



University of Idaho

College of Agricultural and Life Sciences

ANNUAL CEREAL FORAGE PRODUCTION

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BARLEY AGRONOMY PROGRAM MISSION



Provide research and Extension programming on sustainable irrigated and dryland barley production strategies with an emphasis on nutrient management for yield, end-use quality, plant health, and soil and water quality.

Malt, Feed, Food, Forage

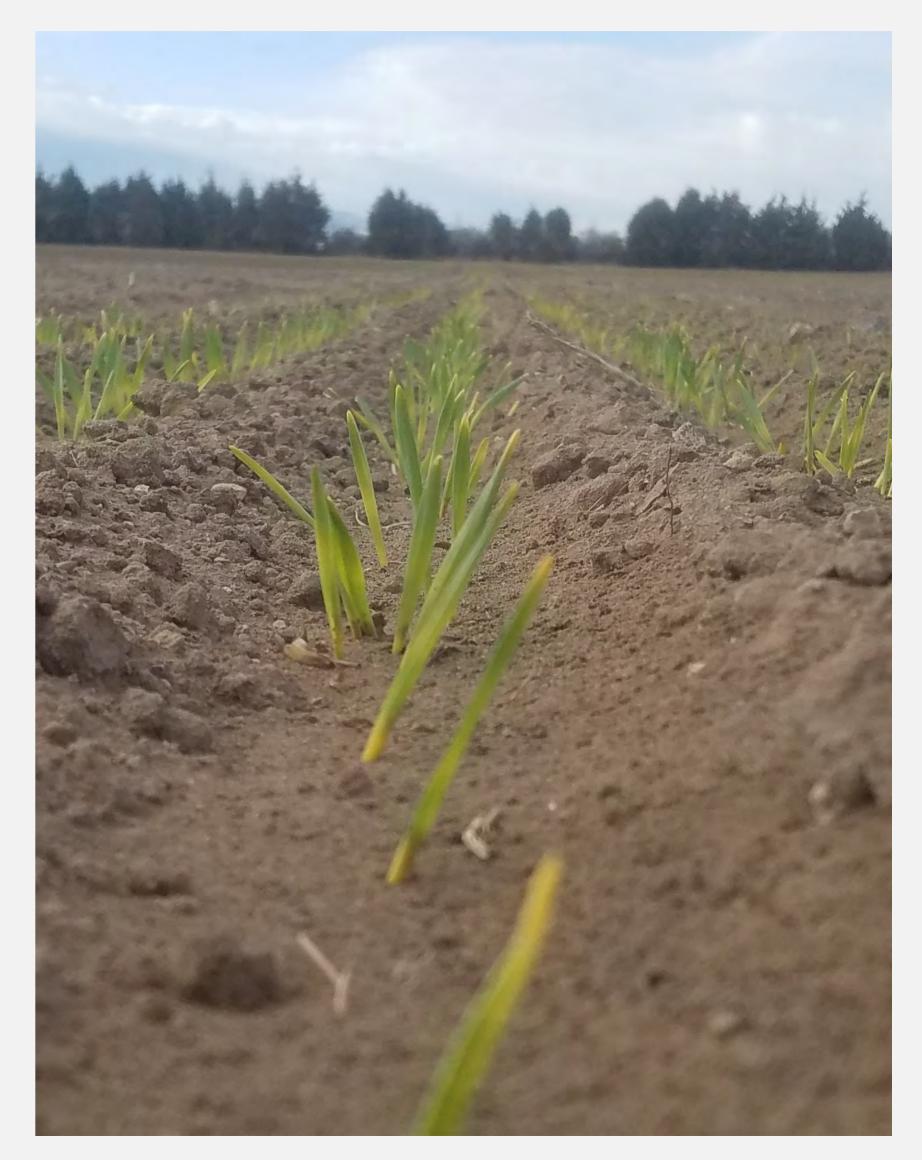


Photo Credit: Jared Spackman

OVERVIEW

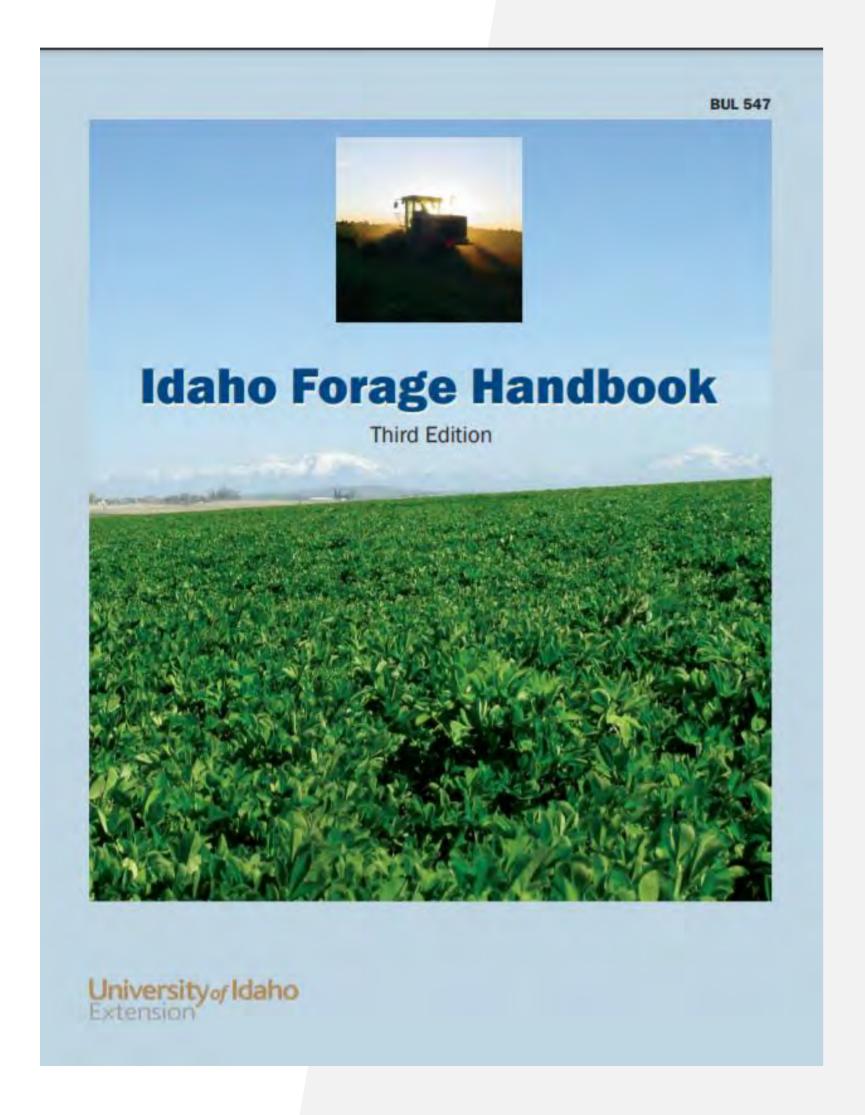


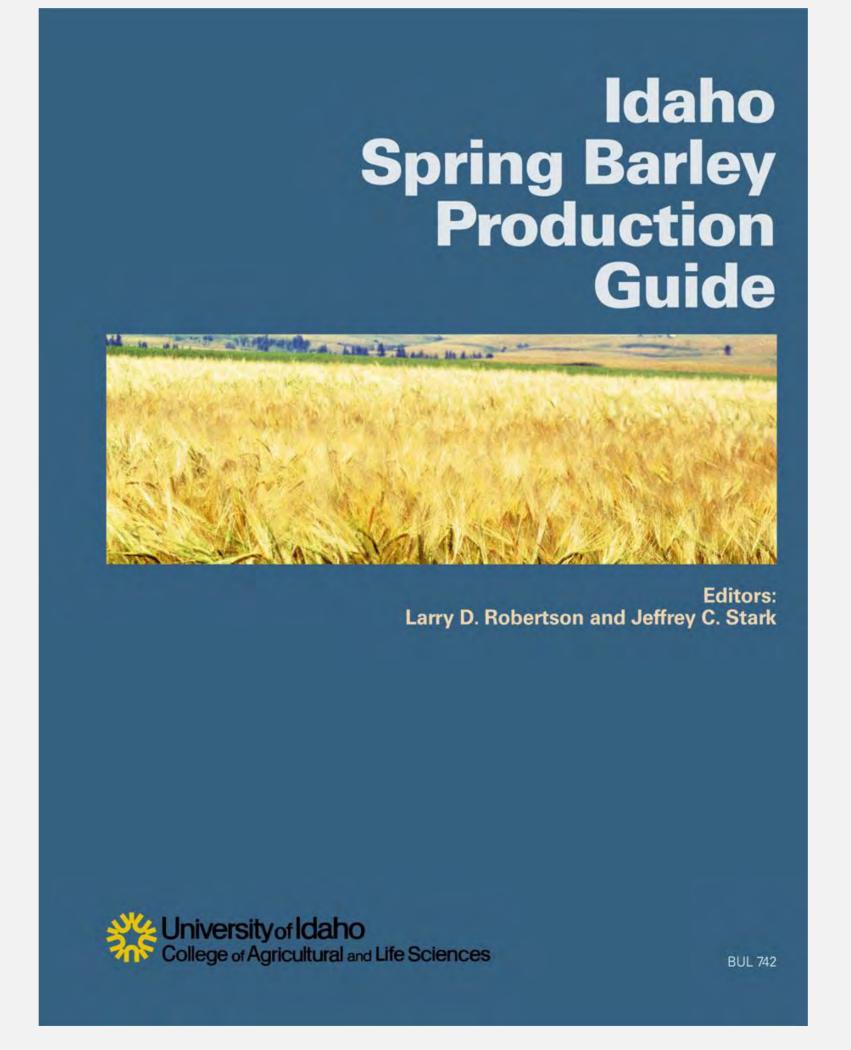
Current Studies

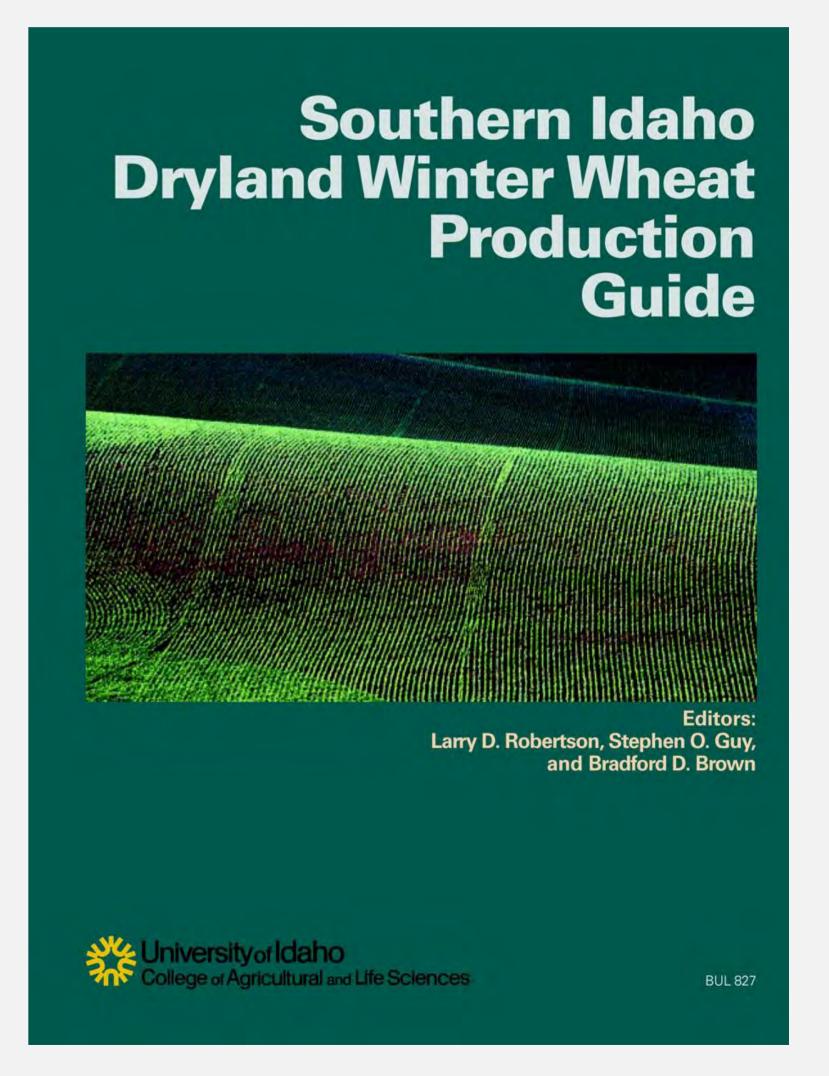
- Small Grain Grower Survey
- Acidic Soils of Southern Idaho
- Nitrogen Rate by Variety
- Cutting Timing by Variety
 - Bulk Density
 - Irrigation Water



GOAL: UPDATE BARLEY AND WHEAT PRODUCTION GUIDES







Complete Small Grain Management Survey for \$30 Gift Card

Southern Idaho

Seeding rate

Plant growth regulators

Irrigation

Crop Rotation

Nutrient management

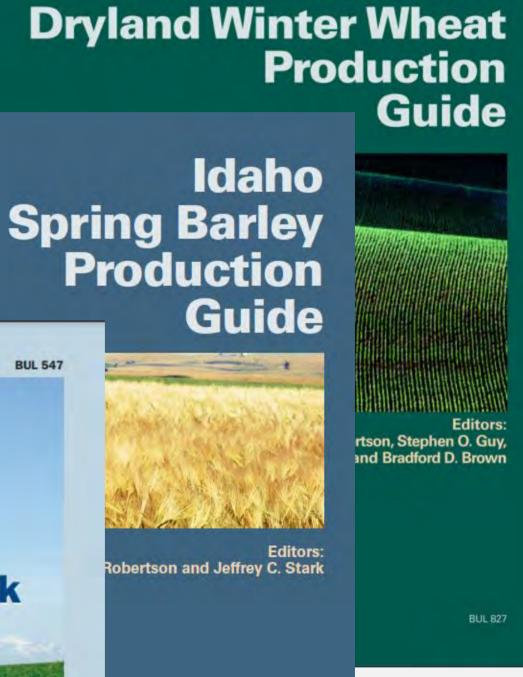
Soil and Tissue sampling

Precision Agriculture/Crop Sensing

Weed, Pest and Disease

Management

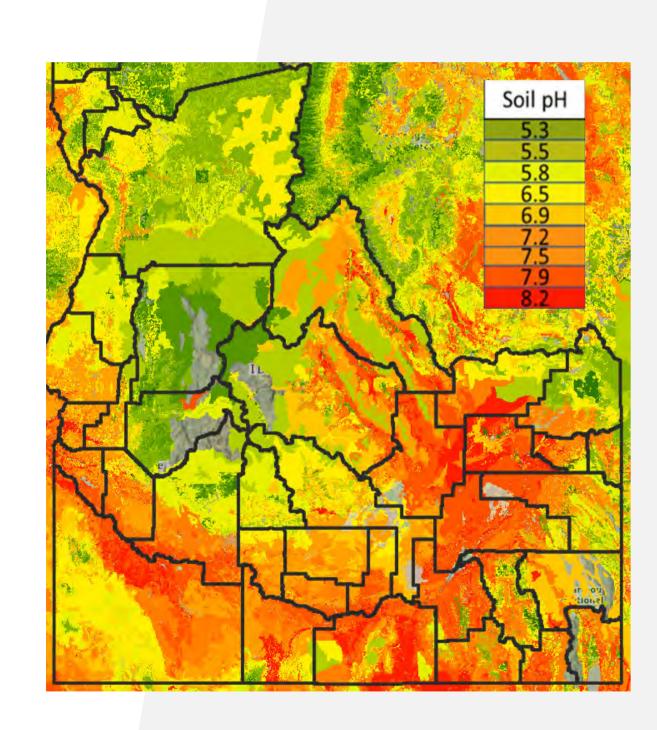








Developing Calibrated Lime Recommendations for Southern Idaho



