ESTIMATING WHEAT HERBAGE MASS USING A WEIGHTED DISK

L.A. Redmon[1], G.W. Horn[2] and C. Lunsford[3]

Story in Brief

We obtained disk height measurements for 4 cultivars of winter wheat (*Triticum aestivum* spp.) during the 1993-94 wheat pasture year. Hand-clipped samples of forage were also obtained concurrently. The data were then analyzed using regression analysis to determine the relationships between herbage mass and disk height. Overall relationships were poor; however, relationships for data collected during December 1993 and February 1994 had r^2 values that ranged from 0.34 to 0.79. The wheat variety AgSeCo 7853 had the strongest relationship between herbage mass and disk height while the variety 2163 had the weakest. Results of this study indicate that use of a weighted disk has the potential to rapidly determine wheat herbage mass. Regression equations need to be developed for different cultivars and different stages of growth to improve the relationships between disk height and herbage mass.

(Key words: Herbage Mass, Disk, Wheat, *Triticum aestivum*, Sward Height.)

Introduction

A rapid method of estimating winter wheat herbage mass would enable stocker cattle producers to assess pasture conditions and make timely decisions regarding stocking density and(or) supplementation strategies. One potential method to estimate herbage mass involves the use of a weighted disk (Castle, 1976). The disk is placed on top of the sward canopy and the height of the weighted disk from ground level is related to herbage mass using regression analysis. The method is easy to use and requires a minimum of training for proper use. The use of a weighted disk, however, has also been reported to be sensitive to minor changes in herbage mass (Michell, 1982). The objective of this trial was to determine the validity of utilizing a weighted disk to rapidly estimate winter wheat herbage mass.

Materials and Methods

We sampled four hard red winter wheat cultivars during November and December 1993 and February 1994 at the Wheat Pasture Research Unit near Marshall. Samples were obtained from four different paddocks each of four

[1] Assistant Professor[2] Professor[3] Senior Agriculturalist

cultivars (2163, 2180, Karl, and AgSeCo 7853; n=16 paddocks, 7.3 to 9.7 ha). Paddocks were under continuous grazing by beef stocker steers at a mean stocking rate of 0.64 ha steer^{-1}. A quadrat was placed in six random locations in each paddock (n=24 for each variety). A circular plexiglass disk 56 cm in diameter (0.25 m^2, 780 g) was then placed over the quadrat. The height of the settled disk from ground level was recorded at four equi-distant locations around the disk circumference and averaged for the disk height at that location. The disk was then removed and the forage inside the quadrat was hand-clipped to ground level, oven dried at 55ºC to a constant weight, and weighed to estimate herbage mass. Twenty four samples per cultivar for each date were obtained for analysis. Regression analysis was subsequently performed (SAS, 1987) to determine the relationship between winter wheat herbage mass and disk height.

Results and Discussion

The r^2 value between wheat herbage mass and disk height across all cultivars was poor. Therefore, the data were sorted and analyzed by cultivar and date, which resulted in improved relationships (Table 1). The resulting r^2 values proved to be acceptable for AgSeCo 7853 and 2163 on specific sampling dates (Figures 1-4). Removing values $\leq$ 1680 kg ha^{-1} from the data set improved the relationship for AgSeCo 7853 and decreased the relationship for 2180 (Table 2). The change in r^2 values indicated a sensitivity of AgSeCo 7853 at decreased herbage mass levels, and for 2180 at higher herbage mass levels. This is probably because as herbage mass for 2180 was reduced by grazing, remaining stem maintained the disk at a height that indicated more herbage mass, when in reality herbage mass had declined. AgSeCo 7853, a more decumbent cultivar, had the strongest overall relationship between herbage mass and disk height.

Frame (1981) noted that the use of a weighted disk under grazed conditions, linear regression developed from the data only explained 39-62% of the variation in mass compared to 80-90% compared to clipping. Our data appears to fit within these parameters. The use of a weighted disk may offer the potential to rapidly estimate wheat herbage mass depending upon cultivar. Some researchers have recommended using specific regression equations for each major growth stage and vegetation type when capacitance meters are used (Neal and Neal, 1973; Currie et al., 1987). This may also be true for weighted disk meters. Different regression equations, therefore, should be developed for different cultivars and morphological stages to improve the predictive ability of herbage mass using the weighted disk. A more likely use for the disk meter may be in a relative sense; i.e., disk heights could be determined for cultivars at which supplementation should be initiated or stocking rate adjustments should

occur. More information is needed before the weighted disk may be used confidently to estimate wheat herbage mass.

Literature Cited

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Table 1. Regression statistics for the relationship between the dependent variable herbage mass and disk height.

Cultivar	Date	Intercept	SE	Slope	SE	r^2
2163	Nov 1993	1601	137.55	8.5	9.27	.04
2180	Nov 1993	1131	246.85	43.2	20.40	.17
7853	Nov 1993	1558	70.17	11.5	6.70	.12
Karl	Nov 1993	1695	120.36	7.5	9.42	.03
2163	Dec 1993	-446	386.74	230.4	32.32	.70
2180	Dec 1993	105	307.50	180.1	30.15	.62
7853	Dec 1993	205	214.44	156.3	21.27	.71
Karl	Dec 1993	-332	333.31	240.7	37.99	.65
2163	Feb 1994	288	655.09	235.3	69.91	.34
2180	Feb 1994	-238	384.76	300.7	49.58	.63
853	Feb 1994	130	188.17	274.7	30.60	.79
Karl	Feb 1994	144	289.30	268.6	42.41	.65

Table 2. Regression statistics for the relationship between the dependent variable herbage mass and disk height. Data <1680 kg ha^{-1} deleted.

Cultivar	Date	Intercept	SE	Slope	SE	r^2
2163	Nov 1993	1806	108.79	-1.4	7.08	.002
2180	Nov 1993	1750	156.77	2.0	12.25	.003
7853	Nov 1993	1807	19.81	-4.0	1.70	.36
Karl	Nov 1993	1734	87.31	7.9	6.81	.08
2163	Dec 1993	-594	438.84	242.0	36.22	.68
2180	Dec 1993	1025	508.30	106.9	45.00	.30
7853	Dec 1993	215	336.14	162.3	26.81	.82
Karl	Dec 1993	-71	471.53	225.7	48.30	.69
2163	Feb 1994	288	655.09	235.3	69.90	.34
2180	Feb 1994	-631	799.91	211.3	92.14	.29
853	Feb 1994	711	273.88	216.7	36.20	.80
Karl	Feb 1994	409	457.58	241.9	60.83	.55