EGF 2017 - Italie (Alghero) - du 07 au 10/05/2017 - VOL 22 - Grassland resources for extensive farming systems in marginal lands : major drivers and future scenarios

Nutritive value and legume content of multi-species swards managed under four cuts per year on organic farms

Decruyenaere V.[1], Farinelle A.[3], Faux A.-M.[2] and Stilmant D.[2]
[1]*CRAW – Walloon Agricultural Research Centre, Production and Sectors Department, 5030 Gembloux, Belgium;* [2]*CRAW – Walloon Agricultural Research Centre, Agriculture and Natural Environment Department, 6800 Libramont, Belgium;* [3]*Fourrages Mieux asbl, 6900 Marloie, Belgium*

Abstract

Increasing forage production is a key strategy to reach feed self-sufficiency on cattle farms. On organic farms, multi-species swards (MSS) are commonly sown and often contain at least 5 plant species. Our objective was to monitor the forage yield, nutritive value and botanical composition of different MSS along the growing season on commercial farms. In 2015, five MSS (MSS1 to 5) were studied on three farms located in Wallonia (Farm1: 3 MSS; Farm2: 2 MSS; Farm3: 2 MSS). MSS3 was present in the three farms. Recorded parameters included the proportion of plant species per cut, and the dry matter (DM) yield, chemical composition, digestibility and nutritive value after pre-wilting. Annual DM yield was mainly linked to sward management and agricultural area (few differences between MSS within farms). Across all cuts, on average (weighted mean), crude protein content (CP) was less than 15% DM, and organic matter digestibility reached 75%. CP increased from cut 1 to cut 3. Plant species proportion varied according to the cut, farm and MSS.

Keywords: grass-legume proportion, yield, nutritive value evolution, organic farming

Introduction

Increasing forage production is crucial to reach feed self-sufficiency on cattle farms. On organic farms, grasslands are often the basis of ruminant diets. In such grassland systems, multi-species swards (MSS) are commonly sown to secure forage stocks. The species in MSS can present various functional and structural advantages and, due to their complementarity, contribute to stabilize grassland yield, both in quantity and quality under low input management systems. This is particularly important under erratic weather conditions. In such a context, this study aimed to follow the performances of several MSS on commercial farms and, in particular, the evolution of forage yield, nutritive value and proportions of grasses and legumes in relation to the number of cuts.

Materials and methods

In 2015, commercial multi-species swards (MSS) from temporary grasslands were monitored on three organic dairy farms in Wallonia. MSS were studied at each cut, and four cuts were taken. All MSS seed mixtures contained both grass and legumes species (Tables 1 and 2). The dry matter (DM) yield (t DM ha^{-1}) was measured after pre-wilting at each cut. Sampling was performed at the cut to determine the MSS botanical composition and after pre-wilting to evaluate the forage quality. Forage samples were oven dried (60 °C, 48 h) to determine the DM content. Botanical composition of MSS was obtained by hand-sorting. Plant species were oven dried (60 °C, 48 h) to determine the proportion of each species in MSS, expressed as % of dry weight. All dried samples were ground in a hammer mill and in a Cyclotec mill (1 mm screen, FOSS), and submitted to Near Infrared Reflectance analysis (FOSS – XDS NIR system). Crude protein (CP), cellulose (CEL) and *in vitro* organic matter digestibility (OMD according to De Boever *et al.*, 1988) were estimated according to NIR model developed at CRAW. Nutritive value of forage was then estimated according to the VEM-DVE system.

Table 1. Proportion of seed

	Trifolium pratense	i r
MSS1	0.06	(
MSS2	0.06	(
MSS3	0.20	(
MSS4	0.10	(
MSS5	0.09	(

[1] *Trifolium* sp. = *Trifolium resupina*

Table 2. MSS per farm, typ

	Farm1
	MSS1
Soil type	Sandy-loam
Surface (ha)	2.5
Sowing (year)	2012 (autu
Date of cuts	20/05; 08/0
Fertilisation	compost

[1] MSS = multi species sward; C =

Results and dis

DM yield, chemica
yield was 9.9±1.2 t
Annual DM yields
on Farm2 probably
the DM yield. C1 v
lower energy value
lower CEL content
the 45% ideal value

Table 3. Annual dry matte

		DM yi (t ha
Farm1	MSS1	11.6
	MSS2	9.3
	MSS3	10.7
Farm2	MSS4	8.2
	MSS3	8.9
Farm3	MSS5	10.5
	MSS3	10.4
Mean		9.9
SD		1.2

wards

, 5030 Gembloux,
Environment
m

farms. On organic
plant species. Our
ı of different MSS
:e studied on three
was present in the
and the dry matter
. Annual DM yield
ween MSS within
ess than 15% DM,
species proportion

g

On organic farms,
s swards (MSS) are
onal and structural
l, both in quantity
der erratic weather
ISS on commercial
ons of grasses and