Aluminum toxicity symptoms



Normal root tip

Deformed root tip



SPRING ANNUAL FORAGE STUDIES



OBJECTIVE 1:

Determine the timing of cutting that optimizes yield and quality for multiple cutting events for barley and oats.

OBJECTIVE 2:

Determine the optimal fertilizer N rate to optimize forage barley and oat quality and yield.



Collaborators: Jacob Bevan

Joseph Sagers

Reed Findlay

Greg Blaser

STUDY LOCATIONS



	Aberdeen	Rexburg	Blackfoot
Soil	Declo Loam	Ririe Silt Loam	
Elevation (ft)	4403	4878	4498
Mean annual precip. (in)	8 – 12	12 – 15	11.5
Mean annual air temp. (F)	45 — 55	43 – 46	47
Frost free period	100 - 140	80 - 100	100
Previous crop	Mechanical Fallow	Spring Wheat	

FORAGE BARLEY VARIETIES





Photo Courtesty: https://bigskyseeds.net/wp-content/uploads/2014/09/Haybet-Forage-Barley-heads.jpg

Haybet

ARS – Montana State University
Betzes/Strip Tease (1987)
2-row hooded spring hay barley
Awnless (beardless)
Similar to Horsford



Photo courtesy: https://hearneseed.com/hayes-beardless-barley/

Hays

Montana State University
Haybet/Baronese (2003)
2-row hooded spring hay barley
Awnless (beardless)



Photo Courtesy: https://greatbasinseeds.com/product/lavina-barley/

Lavina

Montana State University
Haybet/Baronese (2007)
2-row hooded spring hay barle
Awnless (beardless)

