	4	4	4	4	4

Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Sx Y - ANOVA p-value for interactions between independent variables (S- seeding density and Y years), F—the F-test, df- the degrees of freedom.

Table S3a. Plant measurements, yield and chemical composition of white sweet clover, mean values for interaction harvesting stages (H) x years (Y).

Harvesting stages	Years	Plant population after emergence [pcs. m ⁻²]	Plant height [cm]	Green matter yield [kg m ⁻²]	Dry matter yield [kg m ⁻²]	Share of leaves [%]	Total protein [% DM]	Crude fat [% DM]	Fiber [% DM]	Ash [% DM]
A	2018	561.22 ^a	38.71 ^a	1.68 ^{abc}	0.27 ^{ab}	40.26 ^d	22.73 ^d	2.78 ^c	31.53 ^a	14.27 ^d
	2019	541.22 ^a	56.97 ^{bc}	0.66 ^a	0.11 ^a	40.36 ^d	20.91 ^{cd}	1.77 ^{ab}	37.40 ^{ab}	10.83 ^c
	2020	521.22 ^a	45.04 ^{ab}	1.01 ^a	0.15 ^a	41.57 ^d	21.52 ^{cd}	2.69 ^{bc}	34.72 ^a	11.20 ^c
B	2018	556.63 ^a	60.89 ^c	1.76 ^{abc}	0.35 ^{ab}	31.00 ^c	16.21 ^b	1.84 ^{ab}	38.70 ^{ab}	11.81 ^c
	2019	529.96 ^a	76.08 ^d	1.05 ^{ab}	0.21 ^a	30.51 ^c	16.40 ^b	1.76 ^{ab}	39.94 ^{ab}	10.30 ^c
	2020	509.96 ^a	69.83 ^{cd}	2.25 ^{bc}	0.40 ^{ab}	32.43 ^c	18.62 ^{bc}	2.65 ^{bc}	42.17 ^b	11.05 ^c
C	2018	545.10 ^a	169.70 ^f	2.33 ^c	0.57 ^b	23.41 ^b	16.04 ^b	1.82 ^{ab}	37.58 ^{ab}	10.26 ^c
	2019	519.26 ^a	164.82 ^f	2.81 ^{cd}	0.93 ^c	15.01 ^a	12.34 ^a	1.33 ^a	46.89 ^c	6.69 ^a
	2020	499.55 ^a	126.23 ^e	4.04 ^e	0.93 ^c	19.64 ^{ab}	16.07 ^b	1.99 ^{ab}	44.05 ^{bc}	8.36 ^b
HxY	p-vaule	0.9998	0.0000	0.0030	0.0016	0.0042	0.0442	0.0509	0.0267	0.0002
	F	0.0024	29.318	6.0151	6.7704	5.570	3.045	2.786	1.421	9.58
	df	4	4	4	4	4	4	4	4	4

Harvesting stages: A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Hx Y - ANOVA p-value for interactions between independent variables (H- harvesting stage and Y-years), F—the F-test, df- the degrees of freedom.

Table S3b. The content of macro- and microelements of white sweet clover, mean values for interaction harvesting stage (H) x years (Y).

