

Date:
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Healthy Start for Drought Resistant Forages

How Can We Increase Forage Stand Longevity?

- ◇ Focus on establishing successful stands, i.e. **soil fertility**, quality seed, weed control, etc.
- ◇ Choose long lived species & varieties, such as Anik alfalfa or birdsfoot trefoil.
- ◇ Let short lived species reseed periodically.

Reducing Winterkill?

- ◇ **Soil fertility** of fields
- ◇ Timing, severity & repeated cutting or grazing in mid Aug to mid Sept
- ◇ Winter hardy species & varieties
- ◇ Freeze-thaw cycles, frost pockets
- ◇ Landscape & slope

How Can We Improve Drought Resistance?

- ◇ Extensive root systems
- ◇ Disease free plants
- ◇ Adequate **nutrient levels** in both soil & plants, especially **potassium**

Contacts:

Ron Buchanan
(250) 827-3555

Sandra Burton
(250) 789-6885

Julie Robinson
(250) 787-3241

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Introduction

This forage fact focuses on the role of nutrients in promoting healthy and vigorous pastures. Ron Buchanan had questions about how to increase the longevity of his forage stands, reduce winterkill, and improve drought resistance. The green boxes on both sides of the page illustrate some important linkages. The boxes on the left side show each of Ron's questions with a list of key factors. For more detail about these topics see the next page for a listing of factsheets and resources.

The boxes on the right summarize the role of phosphorus and potassium. The photographs below illustrate a potassium deficiency in the alfalfa plants in late May, 2014 at the Kendrews' pasture. Cold spring conditions affected microbial activity and thus the availability of nutrients. Interestingly, by the time the soils field day was hosted at this site (18 days later), the soils had warmed up and the deficiency disappeared.

With the linkages between Ron's questions about forage issues and nutrient roles in mind, we wanted to see if improving the fertility of his hay field with chemical fertilizers, manure or winter feeding additions would make a difference.

Role of Phosphorus

- ◇ Immobile in soil
- ◇ Mobile in plant
- ◇ **Increased root growth & therefore more extensive extracting of moisture & nutrients**
- ◇ Is the "energy currency" in plants; role in energy storage & transfer
- ◇ Encourages reproductive development
- ◇ Earlier maturing of plants

Role of Potassium

- ◇ Relatively immobile in soil
- ◇ Mobile in plant
- ◇ **Crucial to water relations & the osmotic pull of leaves drawing water into roots**
- ◇ **Helps with full use of soil available water to withstand drought stress**
- ◇ **Reduces fungal /bacterial diseases**
- ◇ Important in seed & grain filling, i.e. in converting sugar to starch



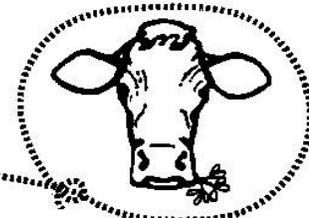
Severe



Moderate

Alfalfa plants from Kendrews illustrating **severe & moderate potassium deficiency** symptoms.

Peace River Forage Association
of British Columbia



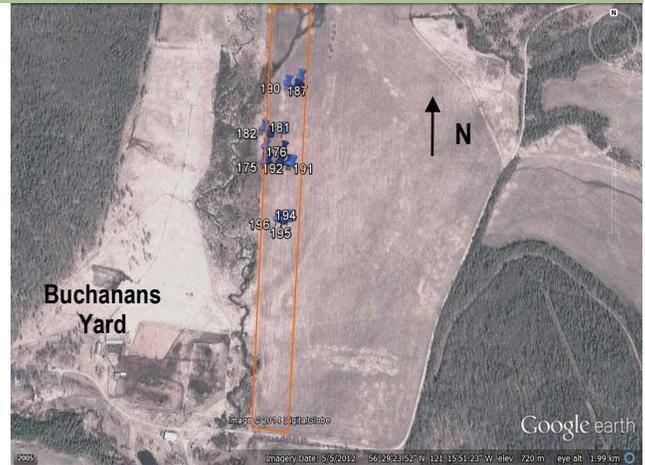
Relevant Forage Facts

- ◇ FF# 31 Maintaining Legumes in Pastures
- ◇ FF# 32 Nutrient Management for Longevity
- ◇ FF# 28 What did we learn from the winterkill study?
- ◇ FF# 34 Clarkes Boost Forage Quality
- ◇ FF# 17 Phosphorus for Healthy Plants & Animals
- ◇ FF# 14 Potassium, A Role in Carbohydrates & Winter Hardiness

Plot Layout

In the spring of 2014, a soil fertility demonstration plot was set up at farm scale with Ron Buchanan on Glenburn Ranches northwest of Fort St. John. There were many lessons learned at this site, but two comparisons are focussed on & described here:

1. Fertilizer with no fertilizer
2. Winter feeding areas, with and without fertilizer.



Location of fertility plot NE of Buchanans' yard.