FORAGE OAT VARIETIES





Photo Courtesty: https://greatbasinseeds.com/product/otanaoats/

Otana

Montana-Idaho (1976) CI5345/Zanster Tall Susc. BYDV, stem rust



Photo Courtesty: https://greatbasinseeds.com/product/monida-oats/

Monida

Idaho-Montana (1984)
Otana/Cayuse
Medium Tall
Susc. Crown rust, stem rust

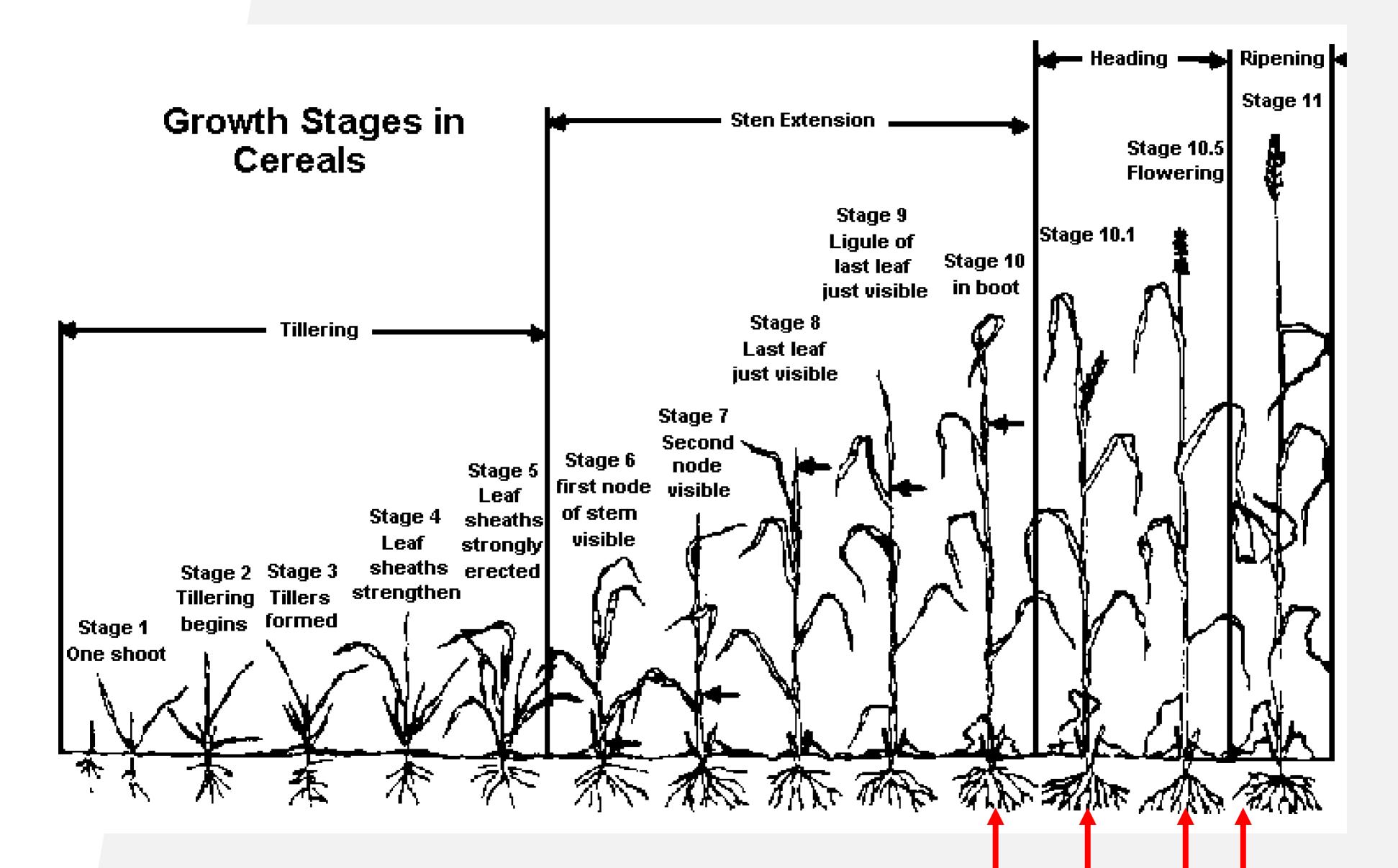


Photo Courtesty: https://circlesseeds.com/project/oats-products/

Ajay
Idaho AES (1991)
74Ab1952/74Ab2608
Short

CUTTING TIMING STUDY





60 lb N/ac as urea at planting

NITROGEN RATE STUDY



N Rate (lb/ac)
0
35
70
105
140



1.1 million seeds/ac

Initial Soil Test Results at Aberdeen



SOIL TEST DATA	Sample	1	12-24	24-36
Ammonium - N, ppm	3.2	VL	2.0	2.0
Nitrate - N, ppm	10	L	7	6
Phosphorus, ppm	15	м	10	5
Potassium, ppm	201	М	161	140
Calcium, meq/100g	8.6	М	9.6	12.0
Magnesium, meq/100g	2.3	М	3.1	4.3
Sulfate - S, ppm	4	VL	9	15

ppm= mg/L for solutions

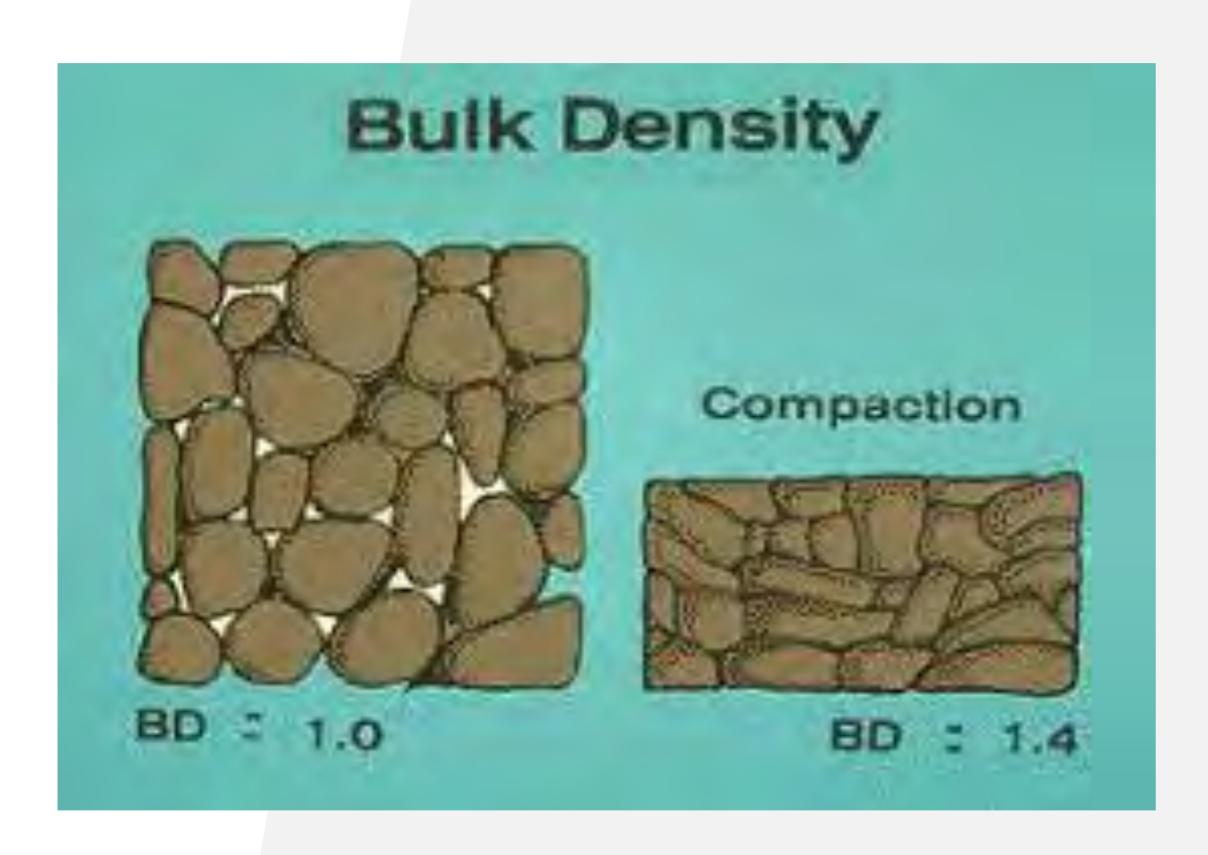
 $ppm = g/m^3$

ppm= mg/Kg for soil

To Convert ppm to lb/ac

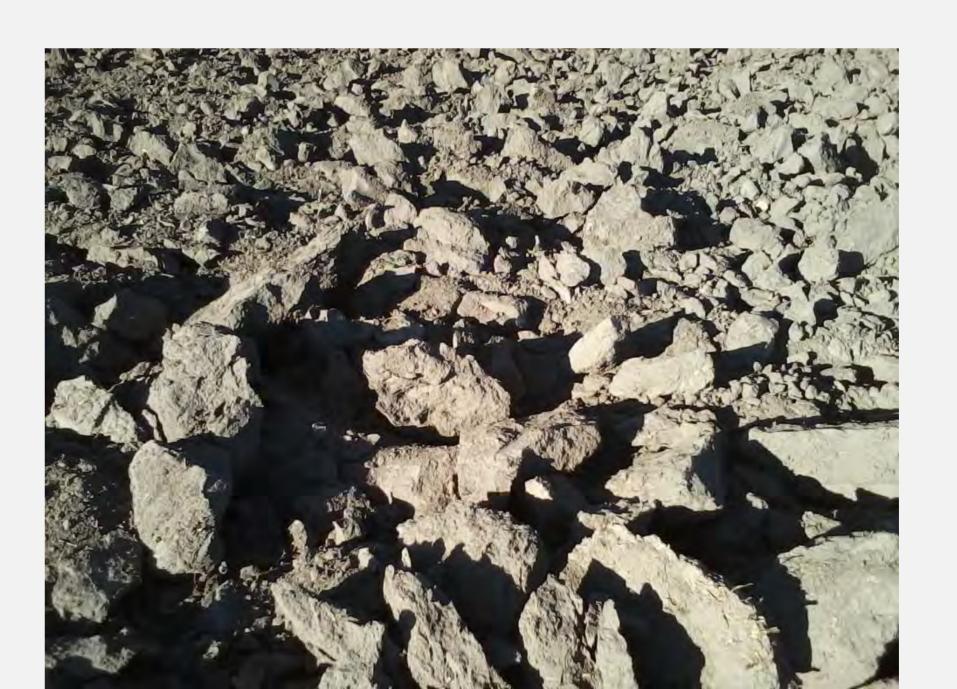
- 1) Area
- 2) Bulk density
- 3) Depth

Bulk Density Affects Available Nutrient Calculations



Bulk Density =
$$\frac{Dry\ weight\ of\ soil}{Volume\ of\ soil}$$





Bulk Density Affects Available Nutrient Calculations



$$\frac{1 \, mg \, NO_3 - N}{1 \, kg \, soil} \times \frac{1 \, lb \, NO_3 - N}{453592 \, mg \, NO_3 - N} \times \frac{1350 \, kg \, soil}{1 \, m^3} \times \frac{4046.86 \, m^2}{1 \, ac} \times 0.3 \, m = 3.6 \, \frac{lb \, NO_3 - N}{ac}$$

