# Sward Height; Visual Estimate Compared with Plate Meter Height

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# SWARD HEIGHT; VISUAL ESTIMATE COMPARED WITH PLATE METER HEIGHT.

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## Abstract

Sward height (SH) is widely used in pasture research and farm practice to evaluate pasture conditions. Visual estimates can take less time than actual measurements. This study compared visually estimated SH, of continuously grazed cool-season permanent pasture with plate meter height. Weekly estimates, by five people, were made on 12, 0.75 to 1 ha fields, grazed at two intensities. Paired data (visual estimate and plate meter height) were subjected to variance and covariance analyses and prediction equations were developed. Average visual height accounted for 86% of the variability in plate meter height. Inclusion of other sources of variability in the model (treatment, date and interactions) accounted for only a further 8% of the variability in plate meter height. On the basis of the strong linear relationships found between visual and plate meter heights, a procedure combining both methods is proposed that would reduce by 25% the time required to make weekly SH measurements of 12, 0.75 to 1 ha fields.

**Keywords:** Herbage mass, herbage availability, methodology.

## Introduction

Sward height (SH) measurements are widely used in pasture research and farm practice as a grazing management tool (Bryan et al. 1989). While direct measurement of herbage mass remains the best method of estimating herbage available, several other techniques are available for measuring SH. The purpose of this study was to compare visual estimates of SH and plate height measurements with a view to reducing the time required to determine herbage available.

## Material and Methods

Data were collected from 12 fields, 0.75 to 1 ha in size, that were being used in a grazing experiment. Pastures were continuously grazed with put-and-take animals to maintain SH at either 4 to 6 cm or 10 to 12 cm. There were six fields at each height. Each week during the 1998-growing season, in each field starting 14 April, SH was estimated visually by five people. Each person walked diagonally through the pastures and evaluated SH independently. One observer (the same one each week) measured the SH with a plate meter (Rayburn and Rayburn, 1998) after making his visual observations. All observers had experience in pasture research but had never visually estimated SH. Each observer followed the same designated route each week. The designated route of each observer differed. All observers were given the plate height measurements of the previous week so that they could compare them with their estimates.

Forty five to fifty plate height measurements were taken in each field each week following an assigned walking pattern. These were averaged and the average was the plate meter height of the field. The same pattern was followed each week. Paired data (individual visual estimates and average plate meter heights) were subjected to variance and covariance analyses. Sources of variation were treatments (SH) and dates (split-plot in time). The relationship between visual and plate meter height was examined over treatments and time for the 1998-growing season. Data were analyzed using the General Linear Model (SAS Institute, 1990). Prediction equations for each observer and the average are presented.

## Results and Discussion

Average plate meter height, across treatment and date, ranged from 4.9 to11.3cm. Visual height (average of five observers) accounted for 86% of the variability in plate meter height before other terms in the model (Table 1). Inclusion of other sources (treatments, date and interactions) of variability in the model accounted for only a further 8% of the variability in plate meter height. There was no interaction between visual height and treatment, however, the significant visual height by date interaction indicated that the relationship between visual and plate meter height was different at different dates. Although significant, this difference was small (Table 1). Examining the data for each individual observer shows that the model $R^2$ ranged from 0.89 to 0.93. Results for four observers showed a significant interaction between visual height and date; one observer did not show this interaction. This observer was the same person who took the plate meter heights. Analyses of variance (data not shown) of individual and average visual heights resulted in almost the same inferences as the analysis of variance of plate meter height. The only difference was in the level of significance of the difference between treatments. Two observers detected a highly significant difference between treatments, the same inference as plate height. One of these observers also took the plate heights. The other three observers detected a significant difference between treatments. Prediction equations for plate height using visual height are presented in Table 2.

Observers in our study were able to calibrate their estimates using their observation of the previous week and the plate meter measurements. The strong linear relationship that we found between visually estimated SH and plate meter height means that visual estimates can be used part of the time during the season without losing much precision. Since each visual observation took about 5 minutes per field whereas plate meter measurements took 15 minutes per field, taking only a visual estimate in some weeks will reduce the time needed to measure SH. Where weekly measurements of SH are to be made we recommend the following procedure: Plate meter measurements are taken the first week. The second week one observer takes visual estimates and then plate meter measurements. For the next 6 weeks visual estimates only are made in odd numbered weeks and both visual and plate meter measurements made in even numbered weeks. This covers the period of the growing season with highest growth rate. For the rest of the season the plate meter measurements are made every third or fourth week. Paired data provide a prediction equation to convert visual to plate meter heights. Such a method, while adding time to the weeks when both visual and plate meter estimates are made, reduces the time required when only visual estimates are made. In an 18-week growing system with 12 fields such as we used, this combination of visual and plate meter height could reduce the time needed to measure SH weekly by 25%. Irrespective of method used sward height measurements are best made following a strict protocol within each field. In addition, if sward heights are to be compared over time it is best if plate meter measurements are taken by the same person.


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**Table 1 -** Analysis of variance of plate meter height and covariance analysis of plate meter height and visually estimated height of pasture.

| Source | df | Analysis of variance partial sums of squares[1] | df | Analysis of covariance partial sums of squares[1] |
|---|---|---|---|---|
| Visual ht (VH)[2] | | | 1 | 887.6*** |
| Treatments (T)[3] | 1 | 305.5** | 1 | 3.7** |
| VH x T | | | 1 | 0.0 |
| Error a | 2 | 2.2 | 4 | 4.0*** |
| Date | 19 | 388.6*** | 19 | 24.0*** |
| VH x Date | | | 19 | 25.8*** |
| T x Date | 18 | 114.2*** | 18 | 11.3* |
| Error b | 233 | 1031.3 | 233 | 1031.3 |
| | | Other information from analyses | | |
| $R^2$ (Model) | | 0.79 | | 0.94 |
| $R^2$ (VH) | | | | 0.86 |
| CV | | 13.2% | | 7.6% |

[1] Dependent variable plate meter height (cm)
[2] Average of five observers
[3] Height of continuously grazed pasture, low = 4 to 6 cm, high = 10 to 12 cm
*** = P<0.001, **=P<0.01, *=P<0.05

**Table 2 -** Prediction equations

| Observer | Prediction equation | $R^2$ |
|---|---|---|
| 1 | Plate height = Visual ht x 0.85 + 1.04 | 0.81 |
| 2 | Plate height = Visual ht x 0.87 + 1.03 | 0.64 |
| 3.[1] | Plate height = Visual ht x 0.94 + 0.45 | 0.83 |
| 4. | Plate height = Visual ht x 0.79 + 1.67 | 0.62 |
| 5. | Plate height = Visual ht x 0.95 + 0.03 | 0.70 |
| Average | Plate height = Visual ht x 1.05 – 0.53 | 0.86 |

[1]The observer that took the plate meter heights.