Field Prediction of Alfalfa Fiber Constituents with PEAQ in Northern Europe and North American Deserts

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Predictive equations for alfalfa quality (PEAQ) to estimate neutral detergent fiber (NDF) and acid detergent fiber (ADF) concentrations of alfalfa before harvest have been developed in the north central USA, but have not been systematically tested above 50°N latitude or in desert environments below 35°N. Nutritive value of alfalfa is affected by temperature, moisture, and photoperiod through alteration of morphology, anatomy, and chemical composition. Also, fall dormancy rating of alfalfa is reported to be associated with nutritive value. For these reasons, the applicability of PEAQ to alfalfa grown in environments dissimilar to where they were developed has been questioned. Our objective was to systematically test performance of PEAQ in northern Poland and on non-dormant alfalfa grown in irrigated desert regions of New Mexico and northern Mexico.

In Poland, a total of 275 alfalfa samples, varying in height from 30 to 110 cm and maturity from vegetative to late flower, were collected from 20 farm fields over 3 years. Observed (laboratory) NDF and ADF values were regressed on predicted (PEAQ) values. The accuracy of PEAQ for predicting NDF and ADF in Poland was equal to that reported in the north central USA ($r^2 > 0.89$; RMSE < 21.6). In most cases regression equations were not biased (slope = 1 and y intercept = 0) and when there was bias it was minimal.

In Mexico and New Mexico alfalfa with fall dormancy ratings of 8 and 9 was sampled over 1 or 2 years at three irrigated locations with heights and maturities as above. Five alfalfa samples were taken per field on each sample date, with a total of 315 samples. Observed NDF and ADF values were regressed on predicted values yielding r^2 and root mean square error (RMSE) values in the range of those previously reported for alfalfa grown in northern states. The accuracy of predictions was improved by using field means (n = 5) rather than individual samples. In most cases regression equations were biased (slope $\neq$ 1 and/or intercept $\neq$ 0), but the magnitude of bias was relatively small.

The results of these two experiments demonstrate that the PEAQ model provides a simple, rapid, and reasonably accurate means to estimate fiber concentrations of alfalfa before harvest in northern Europe and irrigated deserts of southwest USA and northern Mexico. Earlier research documented the performance of PEAQ in humid, northern USA. Although other methods to estimate fiber concentrations have performed as well as PEAQ in certain environments, PEAQ have routinely proven to be robust across the wide range of climatic conditions in which alfalfa is produced.