Effect of Stocking Density of Yak (*Bos grunniens*) on Floral Diversity and Biomass of Rangeland in Northern Qinghai-Tibetan Plateau

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Key words : yak , stocking density , floral diversity , biomass , alpine rangeland , Qinghai-Tibetan Plateau

Introduction Degradation of alpine rangelands in Qinghai-Tibetan Plateau was reported by Song *et al* . (2006) and Li *et al* . (2006) . It is considered that it has been caused by an increase in the numbers of domestic animals following the rise of human populations in addition to global warming . The purpose of this trial was to investigate the effect of stocking density of yaks in set-stock-grazing system on vegetation of rangeland in Qinghai-Tibetan Plateau for preventing the rangelands from deterioration and desertification .

Materials and methods Experiment was conducted in *Elymus nutans*-dominant alpine meadow which was utilized as cold-season-grazing paddock from 1996 to 2004 in Mengyuan Prefecture , Heibei State , Qinghai Province , China . From May in 2005 , 3 one-year-old yaks were set-stocked in each of paddocks with different stocking rates of heavy (H) , moderate (M) , light (L) and control (C) treatments as given in Table 1 . Vegetation was evaluated by 5 50 cm x 50 cm quadrats for each treatment and aboveground biomass were measured by cutting plants in quadrats which were classified into plant species and dried with electric oven in Augusts , 2005 and 2006 .

Results and discussion Vegetation coverage was the highest in C among treatments followed by that in L in 2005 and 2006 . Aboveground biomass was negatively correlated with stocking rate in 2005 ($r=-0.903$, $p<0.1$) and in 2006 ($r=-0.987$, $p<0.01$) , and decreased significantly in M and L between 2 years ($p<0.05$) . Richness index was the smallest in H among treatments but other items did not differed . It was considered that increase of intake which was caused by growth of yaks decreased dramatically aboveground biomass between 2 years especially in M and H by overgrazing .

Table 1 *Characteristics of plant communities in pasture under different stocking rates .*

Item		Treatment			
		Heavy	Moderate	Light	Control
Stocking rate , head/ha		6 .25	4 .11	3 .23	0
Vegetation coverage ,%	2005	82 .5±5 .7^{c}	85 .4±3 .6^{c}	90 .0±3 .1^{b}	96 .6±2 .3^{a}
	2006	70 .0±5 .0^{d}	81 .0±4 .2^{c}	94 .6±2 .9^{b}	100 .0±0 .0^{a}
Height of community , cm	2005	17 .8±4 .4^{ab}	16 .3±3 .7^{b}	19 .8±4 .1^{ab}	24 .1±8 .8^{a}
	2006	5 .2±1 .3^{d}	8 .9±2 .3^{c}	14 .5±4 .9^{b}	25 .4±2 .4^{a}
Aboveground biomass , gDM/m^2	2005	444 .6±134 .6	473 .9±94 .7	583 .5±167 .4	601 .1±139 .0
	2006	240 .4±91 .2^{c}	280 .0±52 .8^{c}	442 .8±84 .4^{b}	626 .4±159 .0^{a}
Richness index , No . of species/m^2		20 .6±9 .1^{b}	26 .0±4 .9^{ab}	28 .2±2 .6^{a}	23 .6±3 .2^{ab}
Shannon—Wiener diversity index		2 .238±0 .821	2 .454±0 .352	2 .493±0 .213	2 .550±0 .128
Simpson diversity index		0 .825±0 .169	0 .869±0 .053	0 .886±0 .035	0 .898±0 .012
Pielow evenness index		0 .750±0 .146	0 .754±0 .069	0 .747±0 .053	0 .808±0 .039

[a,b,c] Mean±SD with different letters within a row differ significantly at $p<0.05$.

Conclusion From these results , proper stocking rate of mature yak older than 2 years old in set-stock-grazing system was estimated to be less than 1 .8 head/ha for securing the enough intake during cold season .

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References

Song R . , Hasegawa N . , Idota S . , Li G . , Nishiwaki A . , Jiu C . , Xu N . , Zhou Q . (2006) . Botanical composition , aboveground biomass and grazing behaviour of yak (*Bos grunniens*) in the southern rangeland of Qinghai Province , China . *Acta Prataculturae Sinica* . 15 (suppl .) . 289-291 .

Li G . , Hasegawa N . , Song R . , Fukuda A . , Li H . , Xu Y . , Xu N . (2007) . Spatial variety in vegetation of *Potentilla fruticosa* rangeland rotationally grazed by yak (*Bos grunniens*) in warm and cold seasons on the distance to night paddock in northern Qinghai-Tibetan Plateau . *Animal Behaviour and Management* . 43 . 83-98 .(in Japanese with English abstract)