Reported soil test value in ppm or mg/kg

Conversion factor of mg to lb

Assumed bulk density of the soil

Surface Surfac

Soil sampling depth

Initial Soil Test Results at Aberdeen



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Calcium, meq/100g	8.6	М	9.6	12.0
Magnesium, meq/100g	2.3	М	3.1	4.3
Sulfate - S, ppm	4	VL	9	15

Lb N/ac using a bulk density value of 1.35 Mg/m3				
0-12"	12-24"	24-36"	0-36"	
11.5	7.2	7.2	25.9	
36	25.2	21.6	82.8	
			108.7	

Initial Soil Test Results at Aberdeen



					Lb N/ac using	g a bulk dens	ity value of 1	.35 Mg/m3
SOIL TEST DATA	Sample	<u>: 1</u>	12-24	<u>24-36</u>	0-12"	12-24"	24-36"	0-36"
Ammonium - N, ppm	3.2	VL	2.0	2.0	11.5	7.2	7.2	25.9
Nitrate - N, ppm	10	L	7	6	26	25.2	216	02 0
Phosphorus, ppm	15	M	10	5	36	25.2	21.6	82.8
Potassium, ppm	201	М	161	140				108.7
Calcium, meq/100g	8.6	M	9.6	12.0				
Magnesium, meq/100g	2.3	M	3.1		Lb N/a	c using the m	neasured bulk	density
Sulfate - S, ppm	4	VL	9		0-12"	12-24"	24-36"	0-36"
			Bu	ılk Density Mg/m	1.72	1.75	1.75	
				NILL NI	4.4.6	0 0	0 0	
				NH ₄ -N	14.6	9.3	9.3	33.2
				NO ₃ -N	14.6 45.9	9.3 32.7	9.3 28	33.2 106.6

Initial Soil Test Results at Rexburg



Ammonium - N, ppm	3.2	VL	2.6
Nitrate - N, ppm	5	VL	8
Phosphorus, ppm	34	Н	12
Potassium, ppm	199	M	121
Calcium, meq/100g	10.2	Н	10.2
Magnesium, meq/100g	1.6	L	1.9
Sulfate - S, ppm	5	L	6

	Lb N/ac using the measured bulk density			
	0-12"	12-24"	0-24"	
Bulk Density Mg/m ³	1.6	1.72		
NH ₄ -N	13.7	11.9	25.6	
NO ₃ -N	21.3	36.7	58	
			83.6	





	Aberdeen
	Lb/acre foot
рН	8.1
Sulfate-Sulfur	70.0
Calcium	119.4
Magnesium	64.2
Sodium	98.7
Nitrate-Nitrogen	15.4
Potassium	16.1
Phosphorus	0.1
Boron	0.3

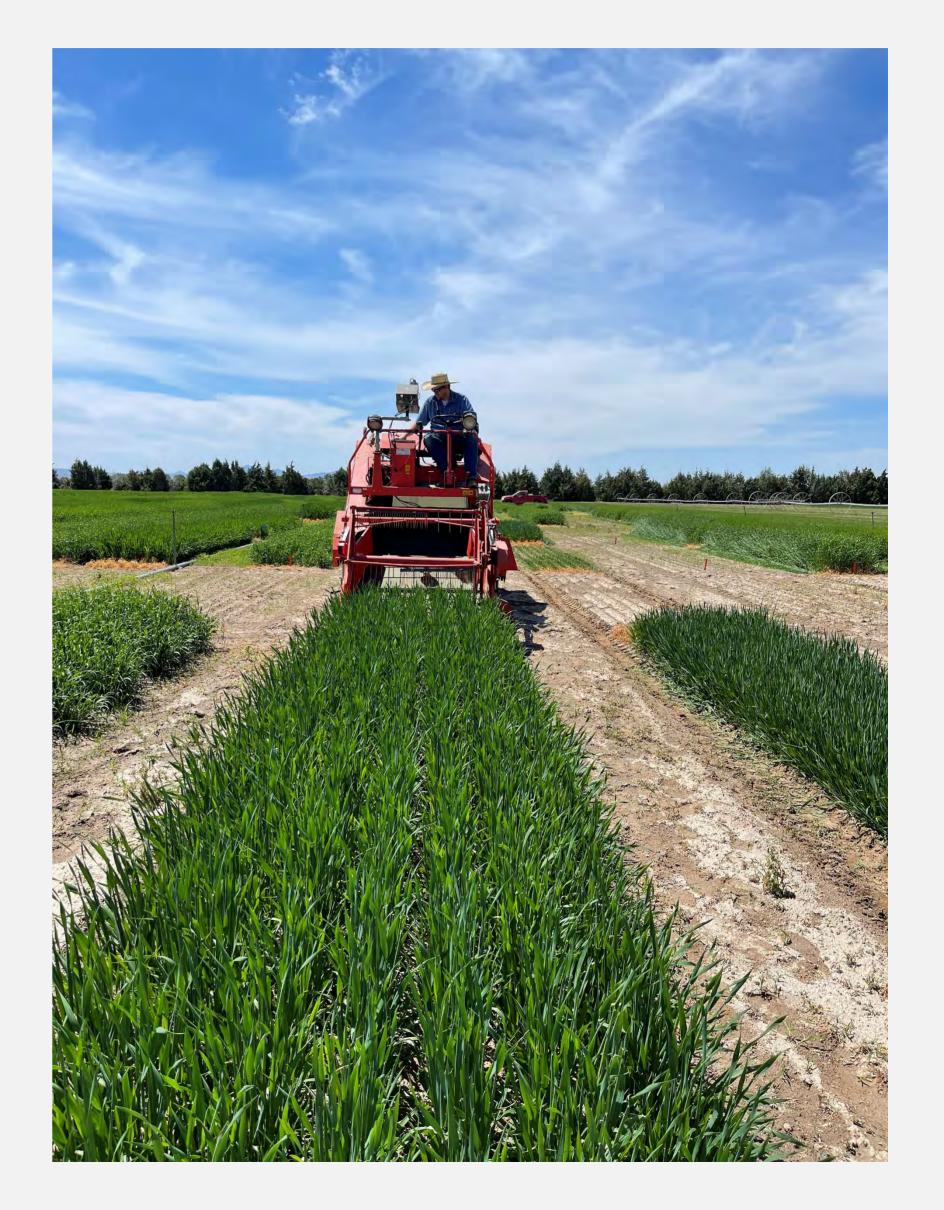


YIELD - CUTTING TIMING



Dry Harvest Yield (0% moisture) P>F

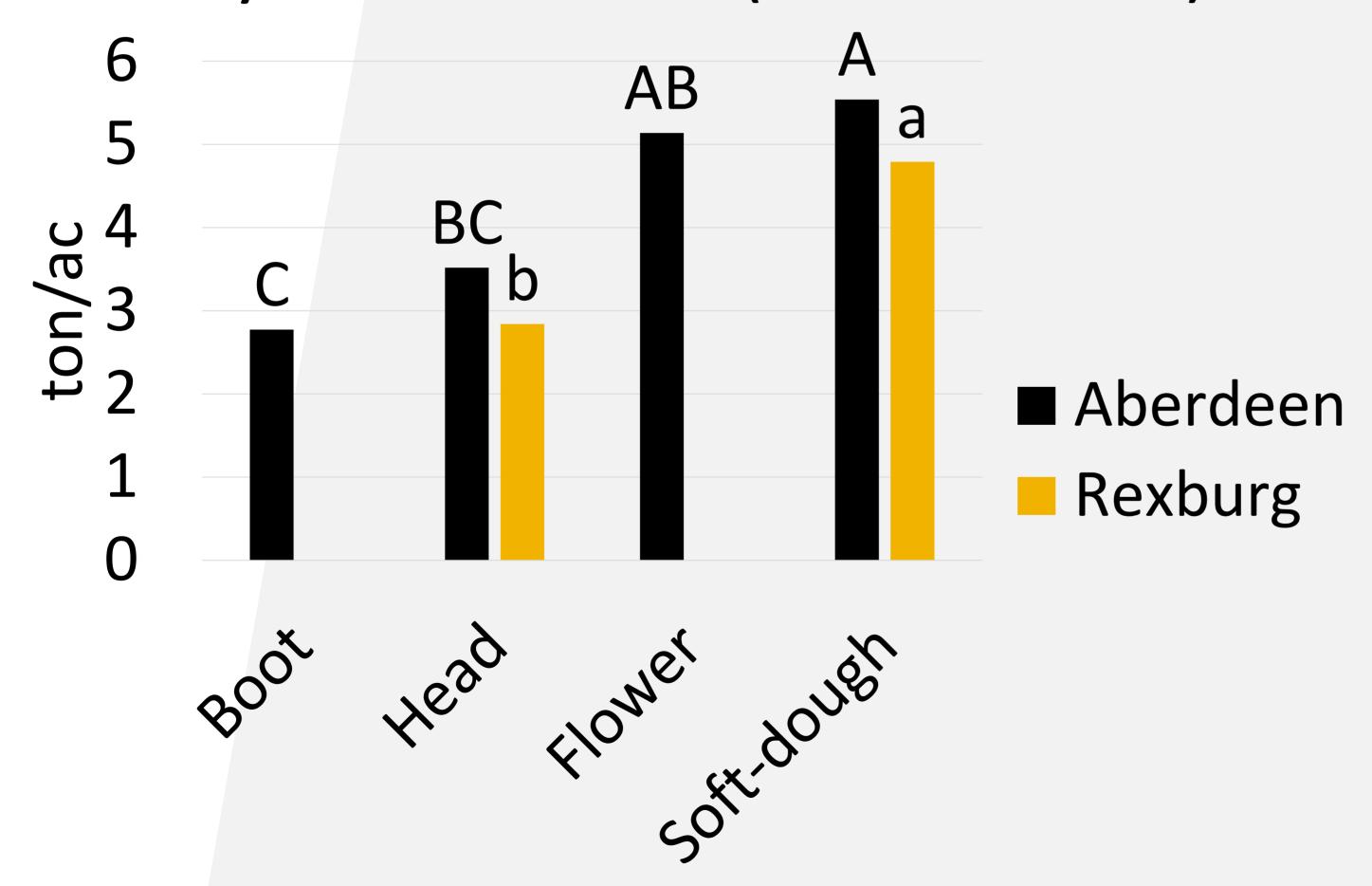
	Aberdeen	Rexburg†		
Cut Time (C)	0.0055	0.0049		
Variety (V)	0.0202	0.0309		
C*V 0.0585 0.2958				
†Only heading and soft-dough				

