Calculation of Sample Number to Accurately Measure Available Pasture Forage

J. L. Moyer, Southeast Agricultural Research Center, Kansas State University, Parsons 67357; and J. J. Higgins, Department of Statistics, Kansas State University, Manhattan 66506

Corresponding author: J. L. Moyer. jmoyer@oznet.k-state.edu


Measurement of available forage dry matter is a fundamental practice in well-managed grazing systems. Sanderson and Rotz (3) evaluated the importance of accurately estimating available forage dry matter in pastures to dairy-cow graziers using a computer simulation model. The model indicated that estimating available forage within 10% would result in substantial profit increases. Tools for estimating available forage were described, and collection of 30 to 50 readings per 1- to 2-acre paddock was recommended for accurate estimation of available forage.

The number of readings required to obtain a designated level of precision depends on the variability of measurements within the paddock. Taking an appropriate number of readings could increase the efficiency of data collection while providing reliable results. We describe a method to estimate appropriate sample number as readings are collected based on a simple statistical formula used with a laptop computer or hand-held PDA.

If the pasture variation is uniform and the necessary precision of the mean estimate is specified, the number of readings required to accurately estimate available forage can be determined as readings are taken using a simplified formula from Kitchens (2):

\[ N = 4 \times \frac{S^2}{D^2} \]

where \( N \) is the number of readings needed to produce the desired precision with 95% confidence, \( S^2 \) is the sample variance, and \( D \) is the desired precision expressed as a proportion (e.g., 5, 10, or 20%) of the mean. A laptop or PDA with Excel can be programmed to generate running estimates as readings are added.

Sample calculations from two pastures where available forage differed were shown in an Excel spreadsheet which also includes formulas used to calculate variance and desired sample number. The sample spreadsheet is available for download at Forage and Grazinglands.

Data for available forage were collected from tall fescue (Festuca arundinacea Schreb.) pastures under grazing using disk meters constructed of plexiglass (Fig. 1). Readings were taken in random, triangular triplets; i.e., three drops 10 ft apart by two operators at the end of the grazing season. Disk height was measured to the nearest 1/8 inch. Readings taken by two operators differed, but a clear trend emerged for each after only a few readings.