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Managing noxious weeds with livestock: Studies on leafy spurge¹

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Abstract:

Leafy spurge (*Euphorbia esula* L.) is a noxious weed that has many favorable attributes but is avoided by most animals. When defoliated leafy spurge quickly loses its competitive advantage. Animal factors that influence postingestive consequences associated with consuming leafy spurge include: livestock species, experience and physiological state. Goats have demonstrated a greater preference for this plant in all trials regardless of other factors. Previous experience appears to be the second most important factor that increases preference for leaf spurge.

Introduction

Managing leafy spurge by livestock grazing is potentially the best solution for this and other exotic weeds on rangelands. Livestock grazing may not always provide a feasible solution, but when it does it has two definite advantages over other methods of controlling weeds. First, the use of pesticides and biocontrol may have negative environmental or perceptual consequences. Second, instead of simply eliminating a plant that is considered a problem, grazing livestock could convert leafy spurge from a pest to forage. However, the use of livestock for grazing leafy spurge or other noxious weeds will require more dedication and greater managerial skills than other methods of weed control.

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Methods

Many studies on using sheep and goats to graze leafy spurge have been conducted at the U.S. Sheep Experiment Station since 1989. These studies have involved small pasture grazing trials, pen feeding trials, and aversion studies. The goal of our research is to discover ways to manipulate either the grazing animal or the leafy spurge plant and cause leafy spurge to become a preferred forage.

In the grazing trials, animals graze small spurge-infested pastures for periods of 1 to 2 weeks at which time pastures are generally 70% utilized. Data collected includes bite counts, biomass, composition by forage category, and density counts. Diet data is expressed as the difference between the percent spurge in an animal's diet and the percent available in the herbage. This preference index ranges from -99 to +99. Biomass and density measurements are used to calculate percent utilization of the different forage categories. Paired choice confinement feeding trials were conducted to estimate preference for leafy spurge without the confounding effects often present in grazing trial. Paired choice tests consist of providing leafy spurge and an alternative feed or leafy spurge from two different sources. The two separate feeds are placed in separate containers and intake is recorded. Tests are conducted for 2 to 4 days alternating the forage choices between containers.

Conditioned food aversion is a learned behavior whereby an animal learns to avoid a novel food when consumption of the novel food is followed by gastro-intestinal illness. Aversion trials were conducted by offering animals a novel food (typically rolled oats or corn) for 30 minutes for 2 days. Following the second day a small amount of leafy spurge (0.15% of body weight) or a non-aversive control forage (e.g., alfalfa) is pumped into the rumen with a stomach tube. A decline in novel food consumption on the day following dosing indicates the animal was averted.

Results

Sheep versus goats

In this study mature animals with no previous experience grazing leafy spurge were used. Innate differences in preference for leafy spurge by sheep compared to goats was tested using confinement feeding trials and pasture trials. A paired feeding trial compared intake of leafy spurge to either arrowleaf balsamroot or crested wheatgrass during a 30-minute period. Averaged across both species of other forages offered, goats consumed 57% of their intake from leafy spurge during the paired choice trial compared to 28% for sheep.

A grazing trial compared preference for leafy spurge by sheep and goats. Preference for leafy spurge was affected by livestock species, period and their interaction. Goats pre-

ferred spurge and avoided grass during both periods ($P < 0.03$), while sheep showed opposite preferences. As the pasture was utilized and preferred species became less available goats decreased their preference for leafy spurge while sheep increased their avoidance of this plant ($P < 0.05$). Thus, as spurge became less available during the progressive defoliation of the pasture, goats switched to the more available grass. As the pasture was progressively defoliated, grass became less abundant but sheep continued to consume grass at levels similar to when the trial began, resulting in an even greater avoidance than during the initial phase of the trial.

An aversion trial showed negative postingestive consequences by sheep consuming leafy spurge but not by goats. Sheep dosed with leafy spurge decreased their intake of novel feed by half while sheep receiving crested wheatgrass increased consumption of novel feed. Goat consumption of novel feed increased or remained the same following dosing by either plant material.

Diet selection differences among ruminant species may be partly caused by differences in rumen metabolism of phytochemicals. We tested this hypothesis by conducting an aversion trial on sheep using leafy spurge that was fermented for 12 hours in either sheep or goat rumen digesta. Novel food (rolled oats) consumption declined ($P = 0.03$) in sheep dosed with leafy spurge fermented in sheep digesta but not in sheep dosed with leafy spurge fermented in goat digesta.

Effect of location

An experiment was conducted to decide if spurge palatability differed between ND and ID. Sheep grazed a greater percent of spurge stems in ND compared to ID ($P < 0.001$) but utilization of spurge stems was not affected ($P > 0.30$) by the origin of the sheep. By the end of a trial sheep grazed 99% of the spurge stems in North Dakota compared to 70% in Idaho. In Idaho, sheep did not consume large amounts of leafy spurge until the second half of a trial. This showed that at this location significant utilization will not occur until other forages have been consumed. Sheep avoided spurge in Idaho but in North Dakota the contribution to the diet was about equal to its availability in the standing crop. Feeding trials confirmed this difference in palatability between leafy spurge from the two locations. Sheep consumed over 3 times as much ($P < 0.001$) of the spurge grown in North Dakota compared to plants from Idaho.

Previous experience

The objective of the study was to determine if exposure of young lambs to leafy spurge would increase the consumption of this plant. A paired feeding trial investigated the consumption of leafy spurge paired with arrowleaf balsamroot by orphan lambs during a 30-minute feeding period. Experienced lambs consumed a higher percentage leafy spurge than naive lambs ($P < 0.03$). A grazing trial investigated preference for leafy spurge on pastures with high or low leafy spurge biomass. Experienced compared to naive lambs had a higher percentage of bites ($P < 0.001$) and preferred leafy spurge in the high spurge biomass pasture, but not in low biomass pastures. Naive lambs avoided leafy spurge in both pastures.