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Research and Extension



Introduction

Impact of Stubble Height on **Soil Moisture Dynamics**

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Summary

Improvements in harvest efficiency (Haag et al., 2004) and perceptions regarding improved soil moisture storage have influenced the increased adoption of stripper headers. The use of stripper headers in harvesting small grains creates unique residue properties following harvest.

The impacts of wheat residue height on the wind profile (McMaster et al., 2000) and irradiant energy interception (Baumhardt et al., 2002) have been quantified and used to estimate potential evaporation.

The impacts of residue are most important in the High Plains where evaporative demand is high and fallow periods are utilized to replenish soil water supplies.

Improvements in soil water storage enhance overall system productivity and improve opportunities for intensifying High Plains crop rotations.

Objective

The objective of this study is to determine the impact of stubble height on soil moisture during the post harvest fallow period.

Materials and Methods

Water content decline, expressed by slope coefficients as $(_mm water)(mm ET_0)^{-1}$, varied among treatments as shown in Table 1. The R² values for these regressions ranged from 0.998 to 0.801 with a mean of 0.955.

The bare treatment had the highest rate of decline in 9 of 10 periods.

The stripped treatment had the lowest rate of decline in 7 of 10 periods. The stripper treatment never had the highest rate of decline among the 10 periods.

The bare treatment had the highest level of accumulated water loss (Table 2), followed by the cut and stripped treatments.

In the period of longest duration, the bare soil treatment was better described by a second-order polynomial. The first derivative was evaluated and indicated that the water loss rate decreased with increasing cumulative ET_0 . (Fig. 2)

References Cited

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Hard Red Winter Wheat (TAM111) was harvested with a stripper header (Model CVS32, Shelbourne-Reynolds Engineering, Colby, KS) in Decatur County, KS (2005) and Red Willow County, NE (2006).

Stubble height treatments consisted of stripper harvest with no further alteration - 71 cm (28 in), standard platform harvest -25 cm (10 in) height, and short cut -10 cm (4 in).

Treatments were arranged in a randomized complete block design with four replications and were applied following wheat harvest using a conventional small grains platform.

Dielectric soil moisture sensors (Model EC-20, Decagon Devices, Pullman, WA) were placed in the center of 15.2 x 15.2 m plots to obtain readings from a depth of 0 - 32 mm in the soil profile. Sensors were also placed to obtain readings from 229 – 381 mm in the soil profile.

Measurements were obtained every minute and hourly averages were recorded (Fig. 1) using a 21X datalogger and AM32 multiplexer (Campbell Scientific, Logan, Utah).

Data were split into temporal periods between rainfall Daily values of volumetric water content were events. obtained for each treatment by averaging across replications. Depth of water values were calculated by treatment and linearly regressed against potential evapo-transpiration, ET_o (Penman equation calculated at McCook, NE).

Figure 1. Shallow profile volumetric water water plotted against time for a single replication in 2006.

Figure 2. Shallow profile water (mm) as a function of cumulative ET_0 for a 35 day drying event.

Table 1. - Linear regression coefficients expressed as (mm profile water)(mm ET_o)⁻¹

	2005	- Decatur	County, Ka	ansas	2006 - Red Willow County, Nebraska						
DOY	229-236	238-248	249-283	284-292	220-224	225-230	231-237	239-244	244-250	252-262	
10 cm (4 in) Cut	-0.0681	-0.0773	-0.0342	-0.0729	-0.1064	-0.0877	-0.0865	-0.1270	-0.1143	-0.0346	
25 cm (10 in) Cut	-0.0248	-0.0442	-0.0279	-0.0301	-0.0373	-0.0686	-0.0474	-0.0629	-0.0632	-0.0462	
71 cm (28 in) Stripped	-0.0292	-0.0365	-0.0277	-0.0270	-0.0524	-0.0533	-0.0450	-0.0676	-0.0600	-0.0320	

Values in red represent the highest loss rate for the given time period. Values in blue represent the lowest loss rate.

Table 2. - Estimated soil water loss (mm) from shallow profile using regression coefficients.

	2005 - Decatur County, Kansas						2006 - Red Willow County, Nebraska						
DOY	229-236	238-248	249-283	284-292	Total	220-224	225-230	231-237	239-244	244-250	252-262	Total	
Cum. ET _o	44.07	84.86	231.14	35.84	395.91	41.43	34.62	42.29	30.99	37.41	61.82	248.56	
10 cm (4 in) Cut	3.00	6.56	7.90	2.61	20.08	4.41	3.04	3.66	3.94	4.28	2.14	21.45	
25 cm (10 in) Cut	1.09	3.75	6.45	1.08	12.37	1.55	2.37	2.00	1.95	2.36	2.86	13.09	
71 cm (28 in) Stripped	1.29	3.10	6.40	0.97	11.76	2.17	1.85	1.90	2.09	2.24	1.98	12.24	