ıonitored on three
ken. All MSS seed
DM) yield (t DM
t to determine the
rage samples were
iS was obtained by
ı of each species in
and in a Cyclotec
OSS – XDS NIR
(OMD according
W. Nutritive value

Table 1. Proportion of seeds in the multi species swards (MSS) at sowing.[1]

	Trifolium pratense	*Trifolium repens*	*Trifolium* sp.	*Medicago lupulina*	*Lotus corniculatus*	*Lolium* sp.	*Dactylis*	*Festuca*	*Phleum*
MSS1	0.06	0.12				0.20	0.17	0.26	0.19
MSS2	0.06	0.06	0.09			0.31	0.15	0.27	0.06
MSS3	0.20	0.12	0.10	0.05	0.05	0.26	0.08	0.06	0.08
MSS4	0.10	0.10				0.54		0.27	
MSS5	0.09	0.05	0.05	0.02	0.02	0.28	0.31	0.14	0.04

[1] *Trifolium* sp. = *Trifolium resupinatum* and/or *Trifolium hybridum*.

Table 2. MSS per farm, type of soil and date of cuts (C1, C2, C3 and C4).[1]

	Farm1			Farm2		Farm3	
	MSS1	MSS2	MSS3	MSS4	MSS3	MSS5	MSS3
Soil type	Sandy-loam (85%)			Loam (89%)	Loam (82%)	Loam (87%)	Loam (89%)
Surface (ha)	2.5			3.2	3.9	6.2	3.2
Sowing (year)	2012 (autumn)			2014 (autumn); under cover of barley and oat for MSS3		2013 (autumn)	
Date of cuts	20/05; 08/07; 31/08; 29/09			15/05; 29/06; 06/08; 26/09		08/05; 13/06; 30/07; 23/09	
Fertilisation	compost			slurry: 22 m^3 ha^{-1} before sowing (MSS3) and 18 m^3 ha^{-1} after C1		digesta: 20 m^3 ha^{-1} in spring	

[1] MSS = multi species sward; C = cut.

Results and discussion

DM yield, chemical composition and nutritive value at harvest are presented in Table 3. Total annual DM yield was 9.9±1.2 t ha^{-1}. This result was in agreement with the national Belgian statistics (INS, 2013). Annual DM yields were quite similar to each other at the farm scale. On average, they appeared lower on Farm2 probably linked to sward management (sowing year). On average, C1 contributed to 43% of the DM yield. C1 was late and accounted for more than 50% of DM yield on Farm1, which resulted in a lower energy value of the silage. MSS from Farm 2 and Farm3 were cut earlier (C1) and therefore had a lower CEL content and were more digestible than MSS from Farm1. Total DM content was higher than the 45% ideal value for pre-wilted silage.

Table 3. Annual dry matter (DM) yield, chemical composition and nutritive values of multi species sward (MSS).

		DM yield	C1	C2	C3	C4	DM	CP	CEL	OMD	VEM	DVE
		(t ha^{-1} $year^{-1}$)	Proportion in annual DM yield (%)				%	% DM	% DM	% DM	kg DM^{-1}	g kg DM^{-1}
Farm1	MSS1	11.6	54.4	20.0	18.8	6.7	52.6	10.2	28.0	72.6	881	69.9
	MSS2	9.3	50.2	18.4	21.1	10.3	50.4	12.4	27.6	74.0	887	76.1
	MSS3	10.7	53.7	19.8	18.0	8.6	52.0	10.9	28.0	71.4	878	71.3
Farm2	MSS4	8.2	38.3	23.2	14.0	24.5	55.5	12.2	23.4	78.5	951	82.4
	MSS3	8.9	34.0	21.5	17.7	26.8	63.0	12.9	24.1	77.0	935	82.6
Farm3	MSS5	10.5	36.3	24.3	17.3	22.1	48.2	10.6	23.5	81.2	972	81.3
	MSS3	10.4	39.1	17.4	23.3	20.2	46.7	12.2	24.4	77.0	928	80.6
Mean		9.9	43.7	20.7	23.3	20.2	52.6	11.6	25.6	75.9	919	77.7
SD		1.2	8.7	2.5	3.0	8.3	5.4	1.0	2.2	3.5	37	5.4

The botanical composition per cut is given in Table 4. On Farm1 and Farm2, the proportion of legumes increased from C1 to C3, regardless the MSS. On Farm3, the proportion of legumes was lower for all cuts and MSS. CP content increased from C1 to C4 for all MSS on Farm1 and Farm2, as a consequence of the higher legume proportion in C2 and C3 and of nitrogen mineralisation (C4). Ryegrass was the most abundant grass in C1. Ryegrass and especially *Lolium multiflorum*, present in all MSS, is a competitive species characterized by a rapid spring growth. In autumn (C4), *Dactylis* showed a good regrowth and even exceeded that of ryegrass. Fescue and timothy were scarce. Their highest proportions were found in MSS1 and MSS2 which contained the highest proportion of these species in seeds mixture. Red clover was the main legume species in C3.