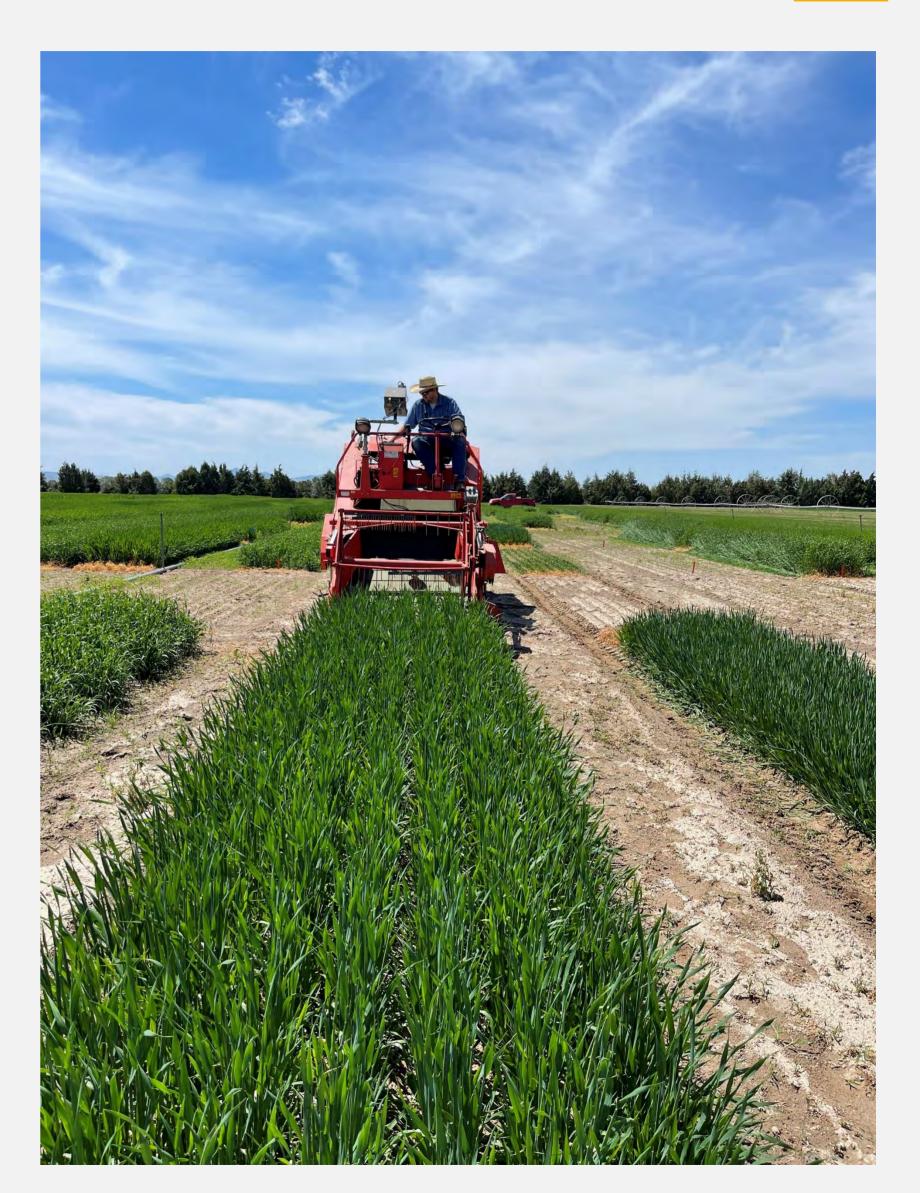


YIELD - CUTTING TIMING



Dry Harvest Yield (0% Moisture)

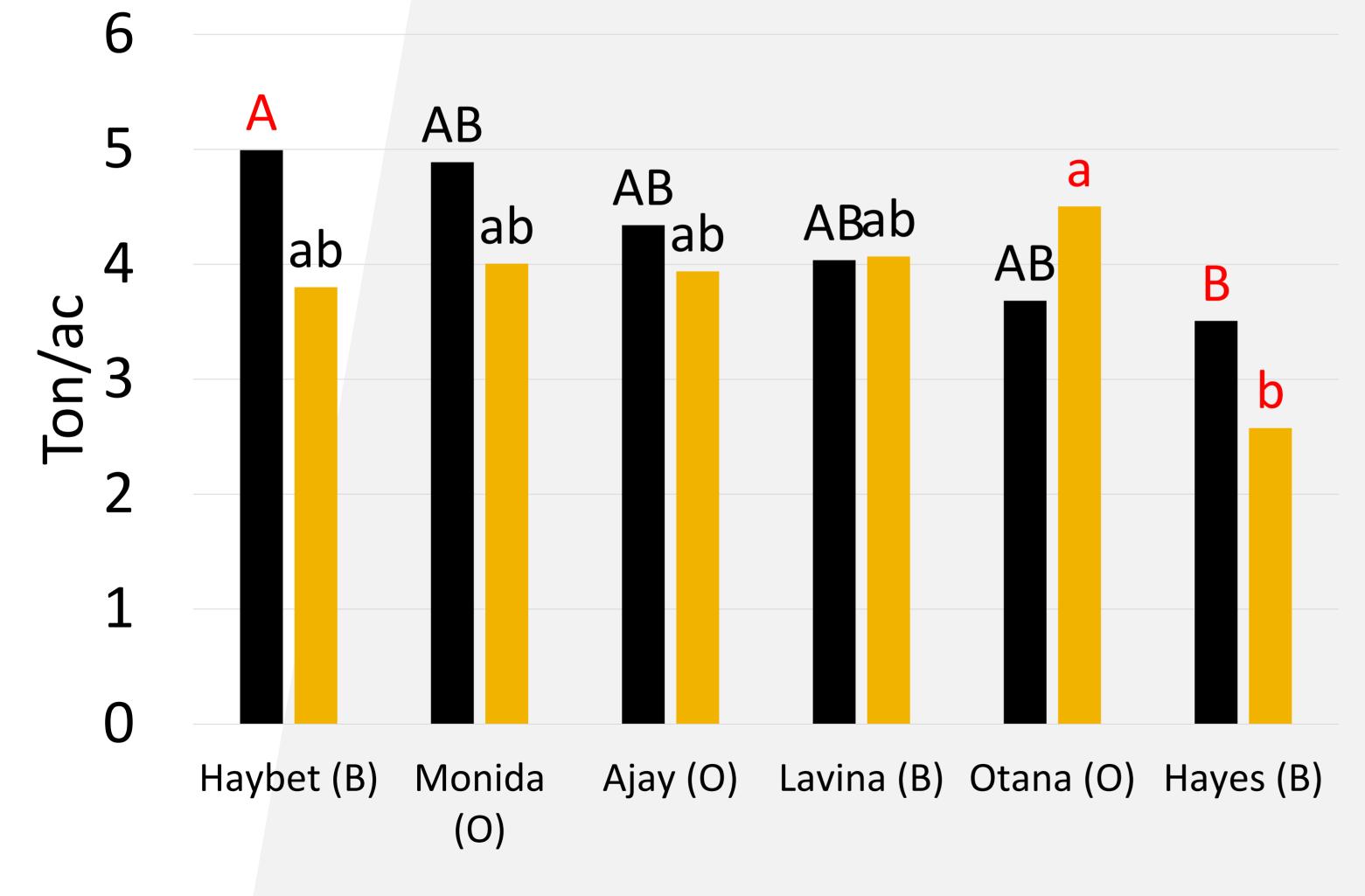




YIELD - CUTTING TIMING



Dry Harvest Yield (0% Moisture)

