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Impact of grazing intensity on feed intake , herbage mass , and animal productivity in the steppe of Inner Mongolia , China

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Key words : sheep , grazing intensity , semi-arid grassland

Introduction In Inner Mongolia in the north-east of China the grassland steppe is traditionally used for grazing . In the last three decades overgrazing by sheep led to a sparely cover of vegetation in winter and enables soil erosion and hence degradation of the grassland . The aim of this study , which is part of a Sino-German DFG research project ,is to evaluate the effect of grazing intensity (GI , sheep/ha) on grassland and animal performance and to determine an optimal grazing intensity , which realizes a high animal and grassland performance in a sustainable way .

Materials and methods Grazing experiments were conducted from July to September in the Inner Mongolia steppe in 2005 and 2006 with six different stocking rates (1 .5 , 3 .0 , 4 .5 , 6 .0 , 7 .5 , and 9 .0 sheep/ha) and two replications . Six sheep per plot were given titanium dioxide (TiO₂) as marker in the first ten days of each month and faecal grab samples were obtained from day 6 to 10 . Faeces were analysed for crude protein to estimate the organic matter digestibility (dOM) with a regression equation (1) , and for TiO₂ (2) to estimate the total faecal output and hence the organic matter intake (OMI) . After each sampling period , daily live weight gain (LWG) of all sheep was determined . Herbage mass (HM) was determined by cutting the sward at 1 cm above ground level on three representative areas in each plot .

Results and discussion The HM decreased with increasing GI (P=0 .033) as shown in Table 1 . The dOM , OMI , and DOMI were not different between the GI's . However , OMI and DOMI per ha increased with increasing GI (P<0 .001) . The LWG per sheep was not influenced by GI (P=0 .155) . However , LWG per ha increased with increasing GI (P=0 .039) .

The LWG per sheep was highest on the lowest GI's and tended to decrease with increasing GI , whereas LWG per ha was highest on the GI with 9 .0 sheep per ha . Accordingly , the highest OMI and DOMI per sheep were obtained on the lowest GI's and tended to decrease with increasing GI whereas the maximum OMI and DOMI per ha were found on the highest GI's . All parameters were significantly influenced by year and period . The influence by year may due to the great variability in precipitation between the years , which affects the herbage quality like dOM (55 .3% in 2005 and 58 .5% in 2006) ,CP (9 .5% in 2005 and 13 .8% in 2006) and NDF (72 .1% in 2005 and 67 .7% in 2006) .

Conclusions The results show the strong impact on GI on grassland productivity . On the short term , heavy grazing lead to high OMI , DOMI , and LWG per ha . However , on the long term negative effects of high GI's on the grassland productivity are expected and , therefore , this study should be continued for further years to show the long term effect of GI and to determine the optimum for a sustainable use .

Table 1 *Effects of grazing intensity on herbage mass , digestibility of organic matter , feed intake , and live weight gain by sheep and by ha .*

	Grazing Intensity						Level of significance				
	1 .5	3 .0	4 .5	6 .0	7 .5	9 .0	SEM	GI	P	GI x P	Year
dOM (%)	57 .9	56 .9	56 .9	56 .4	56 .4	55 .9	0 .63	0 .368	<0 .001	0 .989	<0 .001
OMI (g/sheep/d)	1271	1271	1258	1191	1017	1214	61	0 .157	0 .008	0 .190	0 .036
DOMI (g/sheep/d)	736	727	719	676	576	682	37	0 .153	<0 .001	0 .410	0 .008
LWG (g/sheep/day)	96	104	83	72	67	69	9 .4	0 .155	0 .042	0 .087	<0 .001
HM (kgDM/ha)	1232[a]	1001[ab]	526[ab]	606[ab]	423[ab]	370[b]	143	0 .035	<0 .001	0 .045	<0 .001
IOMha (kg/ha)	1 .91[a]	3 .81[b]	5 .66[c]	7 .15[c]	7 .52[c]	10 .89[d]	0 .32	<0 .001	0 .006	0 .468	0 .035
IDOMha (kg/ha)	1 .10[a]	2 .18[ab]	3 .23[bc]	4 .06[c]	4 .26[cd]	6 .11[d]	0 .21	<0 .001	<0 .001	0 .401	0 .007
LWG (g/ha)	164[a]	319[ab]	379[ab]	432[ab]	495[ab]	623[b]	65 .5	0 .039	<0 .001	0 .003	<0 .001

[abcd] Means of grazing intensity with different superscript differ (P<0 .05)
GI=Grazing intensity ; P=period ; GI x P=interaction between grazing intensity and period

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