TECHNICAL NOTES

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GRAZING MANAGEMENT GUIDELINES

by

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TECHNICAL REVIEW

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- THERE IS NO SUCH THING AS RANGE READINESS FOR PLANTS.

- THE CRITICAL PERIOD IS NOT EARLY SPRING.

- REGROWTH DOES NOT COME FROM ROOT CARBOHYDRATES; BUT, DOES COME FROM CURRENT PHOTOSYNTHATE OF EXISTING LEAF AREA.

A. Effects of Grazing

1. Every function of plants is affected by grazing:

   a. Size of food factory (photosynthetic leaf area).
   b. Food Production.
   c. Root growth.
   d. Water and nutrient availability.
   e. Carbohydrate storage in shoots.

2. The effect of grazing is dependent upon:

   a. Season of use and growth stage.
   b. Grazing intensity (remaining leaf area) which directly affects light interception.
   c. Frequency of grazing (regrowth grazed).
   d. Type of plant (warm season vs. cool season; forb, shrub, vs. grass).
   e. Availability of growing points and new tiller buds.
   f. Shoot carbohydrate reserves.
   g. Size of root system.
   h. Physical effects of grazing animals on plants and soil (trampling may be negative but nutrient cycling a positive response).

3. How grazing at different times of the year affects grasses.

(Note: The dates below are from Ephrata at 1500 feet; Table 1.)

a. When grazing is low risk:

Summer 6/16 - 8/30 Fall 9/1 - 11/30 Winter 12/1 - 2/28

* Grazing has little effect on plant growth unless grazing is severe.
* The reduction of tillers under heavy grazing is due to higher overwinter mortality rather than an inadequate number of tillers emerging in the fall.
* Fall green up is not free forage! It is the basis for next year's production.
* Cured vegetation protects new tillers.
* Cured vegetation provides energy and green growth provides protein to animals.
* Wolf plants are not as likely to be avoided during this period.

b. When grazing is high risk:

Early Spring 3/1 - 4/15

* Has little effect as long as no more than 50% of current growth is removed and duration and frequency is controlled.
* Plants are set for vegetative growth and able to rapidly replace lost leaves and stems, if growing conditions are favorable.
* Growing points are not elevated, and thus, protected.

* **Myth #1: Grazing after range readiness is best for bunchgrasses. This is WRONG! The range readiness concept is outdated.**

* All you need is the soil to be firm enough to prevent soil compaction and enough growth for the livestock.
* Consider the effect of leaf area and air temperature on growth rate and the likelihood of the forage supply staying ahead of the livestock.
* You need enough old growth and magnesium blocks to avoid grass tetany.

c. When grazing is very high risk (CRITICAL PERIOD):

Late Spring 3/20 - 6/25

* The growing points are elevated, and thus, vulnerable.
* If growing points are removed, replacement tillers must come from axillary buds.
* Plants are committed to seed production.
* The ability to replace lost leaves and stems is low and declining.

* **Myth #2: The critical period is early spring. This is WRONG!**

* **The critical period is when plants are trying to make seed (boot stage through soft dough stage).**

* At Ephrata, Washington from 1988 - 1994, the critical period came between 3/20 and 6/25. See the chart "Comparing the Years."
* Grazing during the critical period can have a severe impact and even kill bunchgrasses.

4. The effects of grazing depends upon what's removed.

   a. Leaf blades only - minimal if growing conditions are good.
   b. Leaf sheaths - regrowth will be delayed.
   c. Apical meristem-tiller will die; must be replaced by activation of an axillary bud.

5. How grazing affects roots (Figures 1 and 2):

   (Data a.-d. is from "Grass: The Stockman's Crop" which reports on a comprehensive test for different grasses.)

   a. As long as no more than 50% of topgrowth is removed, grazing has little effect on the roots.
   b. At 60% use, HALF of the roots stop growing for 12 days.
   c. At 80% use, ALL of the roots stop growing for 12 days.
   d. At 90% use, ALL of the roots stop growing for 18 days.
   e. The growing season at Ephrata is 90-140 days (K. Guinn study). 12-18 days relates to 10-20% of the growing season when the plants are not producing.
   f. Under progressively heavier grazing, roots will have fewer branches; become, sparser, shorter, and more concentrated in the top portion of the soil profile.
   g. A balance between roots and topgrowth will always occur.
   h. To minimize weed invasion, have plants with a large, healthy root system.
   i. This is why we should graze no more than 50% of the topgrowth during the growing season.

6. How grazing affects plant growth.

   a. For sodformers (non-jointed species):
      - Maintain leaves and growing points and the plant keeps producing.
      - Graze the leaf growing points and the plants are hurt.
   b. For bunchgrasses (jointed species):
      - As seedheads are elevated on the stem, they become vulnerable to removal.
      - Graze the growing points of stems, you not only kill the stems, but
      - New growth must come from axillary buds which reduces next years stems, and
      - Less than a 1:1 ratio of stem replacement for next year may reduce the stand.

