

Use of Fluorometry to Differentiate Among Clipped Species in the Genera *Astragalus*, *Oxytropis*, and *Pleuraphis*

Author(s): Dean M. Anderson, Gary D. Rayson, Safwan M. Obeidat, Michael Ralphs, Rick Estell, Ed L. Fredrickson, Eric Parker, and Perry Gray

Source: *Rangeland Ecology & Management*, 59(5):557-563. 2006.

Published By: Society for Range Management

DOI: <http://dx.doi.org/10.2111/05-212R1.1>

URL: <http://www.bioone.org/doi/full/10.2111/05-212R1.1>

BioOne (www.bioone.org) is a nonprofit, online aggregation of core research in the biological, ecological, and environmental sciences. BioOne provides a sustainable online platform for over 170 journals and books published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/page/terms_of_use.

Usage of BioOne content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

Technical Note

Use of Fluorometry to Differentiate Among Clipped Species in the Genera *Astragalus*, *Oxytropis*, and *Pleuraphis*

Dean M. Anderson,¹ Gary D. Rayson,² Safwan M. Obeidat,³ Michael Ralphs,⁴
Rick Estell,¹ Ed L. Fredrickson,¹ Eric Parker,⁵ and Perry Gray⁶

Authors are ¹Research Scientists, U.S. Department of Agriculture, Agricultural Research Service, Jornada Experimental Range, Las Cruces, NM 88003-8003; ²Professor and ³PhD Candidate, Department of Chemistry and Biochemistry, New Mexico State University, Las Cruces, NM 88003-8001; ⁴Research Scientist, Poisonous Plant Research Laboratory, Logan, UT 84341; ⁵Research Scientist, Sandia National Laboratories, Albuquerque, NM 87185; and ⁶Research Scientist, Los Alamos National Laboratory, Los Alamos, NM 87545.

Abstract

A rapid and reproducible method to determine botanical composition of forage is an ecological and economic goal for range animal ecologists. Multidimensional fluorometry previously demonstrated the possibility of a unique optical approach for accurately determining species composition of clipped and digested plant materials. Fluorometry may be used to detect toxic plants in standing crop as well as diets by using electronic transitions in chemical structures at wavelengths between 370 and 580 nm. Grass hay (genus *Pleuraphis*) and 6 clipped forbs (4 species of *Astragalus* and 2 species of *Oxytropis*) were examined. The resulting spectral signatures were evaluated for differences in the blue and green regions of the visible spectrum using Principal Component Analysis (PCA). This represents the first published data using chemometrics to differentiate among fluorophores from these plant extracts. It was possible to distinguish between the grass and forbs and among forbs. Further research will be required to evaluate these same plant species in mixed diets and fecal samples.

Resumen

Una meta ecológica y económica de los ecólogos de animales del pastizal es encontrar un método rápido y reproducible para determinar la composición botánica del forraje. La fluoroscopia multidimensional previamente demostró la posibilidad de ser un método óptico único para determinar certeramente la composición de especies de materiales vegetales cortados y digeridos. La fluorometría puede ser usada para detectar plantas tóxicas en la biomasa y en las dietas usando transiciones electrónicas en las estructuras químicas de longitud de onda entre 370 y 580 nm. Se examinaron henos del zacate (del género *Pleuraphis*) y de 6 hierbas (4 especies del género *Astragalus* y 2 del género *Oxytropis*). Las marcas espectrales resultantes fueron evaluadas por diferencia en las regiones azul y verde del espectro visible usando un Análisis de Componentes Principales (PCA). Este reporte representa los primeros datos publicados de uso de quimiometría para diferenciar entre fluoroforos de los extractos de estas plantas. Fue posible distinguir entre el zacate y la hierba y entre las hierbas. Se requerirá más investigación para evaluar estas mismas especies en dietas mezcladas y muestras fecales.

Key Words: botanical composition, fluorescence spectroscopy, poisonous plants, Principal Component Analysis (PCA)

INTRODUCTION

The authors acknowledge the financial support of the International Arid Lands Consortium (Project O3R-03) for related research.

Mention of a trade name does not constitute a guarantee, endorsement, or warranty of the product by the USDA-ARS or New Mexico State University over other products not mentioned. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the US Department of Energy under contract W-7405-ENG-36. By acceptance of this article, the publisher recognizes that the US Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for US Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the US Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Correspondence: Dr Dean M. Anderson, US Dept of Agriculture, Agricultural Research Service, Jornada Experimental Range, Las Cruces, NM 88003-8003. Email: deanders@nmsu.edu

Manuscript received 1 December 2005; manuscript accepted 22 May 2006.

Determining herbivore diets in a rapid and accurate manner remains an unfulfilled goal for 21st century range animal ecologists. Poisonous plants pose a particular challenge to free-ranging animal production. Species in *Astragalus* and *Oxytropis* (locoweeds) can cause widespread poisoning of livestock in the western United States (Kingsbury 1964). In the last century, cattle and sheep mortalities due to toxic plants were estimated for the 17 western states at 1% and 3.5% of total livestock numbers, respectively (Nielsen et al. 1988; Nielsen and James 1992). Adding to the challenge in estimating animal losses from toxic plants is the fact that toxic and nontoxic plants are often found growing together, and some species may or may not be toxic depending on soils or growing conditions. The exact percentage of death losses varies by region and year to year, but recent estimates of the direct and indirect economic losses due to toxic plants are \$340 million annually (James et al. 1992).

Download English Version:

<https://daneshyari.com/en/article/4405087>

Download Persian Version:

<https://daneshyari.com/article/4405087>

[Daneshyari.com](https://daneshyari.com)