Conclusions

This descriptive study provides an illustration for a group of farmers of changes in grass-legume proportions of MSS. In temporary grasslands, species equilibrium is variable and depends on grassland management, which was not studied here. On this basis, MSS present satisfactory annual DM yields and produce good quality forage. As expected, legume proportion increased from C1 to C3, which influenced both forage quantity and quality. The variability in species proportions among cuts and MSS remained high. The control of these proportions, using adapted management schemes, remains a key challenge for MSS.

Table 4. Grass-legume proportions and crude protein content per multi species sward (MSS) cut.[1]

Parameters	Cut	Farm1			Farm2		Farm3		Mean (SD)
		MSS1	MSS2	MSS3	MSS4	MSS3	MSS5	MSS3	
White Clover (% DM)	C1	3.6	15.4	8.6	5.1	6.0	5.7	4.2	6.9 (4.0)
	C2	13.0	37.7	13.1	12.5	17.2	13.8	8.9	16.6 (9.6)
	C3	5.9	23.0	8.2	12.0	15.0	22.0	18.4	14.9 (6.6)
	C4	20.8	33.5	18.8	20.2	20.9	21.1	3.6	19.8 (8.7)
Red Clover (% DM)	C1	16.9	2.2	12.0	6.6	5.0	8.2	17.0	9.7 (5.8)
	C2	42.9	7.7	40.7	24.4	22.8	1.5	12.0	21.7 (15.9)
	C3	76.3	37.4	65.3	75.8	70.2	10.1	24.6	51.4 (27.0)
	C4	15.7	3.8	16.6	49.3	58.3	10.7	32.6	26.7 (20.6)
Ryegrass sp. (% DM)	C1	70.0	22.7	46.9	45.8	67.8	79.8	67.5	57.2 (19.7)
	C2	36.7	9.9	37.9	32.7	53.1	79.2	70.0	45.6 (23.7)
	C3	4.1	7.7	5.4	10.0	10.4	61.4	32.1	18.7 (21.1)
	C4	2.8	50.6	7.9	5.4	4.4	7.0	2.8	11.6 (17.3)
Dactylis (% DM)	C1	1.1	40.0	30.9	0.3	20.8	6.3	11.2	/
	C2	2.0	34.7	6.4	4.1	2.7	4.8	6.9	/
	C3	12.0	30.9	12.8	0.9	4.4	5.7	19.0	/
	C4	15.4	7.3	41.3	6.9	16.4	38.2	57.0	/
Crude protein (% DM)	C1	7.2	9.6	7.7	8.1	9.9	9.3	10.5	/
	C2	10.3	11.4	10.9	11.2	11.8	8.5	10.6	/
	C3	15.6	16.1	16.0	16.5	13.1	11.2	14.1	/
	C4	20.1	20.2	19.1	14.7	17.5	14.7	14.9	/

[1] C = cut; DM = dry matter; SD = standard deviation

References

De Boever J.L., Cottyn B.G., Andries J.I., Buysse F.X. and Vanacker J.M. (1988). The use of pepsin cellulase technique to predict digestibility metabolizable and net energy of forages. *Animal Feed Science and Technology* 19, 247-260.

INS, 2013. Avaialble at: http://tinyurl.com/hyftebx.

Parasitism a
farming mar

Faux A.-M.[1], Decru
[1]*CRAW – Walloon*
6800 Libramont, B
Department, 5030

Abstract

Organic farmers a
parasitism issues an
with respect to para
approach. Six orga
2015 and 2016. Re
abundance in faece
supplement, if any,
between recorded
a positive correlatio
number of plots we
and parasitic pressu
stocking rate for cc

Keywords: cattle,

Introduction

Parasitism is a ma
more important in
use of anti-parasite
limited impact on
populations is the
herd, grass and fee
2014). Here, we in
dairy and beef far

Materials and

A survey was run
All Farms were lo
591 (Farm 6) m a.
grazing season (P
in Farms 4 and 5
soils with shale an
slightly stony and

Heifers were wei
Faeces were colle
noted on scale of
Paramphistomum
measured at the e