7. Where does regrowth come from?

   a. **Myth #3: Root carbohydrate reserves is most important for regrowth following a severe grazing. This is WRONG!**

   b. There is no indication that root carbohydrate reserves are mobilized for shoot growth.
   c. Most reserves are located in stem bases.
   d. Reserves in grass stem bases affect regrowth for only 2-7 days following grazing.
   e. Current photosynthesis is the most significant source of carbohydrates (88-99%) (Figure 3).

8. Severe grazing cannot be expected to increase production of native bunchgrasses especially in dry environments.

9. Bunchgrasses may be eliminated by intensive, long-term grazing.

   a. Decrease of basal areas of individual plants.
   b. Fragmentation of large plants into smaller plants.
   c. Plant basal areas are reduced below critical size and tiller numbers are reduced.

10. Characteristics that provide resistance to grazing:

   a. Low growing points.
   b. Delayed elevation of growing points.
   c. Predominance of vegetative only shoots over reproductive shoots.
   d. Deep and expansive root system or added drought tolerance and acquisition of minerals.

B. Grazing Management Guidelines

1. There are three types of grasses:

   a. Non-jointed species (sodformers).
   b. Introduced jointed species (bunchgrasses).
   c. Native jointed species (bunchgrasses).
   d. Match the type of grass with its appropriate grazing management strategy.

2. Four criteria determine the susceptibility to grazing and the rate of recovery:

   a. The amount of leaves and stems remaining after defoliation.
   b. The susceptibility of growing point to damage or removal:

      * Growth form (bunch or sodformer).
      * Ratio of reproductive to vegetative tillers.
      * Height and location of growing point (time of year).
      * Time of grazing.

   c. Ability of plants to produce new tillers.
   d. Ability of plants to allocate resources to maintain a favorable shoot-root ratio.

3. Recovery by sodformers (answers relate to 2. a-d):

   a. Rancher decision to control intensity, duration, and timing of grazing.
   b. Growing points are protected.
   c. Easily produces new tillers.
   d. No problem with shoot-root ratio.

4. Recovery by bunchgrasses (Answers relate to 2. a-d):

   a. Rancher decision to control intensity, duration, and timing of grazing.
   b. Growing points are vulnerable depending on growth stage.
   c. Ability to produce new tillers is quite limited.
   d. Maintenance of shoot-root ratio is variable among grass species.

   * The response difference between sodformers and bunchgrasses is why they have different grazing management guidelines based on different amounts of biomass removed and/or remaining on these two growth forms.

5. Maintaining shoot-root ratio following defoliation:

   a. Crested Wheatgrass

      * Introduced from Asia; evolved with heavy grazing pressure.
      * Reduces root growth after defoliation.
      * Allocates more resources to shoot growth.
      * Quickly re-establishes a favorable shoot-root ratio.

   b. Bluebunch Wheatgrass

      * Native (Washington state grass); evolved without heavy grazing pressure.
      * Roots grow at the same rate after defoliation.
      * Unable to re-allocate resources to grow additional leaves and stems.
      * Ratio between shoot and roots becomes very unbalanced.
      * In subsequent years:

         - Excessive root die off
         - Poor plant health
         - Plant death

      * The response difference between crested and bluebunch is why natives and introduced species have different grazing management guidelines. The response difference is related to rapid new tiller production in crested.

6. Management guidelines for non-jointed species:

Kentucky bluegrass	Bromegrass
tall fescue	orchardgrass
pinegrass	perennial ryegrass
saltgrass (not a true sodformer)	quackgrass

   * High number of vegetative to reproductive stems.
   * Growing points remain close to the ground, usually too low to be grazed.
   * Able to quickly regrow if growing points have not been removed.
   * If growing points are removed, they can readily activate other growing points.
   * Has ability to replace photosynthetic tissue quickly when soil moisture exists.

a. Leave enough leaves and stems to keep plants producing.

* Graze above apical meristems and growing points.

b. Leave enough leaves and stems for site stability.

* Two inches for site protection.
* Cattle need four inches to effectively graze.

c. Grazing systems that are appropriate:

(1) Continuous but moderate use.
(2) Rapid rotation started early to keep plants vegetative with a 21-25 day regrowth period for each field during rapid growth.

- Short duration.
- Savory grazing method.

(3) Deferred rotation and rest rotation are overkill.
(4) The key area is the heavily used area of the pasture.

7. Management guidelines for introduced jointed species:

smooth brome	reed canarygrass
creeping meadow foxtail	annual ryegrass
timothy	crested wheatgrass
intermediate wheatgrass	pubescent wheatgrass
Siberian wheatgrass	tall wheatgrass

* If growing point is not removed:

* Reduces root growth after defoliation.
* Allocates more resources to shoot growth.
* Quickly re-establishes a favorable shoot-root ratio.