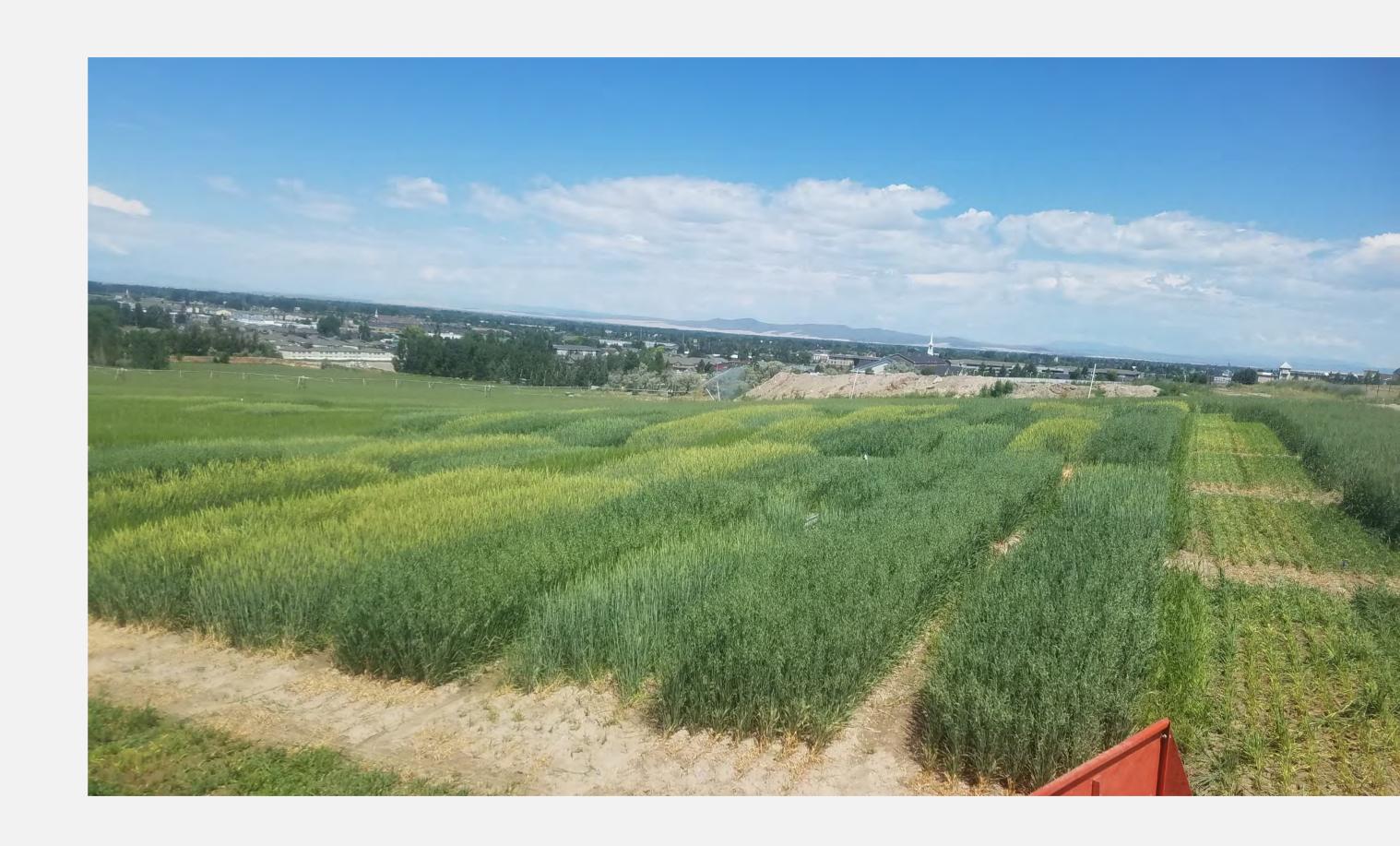




YIELD - N RATE

Dry Harvest	Yield
(0% moistur	e) P>F

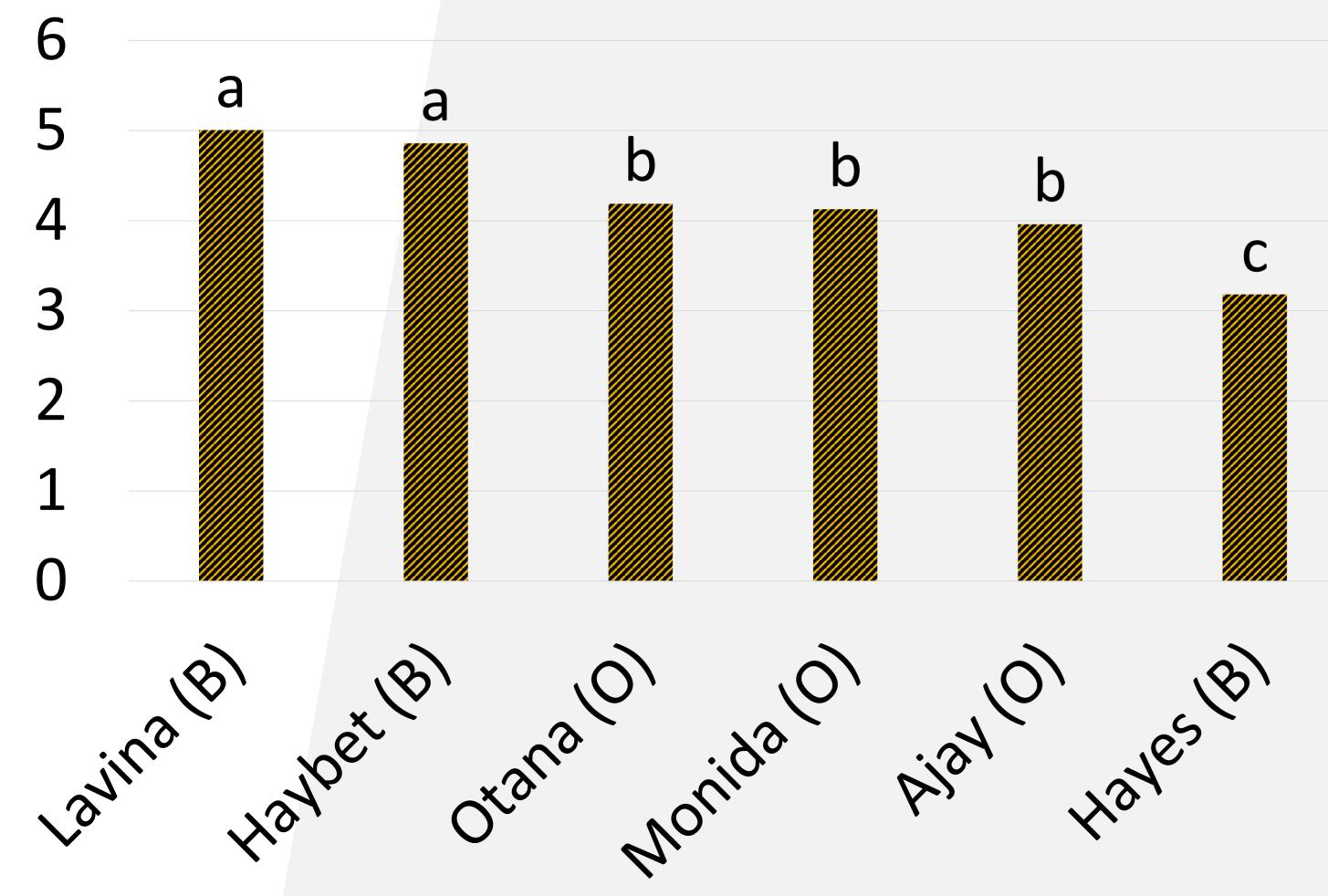
N rate	0.0007
Location	0.0119
Variety	< 0.0119
Location*Nrate	0.0009
Nrate*variety	0.2492
Location*Nrate	
*Variety	0.0638

