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Management strategies to increase botanical diversity at grassland with a history of intensive agricultural management

Aim

To decrease amount of cultural species to create more space for biodiversity of wild species in a former grassland disturbed by 32 years in rotation with intensive agricultural management.

Locality and management

Before 1955: Low- lying meadow/pasture on peat soil.
1955-1987: Intensive production – mainly grain.
1988-1996: No fertilizer, late cutting followed by grazing – mostly sheep
1997-2007: Different management in experimental plots in three blocks.

Continuous cattle grazing (GG).
Early (ECG) or late cut (LCG) followed by grazing.
Two cuts. First cut early (ECC) or late (LCC).
Addition of K-fertilizer with early cutting and two cuts (FECC). Abandonment (A).

Results and comments

Continuous summer grazing (GG)
Flowering in June decreased (eaten by animals).
No establishment of a rosette species (*Cirsium palustre*, Ellenberg N=3) (too disturbed ground).

Early cut with (ECG) and without grazing (ECC)
First cut 10th June
Flowering in June increased if cutting was followed by grazing.
Deschampsia caespitosa (EN=3) and *Juncus effusus* (EN=4) increased if early cutting was followed by grazing (stratification by cattle).
Cultural species did not decrease.
'Other herbs' increased with early and two cuts.

Late cut with (ECG) and without grazing (ECC)
First cut 15th July
Flowering in June increased if cutting was followed by grazing.
D. caespitosa (EN=3) increased.
Cultural species decrease.
'Other herbs' did not increase.
Bad establishment of a rosette species (*C. palustre*, EN=3) (the sward was too competitive).

Fertilized (FECC). First cut 10th June
Phalaris arundinacea (EN=7) increased (high nutrient uptake).

Abandonment (AA)
Increase in species in the first years.
Flowering decreased (postponed flowering).
Good establishment of a rosette species (*C. palustre*, EN=3) (bare peat ground followed stop of management).
P. arundinacea (EN=7) increased (nutrient mobilization).
Cultural species decreased.

The effect of management strategies on species groups and single species.
The unit is species abundance (PS, Sum of Point) per 5m².
E: Cut 10th June. L: Cut 15th July.
Light grey: Values differ from the reference year (Ref.) 1997. (*α = 0.05*).

		Ref.	After 6 years of management (2003), n=21							After 10 years of management (2007), n=21						
1st Treatment Cut time			Graze	Cut E	Cut L	Cut E	Cut L	Fertill. E[1]	Aban don	Graze	Cut E	Cut L	Cut E	Cut L	Fertill. E	Aban don
2nd Treatment			Graze	Graze		Cut	Cut	Cut	ment	Graze	Graze		Cut	Cut	Cut	ment
		1997	G G	EC G	LC G	EC C	LC C	FEC C	A A	G G	EC G	LC G	EC C	LC C	FEC C	A A
Species	PS	81	119	132	135	117	105	94	106	95	115	106	114	107	112	86
Flowering	PS	44	.	.	.	.	.	.	.	19	69	63	41	47	40	9.7
D. caespito.	PS	0.71	4.7	5.0	9.7	2.0	4.7	1.3	6.0	7.3	9.7	14.3	5.7	13.3	2.3	5.7
J. effusus	PS	0.75	2.3	1.3	2.3	1.3	2.3	2.0	0	1.7	5.0	3.3	1.3	1.3	1.3	0
P. arundina.	PS	7.1	6.0	7.7	3.7	11.0	9.3	9.7	4.3	9.0	3.0	6.0	13.3	9.3	17.3	13.7
Cultural sp.	PS	26	22	21	22	25	15	9	12	12	20	7	23	12	13	5
Other herbs	PS	12	32	32	26	32	15	17	35	19	16	17	30	14	25	32
C. palustre	PS	0.17	0	0	0.33	2.7	1.3	0.33	8.3	0	0.33	1.7	0.67	0	2.7	8.0

1) Cut late 1997-2004

Early cutting removes nutrients and promote establishment

Short time abandonment plots as stepping stones

Perspectives for restoration

Initial phase should include management by early and two cuttings to remove nutrients and to promote species establishment.

Small abandonment plots initially function as species stepping-stone areas.

Later on management could be late cutting to promote seed setting - followed by grazing to create different niches.

Nor continuous grazing neither late cutting alone were good options to increase diversity in wild species.