* Ability to regrow depends on the state of growth and the ability to reallocate resources:

* For introduced species, if growing point is removed during the boot stage, the reallocation of energy goes to axillary buds for tiller recruitment, but moisture will most likely be limiting.

* Removal of topgrowth at or after soft dough stage results in plants going dormant.

a. Proper grazing use:

* 50% of what is there during the growing season.
* 60% when dormant.

b. Graze no field more than half the growing season.
c. Graze no field more than 2 out of 3 years during the critical period (boot through soft dough stage).

d. Grazing systems that are appropriate:

(1) Rotation of grazing between critical and noncritical periods from one year to the next.
(2) Deferred rotation, rest rotation and intensive deferred rotation are overkill.
(3) Key area should reflect average use.

8. Management guidelines for native bunchgrasses (jointed species):

bluebunch wheatgrass	needle-and-thread
Idaho fescue	Thurber needlegrass
basin wildrye	big bluegrass
prairie Junegrass	

* If growing point is not removed

* Roots grow at the same rate after defoliation.
* Unable to re-allocate resources to grow additional leaves and stems.
* Ratio between shoot and roots becomes very unbalanced.

* Ability to regrow depends on the stage of growth and the ability to reallocate resources:

* For native species, if growing point is removed during the boot stage, the reallocation of energy goes to roots; this throws the root:shoot ratio off resulting in a long term die-off of a portion of the plant.

* Removal of topgrowth at or after soft dough stage results in plants going dormant.

a. Proper grazing use:

* 50% of what is there during the growing season.
* 60% when dormant.

b. Graze no field more than half the growing season.
c. Graze no field more than 1 out of 3 years during the critical period (boot through soft dough stage).
d. Defer each field 1 out of 3 years (growing season).
c. Grazing systems that are appropriate:

(1) Deferred rotation.
(2) Rest rotation.
(3) Intensive deferred rotation.
(4) Short duration and Savory grazing method are <u>not appropriate</u>.
(5) Rotation of grazing between critical and non-critical periods from one year to the next when key areas are the heavily used areas of the pasture.

9. Management guidelines for forest grazing:

a. If all grasses are native bunchgrasses, use the criteria above for native bunchgrasses.

b. If all grasses are jointed species (pinegrass, bluegrass), use the criteria above for sodformers.

c. If the area has both sodformers and native bunchgrasses:

* Fence separately and use separate criteria for each, or
* If cannot separate, use the criteria for native bunchgrasses.

10. Management guidelines for riparian areas **(key areas are the non-functional components of the system):**

a. Fence out when:

* Banks are not stable.
* Sediment is not being filtered.
* Riparian area is large enough to create a riparian pasture.

b. Managing woody species:

* To establish rest 2 years or install a temporary fence.
* Defer summer and fall.
* Graze after spring runoff and let plants regrow for the next runoff event.

c. Managing grasses and grass-like species:

* If grasses in riparian areas are sodformers, so use sodformers criteria tempered with the woody criteria above.
* Most sedges will respond positively to management based on native bunchgrass criteria.

11. Management Guidelines for Annual Rangeland:

a. In the rare cases where the plant communities are 100% annuals:

* Graze so as to leave enough plant cover to protect the site from erosion (at least 30% cover).
* Use the Range Health Indicator Worksheet to judge trend.

b. When the plant community still has perennials present:

* Manage for the perennials.
* Graze early spring and fall:

(1) In early spring move the livestock when they switch their diet from annuals to perennials.

(2) In the fall graze no more than 60% of the perennials bunchgrasses; maintain a stubble height so that 40% of the bunchgrasses are not eaten.

12. Conclusions on Grazing Management:

a. Only two factors of plant growth are within our control:

* Size of leave area remaining after grazing. (Intensity)
* Time of grazing. (Timing and Duration)

b. The size of leave area remaining after grazing and time of grazing should be the primary focus of ranchers management.

c. A cow is a management tool to manipulate and improve plant communities.

d. Do not forget the two natural laws:

* If we keep down the shoot, we kill the root.
* Nature abhors empty space; abuse the good plants and undesirables will invade.

e. Over-grazed grasses cannot remain healthy, vigorous and productive any more than a steer can gain weight on a maintenance ration.

f. Leave enough leaf area to ensure photosynthesis.

g. For native bunchgrasses minimize the severity of grazing when grasses are most susceptible by:

* Grazing no field more than half the growing season.
* Grazing only 1 in 3 years during the critical period (2 out of 3 for introduced jointed).
* Deferring each field 1 out of every 3 years during the growing season.