Details of Plot 1

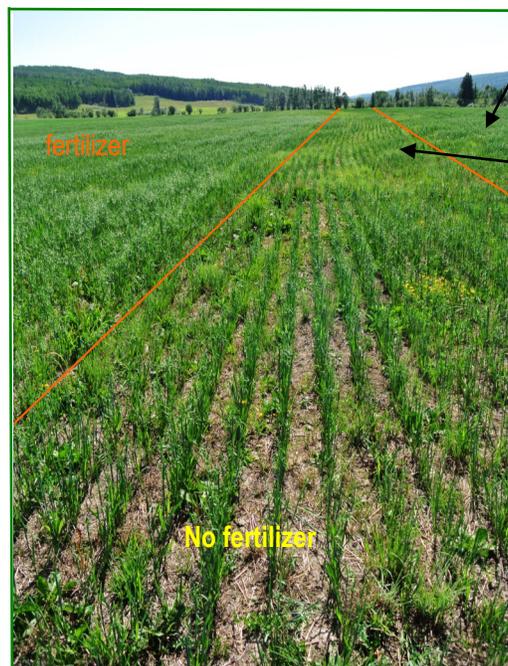
Fertilizer comparison

Prior field history:

- ◇ 2010-2012: grass legume hay with low yields (< 0.9 ton/ac)
- ◇ 2013: green feed oats

Plot Season 2014:

- ◇ May: soil samples taken
- ◇ June 7: seeded oats for green feed with 15 ft wide JD 752 direct seeding drill
- ◇ Seeding rate about 2.8 bu/ac
- ◇ 75 ft strip left with no fertilizer
- ◇ Remainder of field fertilized with 130 lb/ac of 9-20-20-5
- ◇ Each treatment about 5 ac
- ◇ Established 3 benchmarks per treatment (see blue pegs on air photo above right)
- ◇ Plants monitored for growth.



Note: Ron's fertilizer blend was chosen to fit his goals of increasing longevity, reducing winterkill and improving drought resistance.

Winter feeding
+ fertilizer

Winter feeding
+ no fertilizer

Details of Plot 2

Winter feeding effects

- ◇ Fed bales to cattle in winter of 2011/ 12 on an area about 210 by 160 ft
- ◇ Winter fed area has deeper organic enriched topsoil
- ◇ Seeded oats for green feed with 15 ft wide JD 752 direct seeding drill June 2014
- ◇ Seeding rate about 2.8 bu/ac
- ◇ 1 pass x 15 ft with no fertilizer
- ◇ Remainder of winter fed area fertilized with rest of field at 130 lb/ac of 9-20-20-5
- ◇ Established 2 benchmarks
- ◇ Plants monitored for growth.

Monitoring Methods

- ◇ Consulted with cooperator re: field history, plot layout, treatments, fertilizer blend & timing.
- ◇ Set up benchmarks (3 to 5 per treatment) that were representative of the soil landscapes.
- ◇ Skeets were placed at each benchmark & gps coordinates were taken.

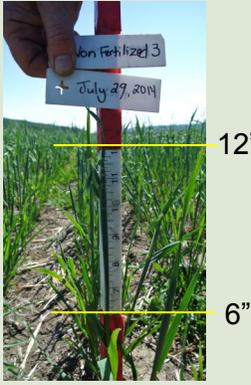
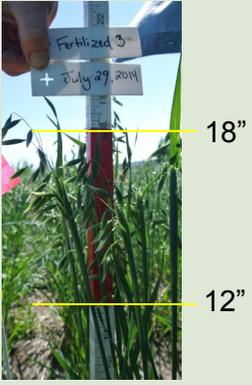
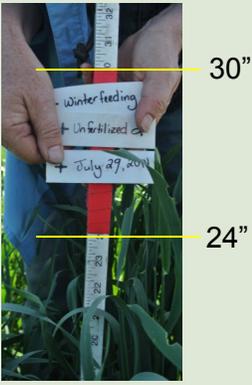
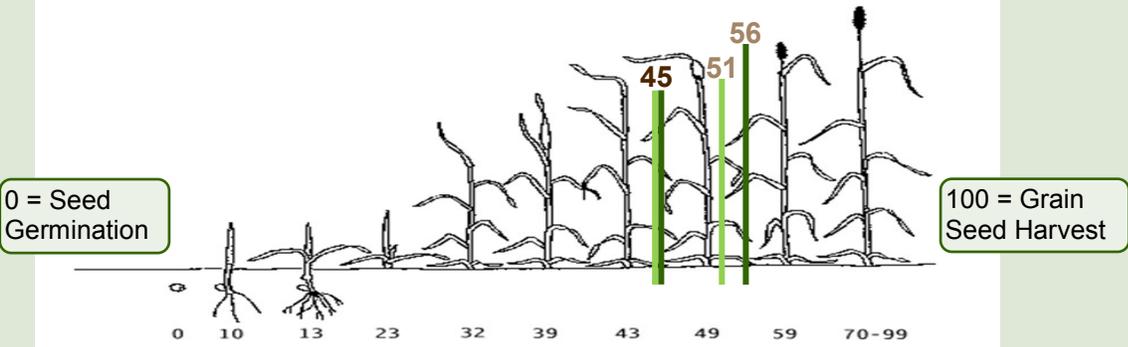
Plant Emergence:

- ◇ Photographs were taken from a standard 5 ft height with hoop or grazing stick for scale.
- ◇ Plant counts were done for a standard area (2 rows or 15"x36") & converted to plants /ft or /m.