Harvesting stage	Years	Ca [mg g ⁻¹]	K [mg g ⁻¹]	Mg [mg g ⁻¹]	P [mg g ⁻¹]	S [mg g ⁻¹]	Fe [mg kg ⁻¹]	Mn [mg kg ⁻¹]	Mo [mg kg ⁻¹]	Cu [mg kg ⁻¹]	Zn [mg kg ⁻¹]
A	2018	13.92 ^{bc}	29.45 ^d	3.21 ^a	3.08 ^{ab}	3.41 ^{bc}	113.65 ^{bc}	20.09 ^c	4.08 ^b	7.86 ^c	14.95 ^b
	2019	11.24 ^{ab}	24.87 ^c	2.68 ^a	4.89 ^d	3.15 ^b	102.74 ^{bc}	14.05 ^{abcd}	4.83 ^b	7.45 ^{bc}	18.67 ^d
	2020	15.38 ^c	20.53 ^{bc}	2.16 ^a	5.10 ^d	4.06 ^c	185.67 ^d	19.25 ^{cd}	1.13 ^a	6.80 ^b	18.90 ^d
B	2018	11.62 ^{ab}	29.23 ^d	3.27 ^a	3.47 ^{bc}	3.16 ^b	54.56 ^{ab}	18.40 ^{cd}	4.66 ^b	6.92 ^b	16.39 ^c
	2019	11.01 ^{ab}	22.47 ^{bc}	3.11 ^a	4.39 ^{cd}	2.85 ^{ab}	118.80 ^{bc}	12.77 ^{ab}	4.50 ^b	6.67 ^b	18.17 ^d
	2020	14.18 ^{bc}	21.25 ^{bc}	2.36 ^a	4.85 ^d	3.93 ^c	122.60 ^{bc}	15.95 ^{bcd}	1.60 ^a	7.47 ^{bc}	18.13 ^d
C	2018	10.28 ^a	16.14 ^b	3.59 ^b	2.16 ^a	2.25 ^a	45.38 ^a	13.77 ^{abc}	2.53 ^{ab}	4.18 ^a	12.92 ^a
	2019	9.20 ^a	12.49 ^a	3.04 ^b	3.73 ^{bc}	2.23 ^a	63.67 ^{ab}	9.40 ^a	2.83 ^{ab}	4.76 ^a	18.65 ^d
	2020	11.54 ^{ab}	16.60 ^{ab}	2.49 ^a	4.75 ^d	3.21 ^b	69.13 ^{ab}	13.45 ^{abc}	1.00 ^a	6.00 ^b	20.02 ^e
p-value		0.5065	0.0001	0.0754	0.0400	0.7647	0.0028	0.7691	0.3220	0.3995	0.0636
H x Y	F	0.860	11.442	2.542	3.141	0.459	6.0723	0.453	1.2597	1.0714	2.700
df		4	4	4	4	4	4	4	4	4	4

Harvesting stage: A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), H x Y - ANOVA p-value for interactions between independent variables (H- harvesting stage and Y-years), F—the F-test, df- the degrees of freedom.

Table S4a. Coumarin content in *Melilotus albus* leaves and stems, mean values for interactions.

Seeding density [pcs. m ⁻²]	Harvesting stage	Leaves [mg g ⁻¹]	Stems [mg g ⁻¹]
500	A	1.80 ^a	2.05 ^c
	B	1.13 ^a	1.72 ^b
	C	0.82 ^a	0.57 ^a
1000	A	1.83 ^a	2.46 ^c
	B	1.18 ^a	1.56 ^b
	C	0.85 ^a	0.60 ^a
1500	A	1.63 ^a	2.35 ^c
	B	1.10 ^a	1.45 ^b
	C	0.81 ^a	0.60 ^a
SxH	p-value	0.9959	0.1826
	F	0.0444	1.752
	df	4	4
Seeding density [pcs. m ⁻²]	Years	Leaves [mg g ⁻¹]	Stems [mg g ⁻¹]
500	2018	1.39 ^a	1.49 ^a
	2019	0.85 ^a	1.48 ^a
	2020	1.52 ^a	1.37 ^a
1000	2018	1.48 ^a	1.51 ^a
	2019	0.86 ^a	1.69 ^a
	2020	1.52 ^a	1.42 ^a
1500	2018	1.30 ^a	1.47 ^a
	2019	0.83 ^a	1.60 ^a
	2020	1.41 ^a	1.33 ^a
SxY	p-value	0.9989	0.9997
	F	0.0230	0.0112
	df	4	4

Harvesting stages: A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$) ANOVA p value for main interactions effects: (S × H, S × Y) between (S- seeding density, H- harvesting stage and Y years), F—the F-test, df- the degrees of freedom.

Table S4b. Coumarin content in *Melilotus albus* leaves and stems, mean values for interactions.

Harvesting stage	Years	Leaves [mg g ⁻¹]	Stems [mg g ⁻¹]
A	2018	1.97 ^c	2.32 ^c
	2019	1.33 ^b	2.39 ^c
	2020	2.16 ^c	2.15 ^c
B	2018	1.36 ^b	1.50 ^b
	2019	1.10 ^b	1.89 ^b
	2020	0.96 ^a	1.33 ^b
C	2018	0.69 ^a	0.65 ^a
	2019	0.71 ^a	0.49 ^a
	2020	0.83 ^a	0.64 ^a
p-value		0.0000	0.0425
HxY	F	29.420	3.083
df		4	4

Harvesting stages: A – before budding, B – budding, C – full flowering. Different letters in the same column indicate significant differences (Tukey's honest significant difference test, $p < 0.05$), Hx Y - ANOVA p-value for interactions between independent variables (H- harvesting stage and Y-years), F – the F-test, df- the degrees of freedom.