

Biological Control with Vertebrates – Livestock Grazing for Weed Management

Broad-spectrum biocontrol. The artificial manipulation of a natural enemy, typically a vertebrate herbivore, to control weeds.

Livestock breeds vary in their grazing and browsing preferences and abilities

Grazing animals can be managed to reduce weedy vegetation and select for desirable weed species.

3 principles for the use of grazing animals to reduce weeds in annual crops, perennial crops, and grazing lands:

1. Weed susceptibility to control by grazing depends on: growth habit, stage in life cycle, growing conditions at the time of grazing, and its palatability to different herbivore species.
2. To apply grazing pressure when weed vulnerability is greatest, growers must routinely observe and analyze the floristic composition of the forage and weed biomass.
3. To manipulate grazing pressure for weed management, growers must have access to appropriate species and numbers of animals and the means such as fencing to confine them in the particular grazing area.

Some grazing systems require control of all vegetation (Most efforts)

Other systems require selective grazing of weeds leaving desirable vegetation unharmed. Safety concerns are much less with this type of biological control.

Grazing animals can be used for 3 types of weed control:

To reduce the total biomass of possible competing vegetation

- Timber tree plantations and orchards

To reduce biomass of a single species or groups of species:

- Geese grazing for grass seedlings in horticultural crops
- Goat grazing for shrubs in sheep and cattle pastures.

To reduce weed seed production and survival

- Animals grazing weeds and crop residue during fallow periods.

Grazing Species Differences

1. Grazing animal spp. have different grazing actions and dietary preferences.

- Goose's small beak – small precise bites, shallow foraging.
- Pigs can forage to greater depths after storage organs

Dietary Preference

Grazers, browsers, intermediate.

Grazers prefer grass: cattle, horses, bison.

Can shift to forbs and shrubs low in volatile oils when grass is limited.

Browsers: goats – eat high percentages of forbs, shrubs, and can use plant materials high in volatile oils more easily than grazers.

Intermediate – sheep use grasses forbs, shrubs depending on availability.

2. Grazing animals differ in their susceptibility to plant chemical compounds.

Centauria solstitialis (yellow starthistle) is poisonous to horses. Sheep and cattle can eat young plants before they get spiny.

Cattle avoid *Euphorbia esula* (leafy spurge), but this weed can be managed with sheep.

Senecio jacobea (tansy ragwort) – lethal amount for cattle and horses is 3 to 7 % body mass. Sheep and goats have a lethal dose of 200 to 300 %.

3. Treading impact varies with species due to size to total hoof area ratio. The higher the ratio the greater the impact. Geese have the highest. Treading impact can adversely affect crops, but can also be used to trample fragile weed species and to open up dense shrub growth for grazing by smaller species

Geese

- Only vertebrates utilized within row crops.
- Prior to synthetic herbicide development in 1940s 200,000 geese weeded cotton plantations in California (San Joaquin Valley).
- Used on strawberries, mint, onions, raspberries, potatoes and Christmas trees.

Geese prefer feeding on grass seedlings. Broadleaf species appear to be unpalatable. Have also been used to control yellow nutsedge and water hyacinth.

Younger geese are used – better foragers than mature birds.

Males are larger and better foragers than females.

Fences can be used to herd geese through large fields and to protect from predators.

Covered area at night to protect from raptors.

Only a limited amount of supplemental feed – moderate hunger encourages grazing.

Lighter than other grazing animals – less damage from trampling.

Can weed wet fields.

Seedling damage in Year 1 due to trampling – either limit the time geese spend in plots or protect seedlings with wire fencing.

Cattle

Silvopastoral systems – grazing for weed control has evolved into management for both tree and animal products.

Coconuts, oil palm and most fruit trees are generally palatable to most livestock.

Orchards and plantations should not be grazed until the tree foliage is out of reach of the animals.

Occurs (1 – 2 years) earlier for sheep than cattle.

Higher coconut yields with cattle grazing than without. Cattle also produced meat and milk. Stocking rate depended on light transmission through the canopy – more animals with higher light transmission.

Sheep

Grassland Weed Control (Pastures and Rangeland)

Zaller, BioControl, 2006, 51:837-850

Target species – broad-leaved dock (*Rumex obtusifolius*)

Biocontrol agent - Sheep *Ovis aries* East Prussian Skudden explicitly feeds on dock.

Sheep grazing was more effective than cutting for reducing the weed abundance.

Grazed areas had fewer legumes, more grasses, fewer sward gaps.

Dense swards limit the ability of the weed to invade the pasture.

Fallow management in dryland cropping

Weed free summer fallows maintained to conserve soil moisture for the subsequent crop.

Historically mechanical fallow with tillage.

Challenge to do this without increasing soil erosion or bulk density.

Chemical fallow is increasing but is more expensive.

Sheep grazing was effective in decreasing weed biomass and weed density.

The decrease was greater with increased stocking rate and multiple season grazing.

Maintained soil residue cover to prevent erosion.