Growth Monitoring:

- ◇ Photographs & plant counts done again with same methodology as when monitoring emergence.
- ◇ Growth stage of the oat plants were determined using the BBCH or extended Zadoks Scale for Monocots and Dicots. This is a scale from 0 for seed germination through all growth stages to 100 or grain seed harvest.

Part of a Series: This forage fact is one of a series produced during the Healthy & Vigorous Forages Project.

| Details | No Winter Feeding | | Winter Feeding | |
|--|--|--|---|--|
| | No Fertilizing | Fertilized | No Fertilizer | Fertilized |
| Heights on July 29 | 12 in (31 cm) | 18 in (45 cm) | 23 in (58 cm) | 26 in (66 cm) |
| Photos from Side Showing Plant Height on July 29, 2014 |  |  |  |  |
| Plant Counts | 16 / sq ft | 20 / sq ft | 20 / sq ft | N A |
| Photos from Above Showing Plant Counts July 29, 2014 |  |  |  |  |
| Growth Stage Scale | 51 | 56 | 45 | 45 |
| Growth Stage Description | 50% head emerged Small leaves & heads | 70% head emerged Bigger leaves & heads | Flag leaf sheath swollen More tillering | Flag leaf sheath swollen More tillering |
| Growth Stage Position on Zadoks Scale |  | | | |
| Implications for Green Feed Harvest | Least plant material & green feed yield Slower maturing so later cutting | Less plant material & green feed yield Earlier maturing so earlier cutting | More plant material & green feed yield Slower maturing so later cutting | Most plant material & green feed yield Slower maturing so later cutting |

Take Home Messages

“I can sure see how using a fertilizer blend rather than just nitrogen benefits my forages in a drought situation. I will be changing how I fertilize fields from now on.”
 Ron Buchanan

References

Rejuvenation of Tame Forages: Parklands, publication by AAFC/ PFRA

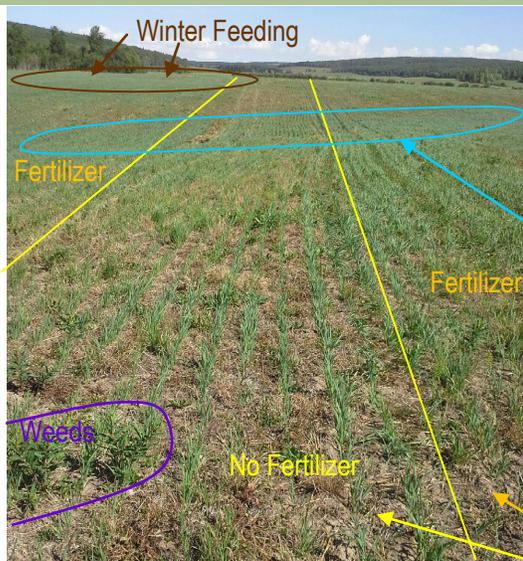
Nutrient Deficiencies in Alfalfa for Forage
www.agriculture.gov.sk.ca/Default.aspx?DN=8764b83f-1c5f-467c-8ccd-b14ceeefe5e6

Rangeland Seeding Manual for British Columbia
 by Allen Dobb & Sandra Burton, published in 2013 by BC Ministry of Agriculture

Peace Forage Seeding Tool
 An interactive website that assist users through different seeding scenarios
www.peaceforagetool.ca

Other Benefits

“The fertilized plants got off to a better start. When grasshoppers invaded the field, these healthier plants showed less damage from the grasshoppers.”
 Fritz Walther



Landscape positions with lower moisture had higher response to fertilizer/ weed competition.

Effect of Winter Feeding

The effect of winter feeding is illustrated clearly by the oat plants on the tailgate (photo at right).

Where Buchanans winter fed their cattle 2 years prior, we observed deeper topsoil, higher organic matter, more extensive rooting systems and healthier plant growth. The bottom line was there was more soil moisture levels. Here the effect of adding fertilizer was not as prominent. The variability in plant growth created by small winter feeding areas created challenges for haying operations.

Managing for Drought

The interaction of fertility and soil moisture was clearly evident, especially earlier on in the season (photo to the left).

In the lower depressions in the field, where the moisture status and organic matter were higher, the difference that fertilizer made to plant growth was masked.

In contrast, on the knolls and mid slopes of the field landscape, soil moisture and topsoil (and thus water holding capacity) were more limited. In these areas, the effect of the fertilizer was more pronounced.



Where To From Here?

Ron’s take home messages are:

1. Focus on fertilizer blends that address overall nutrient levels rather than just nitrogen levels.
2. Spread the benefits of winter feeding and soil improvement over larger areas.
3. Explore better forage species for increasing longevity & drought hardiness while reducing winterkill.



Topsoil with no winter feeding (left) compared with winter feeding (right).

Compiled by: Ron Buchanan, Sandra Burton & Julie Robinson in March 2015.

With Contributions from: Talon Johnson, Fritz Walther and Vicki Moser.

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