

Comparison of visual assessment and quantitative measurement for estimating plant persistence in the selection of grazing-tolerant alfalfa in Italy and the USA

L. Pecetti¹, E. Piano¹, M. Romani¹, and J.H. Bouton²

¹ Istituto Sperimentale Colture Foraggere, Lodi, Italy; and ² University of Georgia, Athens, GA

A standard test for grazing tolerance is adopted by the North American Alfalfa Improvement Conference. Alfalfa persistence is measured by counting live plants (or crowns) in small quadrats, or by counting the number of increments coincident with live plants on a graduated rod beside a drilled row in the plot. However, these methods tend to be time and labor intensive, and a more rapid technique may be desirable, especially when germplasm entries under evaluation are in large number. Researchers have developed visual rating systems to estimate differential persistence among germplasm entries; however, little information is available to compare qualitative (or subjective) to more quantitative (or objective) methods. The current study aimed at evaluating the effectiveness of visual assessment of alfalfa persistence under grazing compared with quantitative measurements, under different environments in Italy and the USA.

Two grazing experiments were established in succession at Lodi, northern Italy, including 31 and 62 half-sib progenies under selection, respectively, replicated five times and evaluated with reference to a grazing-tolerant and an intolerant check variety. The plots were single, dense rows, ca. 4 m long, spaced 70 cm apart and separated by a tall fescue row sown in between. Continuous stocking by sheep (with cattle addition in peak periods) and overgrazing conditions were applied as recommended for effective selection. Persistence after grazing was assessed by a Visual Cover Estimation on two, fixed plot stretches, each 50 cm long, using a decimal scale from 0 = bare soil to 10 = full and dense stand; the plot value was the average of the two stretch values. In addition to the visual score, two quantitative traits were recorded as indicators of persistence. One, termed as Ground Cover Index, was the sum of the maximum width (crown width) of alfalfa vegetation measured on nine points of the plot, every 40 cm from one extreme. The second was termed as Percent Ground Cover and was computed as the number of points occupied by alfalfa vegetation out of total 100 points observed in the plot by placing four times a 625 cm² quadrat grid containing 25 points, formed by intersecting at 5-cm intervals 1-mm steel wires. The analysis of variance revealed that entries differed significantly ($P \leq 0.001$) for each of the persistence criteria recorded in the two experiments, pointing to the wide variation of the tested materials in response to grazing. The tolerant and intolerant checks always differed in their mean values of the persistence criteria. The pairwise comparison of criterion sensitivity by the Schoeman and Schumann test showed that in no instance was the visual assessment of persistence less sensitive in discriminating among entries than either quantitative criterion, nor these last two methods differed between them. Spearman's rank correlation coefficients among the three methods were always highly significant ($P \leq 0.001$), with $r_s \geq 0.92$ for any correlation computed on an entry mean basis.

At Tifton, GA, 11 germplasms and cultivars (including a tolerant and an intolerant check variety) were sown in 1.5 × 3.5 m plots replicated six times. After an intense grazing for 18 months by beef cattle, final persistence was determined either visually, assigning a 1-5 score based on a visual estimate of percentage stand, or quantitatively according to the standard test, by calculating the percentage of 10 cm increments of the original drilled rows in the sward occupied by live alfalfa plants. The results from this trial demonstrated the tolerant and intolerant checks to separate as expected for final stand percentage by the standard test. Of the entries tested for grazing tolerance, only two could be designated as tolerant by the protocol of the same test. There was a high correlation ($r^2 = 0.83$) between the visual scoring system and the quantitative values of stand percentage. When using the visual scores, the two check varieties were also statistically separated, and the same two entries could be designated as grazing tolerant.

Based on the studies conducted at Lodi, Italy, and Tifton, GA, the visual assessment of persistence after grazing was substantially similar to quantitative methods to select the best performing materials, both in absolute terms and with respect to the behavior of the tolerant and intolerant checks. The present results add to the literature evidence in indicating that, despite the different environments and the different evaluated germplasm, visual estimations can provide results similar to the actual measurements. This investigation was not meant, however, to suggest to replace the standard methods of evaluation, but to bring a piece of evidence that, if needed, a proper visual estimation can be adopted, being less time consuming for data collection and also applicable to non-standard plots.