TABLE 1

PLANT PHENOLOGY

For

Bluebunch Wheatgrass

Ephrata, Washington
1500' Elevation

K. Guinn 1/94

GROWTH STAGE	1988	1989	1990	1991	1992	1993	1994	7-YEAR Average
7-8" Leaves	3/20	4/02	3/22	3/28	3/01	4/11	3/20	3/24
Boot	4/18	4/18	4/10	4/21	3/25	4/25	4/10	4/14
Seedheads Out	5/10	5/04	4/22	5/01	4/12	5/16	5/01	5/01
Anthesis	5/30	5/25	5/06 5/27	5/20 6/02	5/10	5/23	5/14	5/18
End Soft Dough	6/10	6/11	*6/01	*6/23	5/31	6/05		6/10
Seed Shatter	6/19	6/25	N/A	6/30	6/07	6/27		6/20
Critical Period:								
	4/15	4/15	4/05	4/20	3/20	4/20	4/10	4/10
	6/15	6/15	6/05	6/25	6/05	6/20		6/15
Number Days	61	61	61	66	78	61		65
End of Deferment Period:								
	6/15	6/15	6/05	6/25	6/05	6/20		6/15

* No seed formation in 1990.

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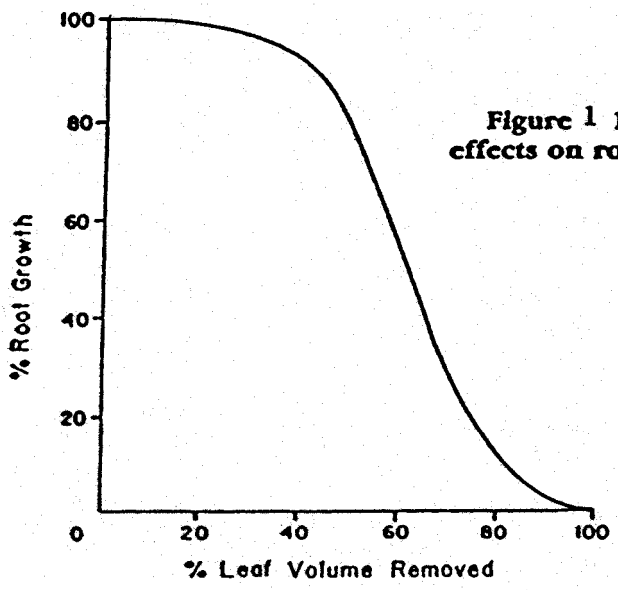

Figure 1 Defoliation effects on root growth.

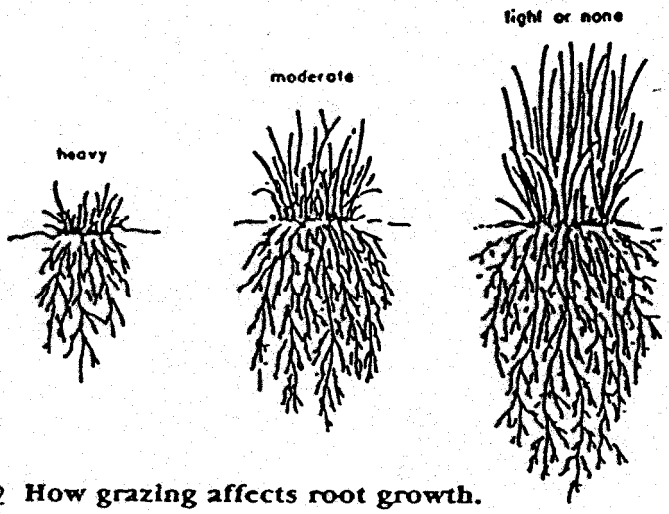

Figure 2 How grazing affects root growth.

A temporary lack of root growth following defoliation may not be entirely detrimental to a grass. Crested wheatgrass reduces root growth following defoliation whereas bluebunch wheatgrass does not. By reducing root growth, crested wheatgrass is able to allocate more resources to shoot regrowth, thus re-establishing the balance between the root and shoot systems (Richards 1984). Because carbohydrates necessary for

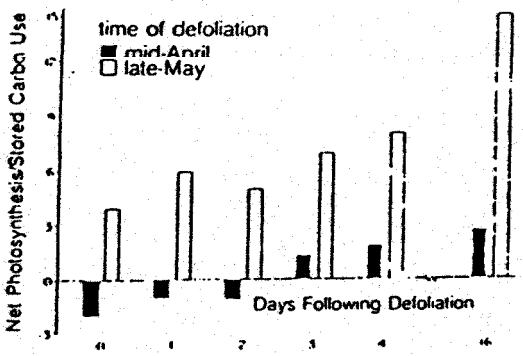

Figure 3 Carbon balance of bluebunch wheatgrass following a severe defoliation on day zero in April and late May. Adapted from Richards and Caldwell 1985.