Studies on Characteristics of Soil Moisture of *Stipa bungeana* Typical Steppe under Different Land Disturbances in Hilly Area of Loess Plateau

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Studies on characteristics of soil moisture of *Stipa bungeana* typical steppe under different land disturbances in hilly area of Loess Plateau

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Key words :Soil Moisture Changes , Moisture Balance , Land Disturbances , Typic Steppe , Hilly Area of Loess Plateau

Introduction Soil Moisture is influenced by rainfall and also by land use (Gerd *et al* . ,2003 ; Basica *et al* . ,2001) .We examined how ungrazed rangeland and areas manipulated by parallel ditches and fish-scale pits compare with respect to restoration effects in areas of *Stipa bungeana* typical steppe in an arid hilly area of Loess Plateau in Ningxia .These treatments enhanced utilization of water resource , however , there is potential danger that previous water resource distribution and water utilization balance could be disrupted .Therefore , it was helpful for ecosystem management to study characteristics of soil moisture with respect to these treatments .

Materials and methods The area of investigation is located in Renwan village of Pengyang county in Ningxia (35°50′N , 106°39′E) . The regional climate is continental , with average annual rainfall of 440mm and evaporation capacity of 1360 .6mm .(1) Sampling sites .Three treatments including ungrazed grassland (BU) , parallel ditches (PD) and fish-scale pits (FP) in three sloping positions were selected as sampling sites .Three sloping positions involved upgrades (UG , altitude was 1565m) , mesoslopes (MS , altitude was 1536m) and downgrades (DG , altitude was 1516m) .These three measures have been carried out for 5 years and the vegetation in sampling sites presented no differences .The predominant plant species was *S .bungeana* . (2) Moisture measurements .Soil moisture in the depth of 0-200cm was measured once every ten-days between March and December in 2006 by drying method .Meanwhile , we designed runoff experimental plot and surveyed runoff collected by parallel ditches after raining .

Results The soil moisture content was most in parallel ditches (Figure 1) , was more in fish-scale pits , was least in ungrazed grasslands with the change of time ($p<0.01$) .The difference of soil moisture content among them was more evident in rainy days .The order of soil moisture content in ungrazed grasslands from highest to lowest was downgrades , mesoslopes and upgrades ($p<0.01$) .The order of soil moisture content in fish-scale pits and parallel ditches from highest to lowest wholly was mesoslopes , downgrades and upgrades ($p<0.05$) , but it had no difference between upgrades and downgrades ($p>0.05$) .Soil moisture content variation in depth of 0-40cm was biggest in ungrazed grasslands , bigger in fish-scale pits , and smallest in parallel ditches , but variation in depth of 40-200cm was biggest in fish-scale pits (Tab .1) .Except rainy season , soil moisture in depth of 0-130cm in parallel ditches and ungrazed grasslands were in negative balance in most of the year (Tab .2) .Soil moisture in parallel ditches was easier to become negative balance than that in ungrazed grasslands when rainfalls and runoffs were less . Surplus of soil moisture in parallel ditches was higher than that in ungrazed grasslands only when parallel ditches intercepted more runoffs .

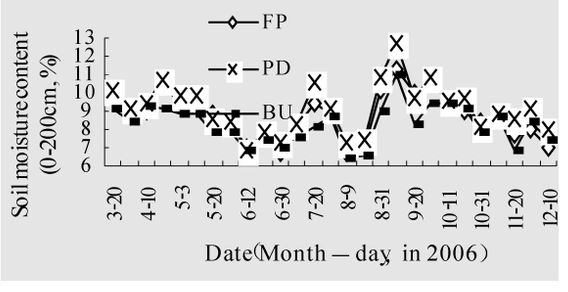

Figure 1 *Seasonal changes of soil moisture content under three measures .*

Table 1 *Statistic eigenvalue about soil moisture contents of different depth soil under three measures .*

Items	Depth (cm)	FP	PD	BU
Standard deviation	0-40	2 .84	2 .80	2 .87
	40-100	1 .56	1 .47	1 .33
	100-200	0 .75	0 .76	0 .53
Coefficient of variation (%)	0-40	28 .17	26 .53	29 .18
	40-100	18 .49	16 .85	17 .18
	100-200	9 .59	9 .13	7 .18

Conclusions Based on seasonal changes and balance of soil moisture under three measures , we conclude that PD and FP could improve soil moisture content in arid hilly area of Loess Plateau , especially in rainy days . However , soil moisture in PD is easier to become negative balance than that in BU when rainfalls and runoffs are less .

Table 2 *Balance of soil moisture under Bu or PD measures(0-130cm) .*

Date	Measures	Changes of soil moisture (mm)	Rainfall (mm)	Runoff or runoff being intercepted (mm)	Moisture loss (mm)	Water balance
March to Jun .	BU	-33 .49	80 .81	0	114 .30	-33 .24
	PD	-46 .68	88 .60	0	135 .28	-46 .86
Jul .to Sep .	BU	30 .01	199 .84	13 .46	156 .37	29 .78
	PD	50 .69	219 .10	53 .83	222 .24	52 .13
Oct to Dec .	BU	-27 .72	26 .64	0	54 .36	-27 .71
	PD	-36 .54	31 .40	0	67 .94	-36 .49
March to Dec .	BU	-31 .20	307 .29	13 .46	325 .03	-32 .21
	PD	-32 .53	339 .10	53 .83	425 .46	-31 .52