Effects of Slope and Defoliation Intensity on the Effectiveness of Desert Wheatgrass for Reduced Runoff and Soil Erosion under Simulated Rainfall

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The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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Key words: runoff, sediment, desert wheatgrass, defoliation, sloping lands

Introduction In order to protect reservoir from non-point source pollution, one of the best management practices is to restore the sloping farmlands to grasslands in the areas surrounding the reservoir. Desert wheatgrass (*Agropyron desertotrum* (Fisch.) Schult.) is notable for its drought resistance and strong ability to stabilize soils and reduce erosion due to the deep penetration of root system and easy establishment. The objective of this study was to evaluate the effects of slope and defoliation intensity on the effectiveness of desert wheatgrass for runoff and sediment reduction.

Materials and methods The experiment was a split-plot with a randomized complete block design. Slope 30% vs. 15% were the two main plots and ground cover types (bare ground, desert wheatgrass defoliated at 6 cm stubble height, and desert wheatgrass defoliated at 12 cm stubble height) as the subplots (1.5 m wide by 4.6 m long) in each block with 3 replicates. The desert wheatgrass was established in the fall of 2005 and defoliated whenever it entered the heading period in 2006 and 2007 and the accumulated forage yield was summarized. In 2006 (the desert wheatgrass got full growth from last defoliation) and in 2007 (the desert wheatgrass was just harvested), two separate simulated rainfalls at a rate of 55 mm h^{-1} for 20 min were applied to the plots on consecutive date; the former represented dry soil condition (Dry Run) and the latter represented wet soil condition (Wet Run). Data were analyzed using SAS 8.02 PROC ANOVA procedure.

Results No significant effect of stubble height was detected on the accumulated forage yield, but 15% slop produced more than 30% slope (data not shown). In the simulated rainfall experiments, 30% slope produced higher runoff and sediment than 15% slope in Dry Run in 2006 and only higher sediment in Wet Run in 2006 and Dry Run in 2007 (Table 1). Plot of 12 cm stubble defoliation produced significantly lower runoff than plot of 6cm stubble defoliation and bareground and least sediment, although the difference was not significant vs. 6cm stubble defoliation plot.

Table 1 *Effects of slope and ground cover type on the runoff and sediment loss in dry run and wet run in 2006 & 2007.*

		2006				2007			
		Dry run		Wet run		Dry run		Wet run	
		Runoff	Sediment	Runoff	Sediment	Runoff	Sediment	Runoff	Sediment
		mm	Mg ha^{-1}	mm	Mg ha^{-1}	mm	Mg ha^{-1}	mm	Mg ha^{-1}
Slope	15%	1.44^{b}	0.65^{b}	3.65^{a}	1.68^{b}	2.63^{a}	1.16^{b}	7.36^{a}	3.47^{a}
	30%	2.09^{a}	2.03^{a}	4.63^{a}	3.63^{a}	3.16^{a}	2.82^{a}	7.52^{a}	4.49^{a}
Cover type	Bare	1.86^{a}	3.67^{a}	5.35^{a}	6.69^{a}	3.67^{a}	5.06^{a}	9.45^{a}	10.56^{a}
	6cm	2.08^{a}	0.23^{b}	4.66^{a}	0.44^{b}	3.01^{ab}	0.56^{b}	7.36^{b}	0.86^{b}
	12cm	1.35^{b}	0.12^{b}	2.42^{b}	0.23^{b}	2.00^{b}	0.35^{b}	5.51^{c}	0.53^{b}

Note: means with different letters in same column within group of slope or cover type are significantly different at 0.05 level.

Conclusions When using desert wheatgrass as vegetative materials for restoration of sloping lands, 12 cm-stubble defoliation could be a reliable management practice for its good performance in both soil and water conservation and forage production.

Acknowledgements This study was funded by the New Star Projects of Beijing Municipal Sci. & Tech. Commission.