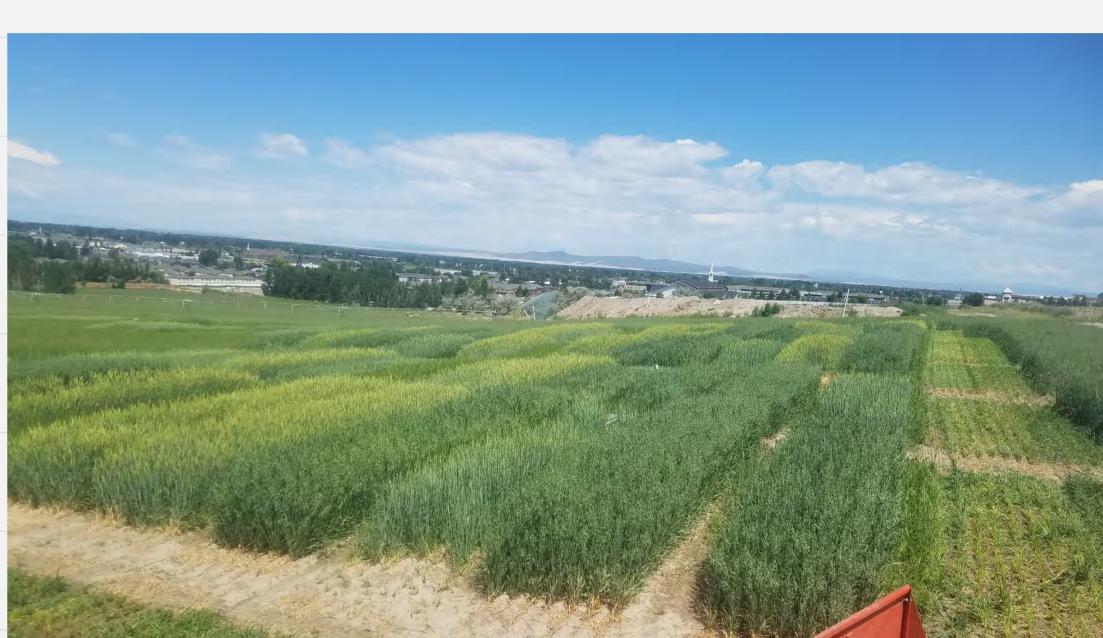


YIELD - N RATE



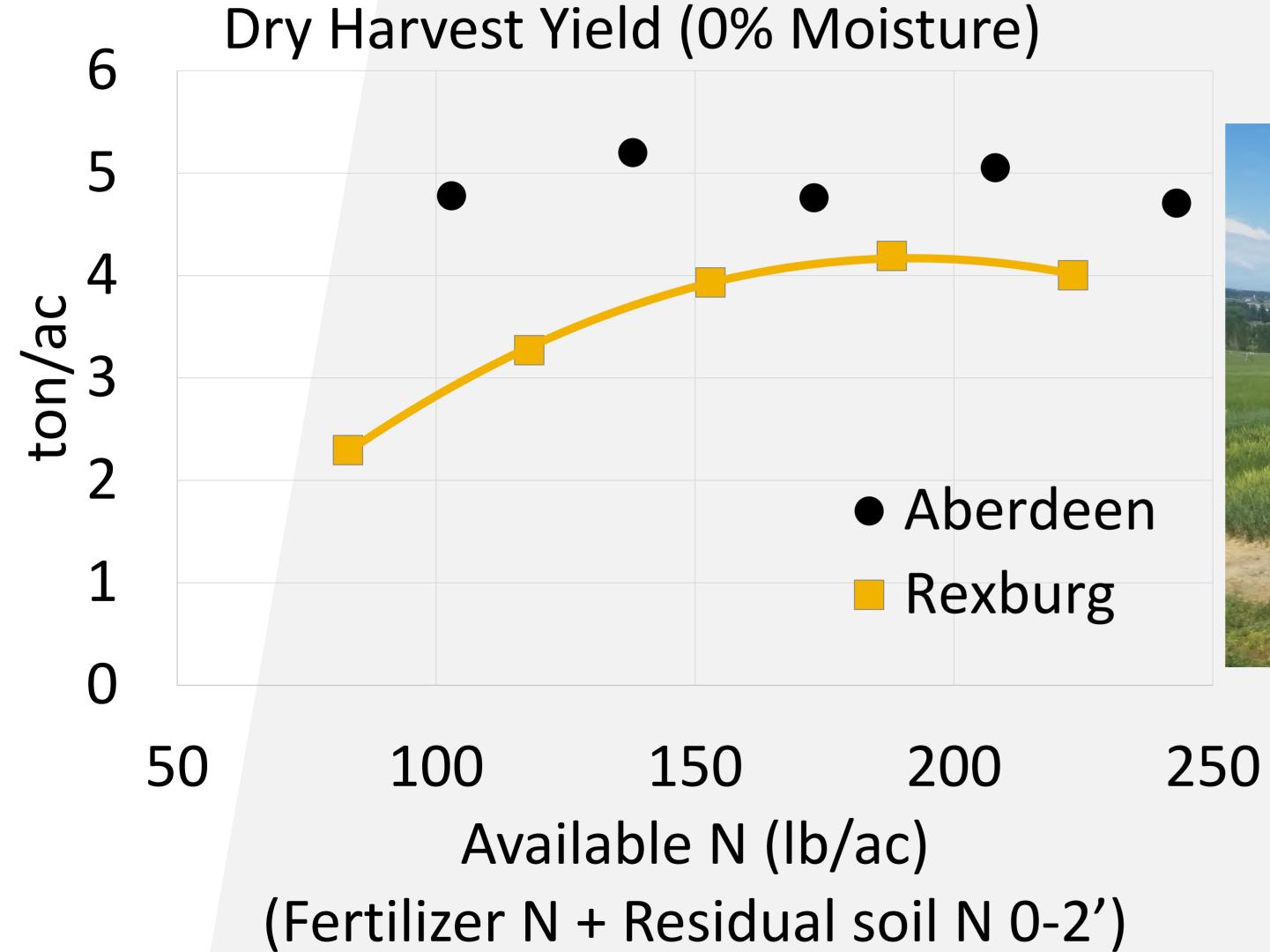
Dry Harvest Yield (0% Moisture)





YIELD - N RATE







CRUDE PROTEIN

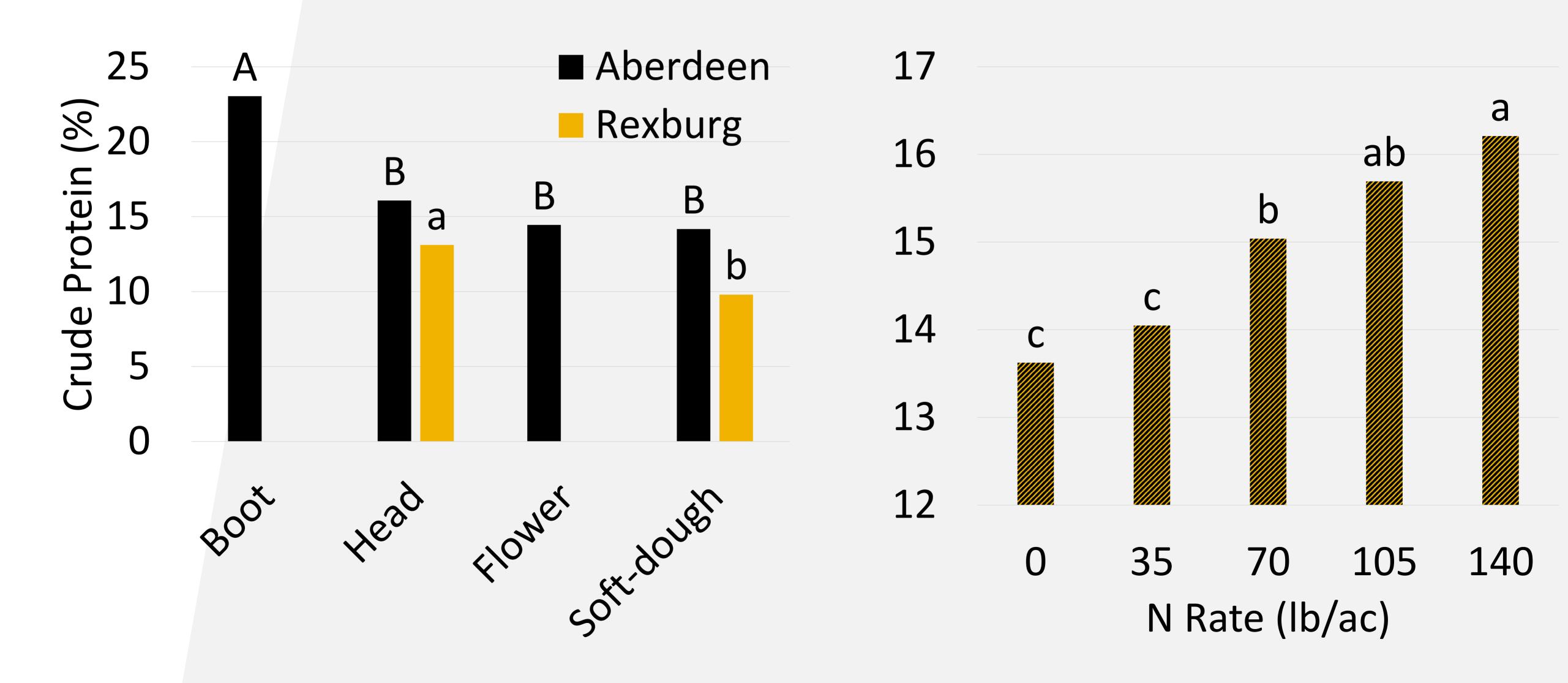


	Crude Protein (0% moisture) P>F		
	Aberdeen	Rexburg†	
Cut Time (C)	< 0.001	0.0067	
Variety (V)	0.6893	0.6017	
C*V	0.1989	0.3706	
†Only heading and soft-dough			



CRUDE PROTEIN





CRUDE PROTEIN



Class	% CP
Pregnant cow, midgestation	7.0
Pregnant cow, last 3 rd gestation	7.9
Lactating cow, 1 st 90 days	9.6
Heifers, midgestation	9.1
Heifers, last 3 rd gestation	9.1
Lactating heifers, 1 st 90 days	10.9

National Research Council's nutrient requirements for beef cattle, cows and first-calf heifers require certain percentages of crude protein (CP) and TDN in their diets (Table 1).

Crude protein was high enough to support each class of cattle nutrient requirements

