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

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Technical Note

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

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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 ecológos de animales del pastizal es encntrar 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

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).

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