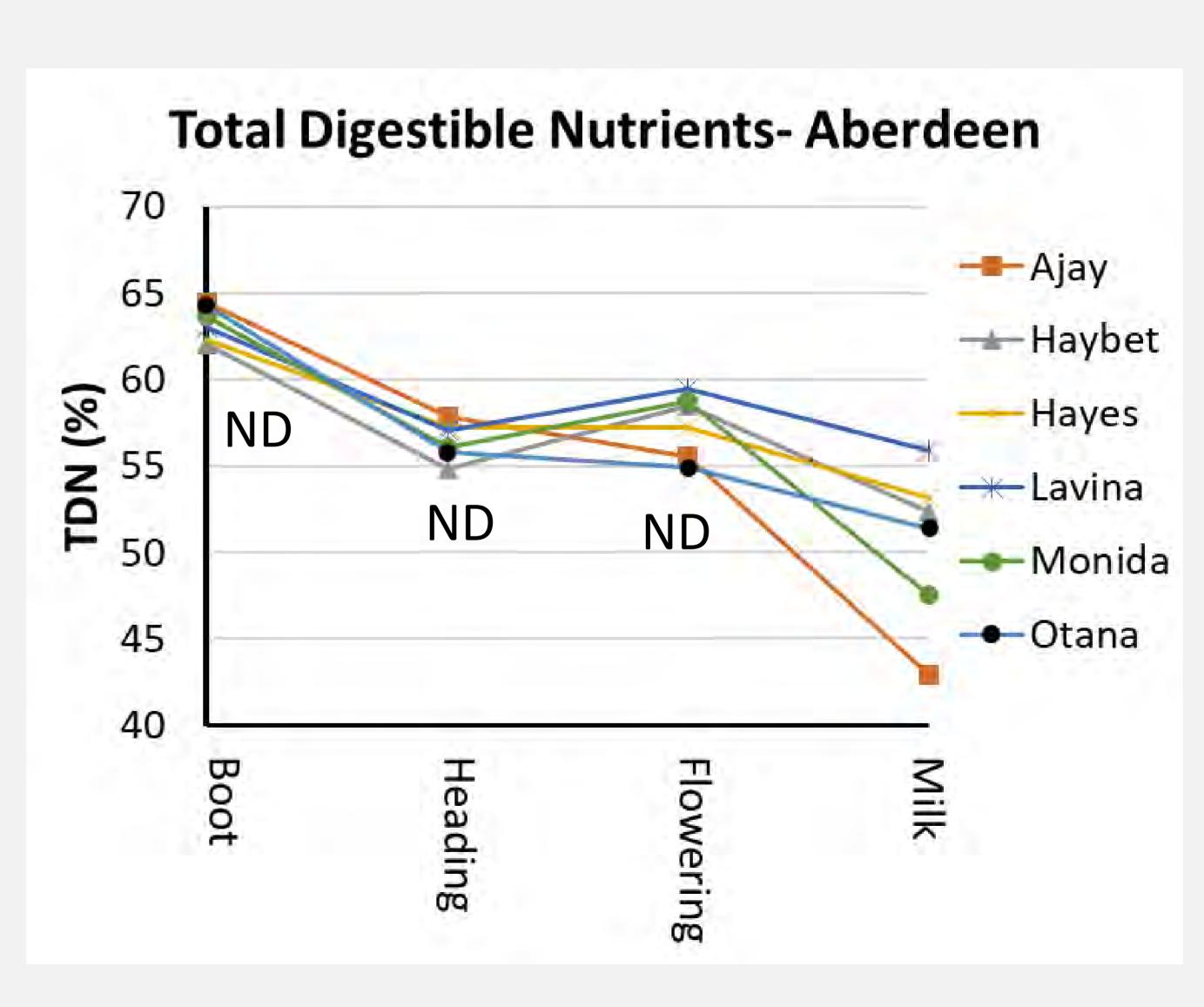
BUL 1013. Spring Annual Forage Hay Production in North-Central Idaho Doug Finkelnburg, James Church, Kenneth Hart

TOTAL DIGESTIBLE NUTRIENTS (TDN)



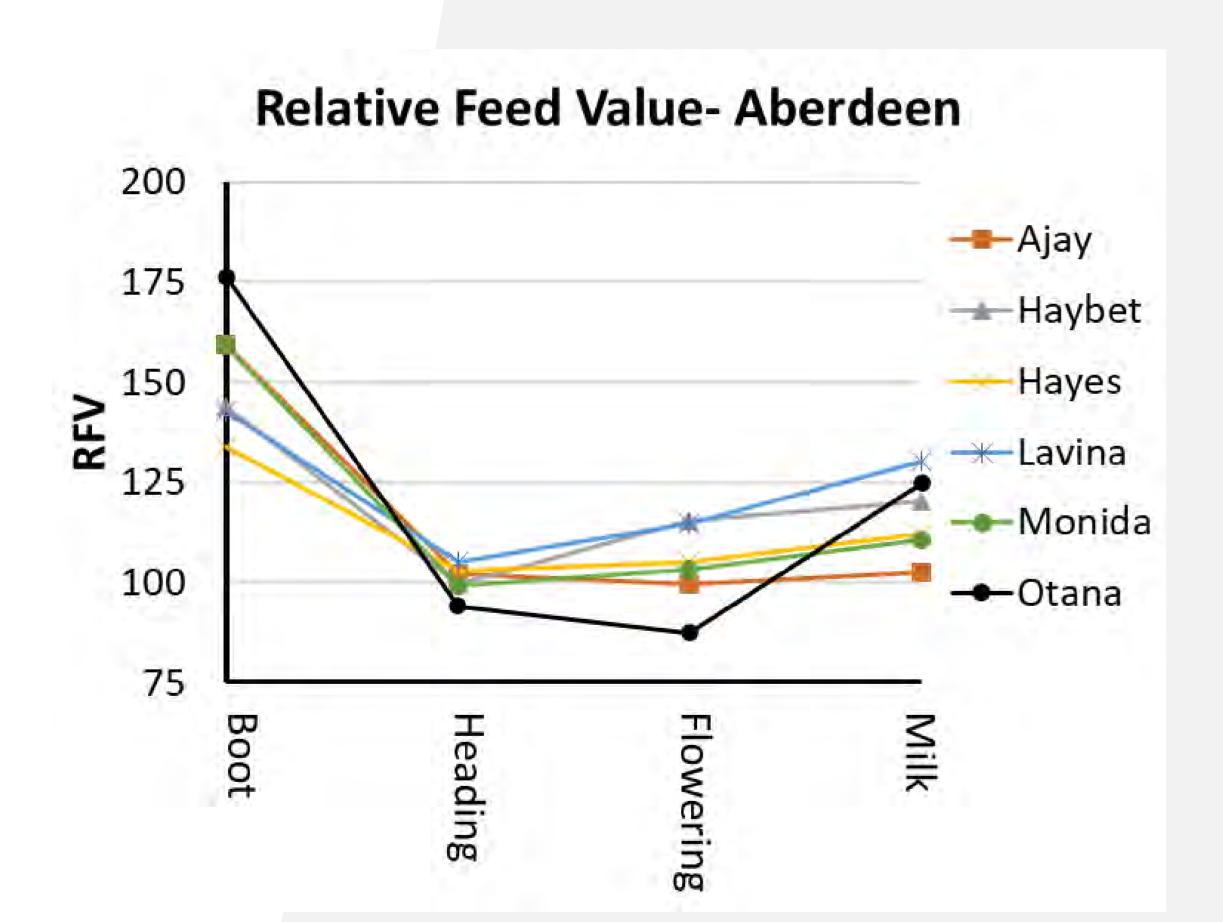
Class	% СР	% TDN
Pregnant cow, midgestation	7.0	49
Pregnant cow, last 3 rd gestation	7.9	54
Lactating cow, 1 st 90 days	9.6	57
Heifers, midgestation	9.1	56
Heifers, last 3 rd gestation	9.1	59
Lactating heifers, 1 st 90 days	10.9	63

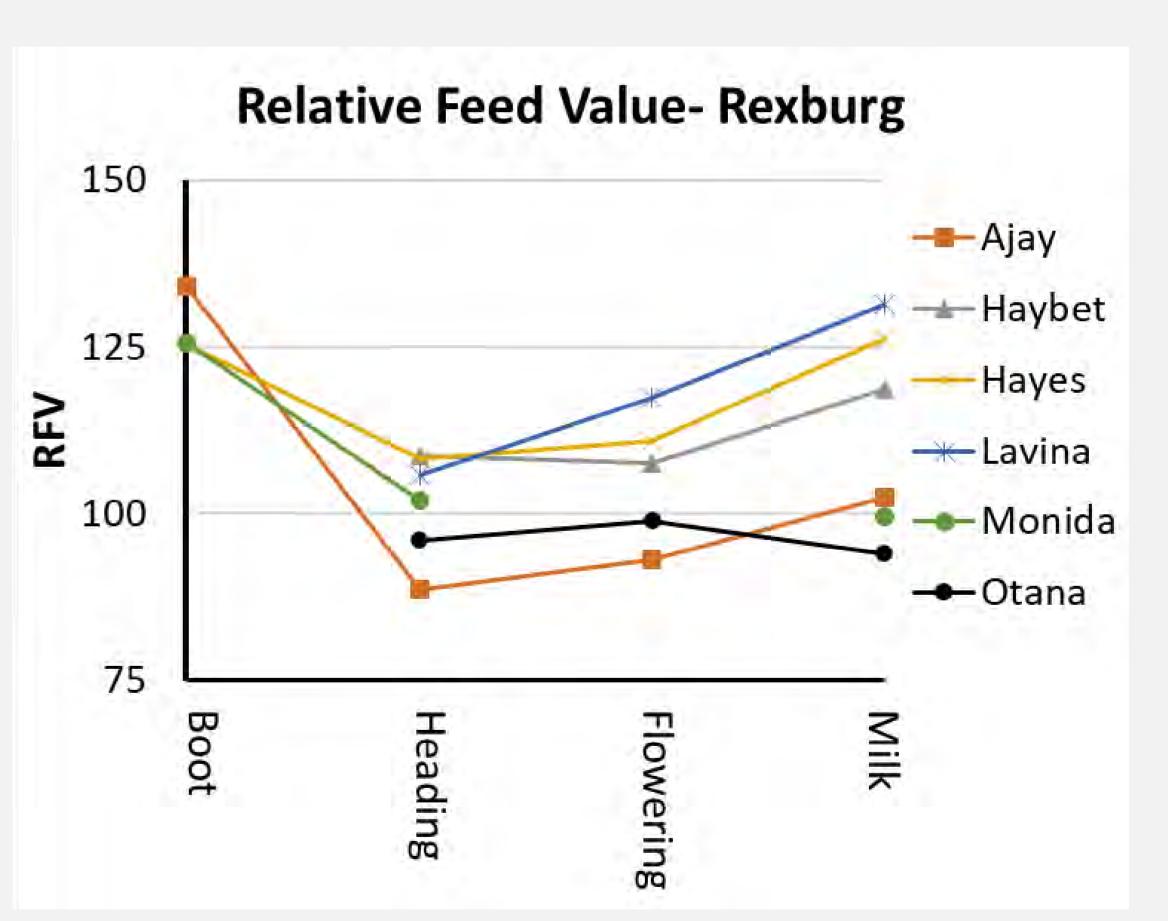
Forage N	TDN (%)
Aberdeen	55
Rexburg	57



RELATIVE FEED VALUE (RFV) CUTTING TIMING



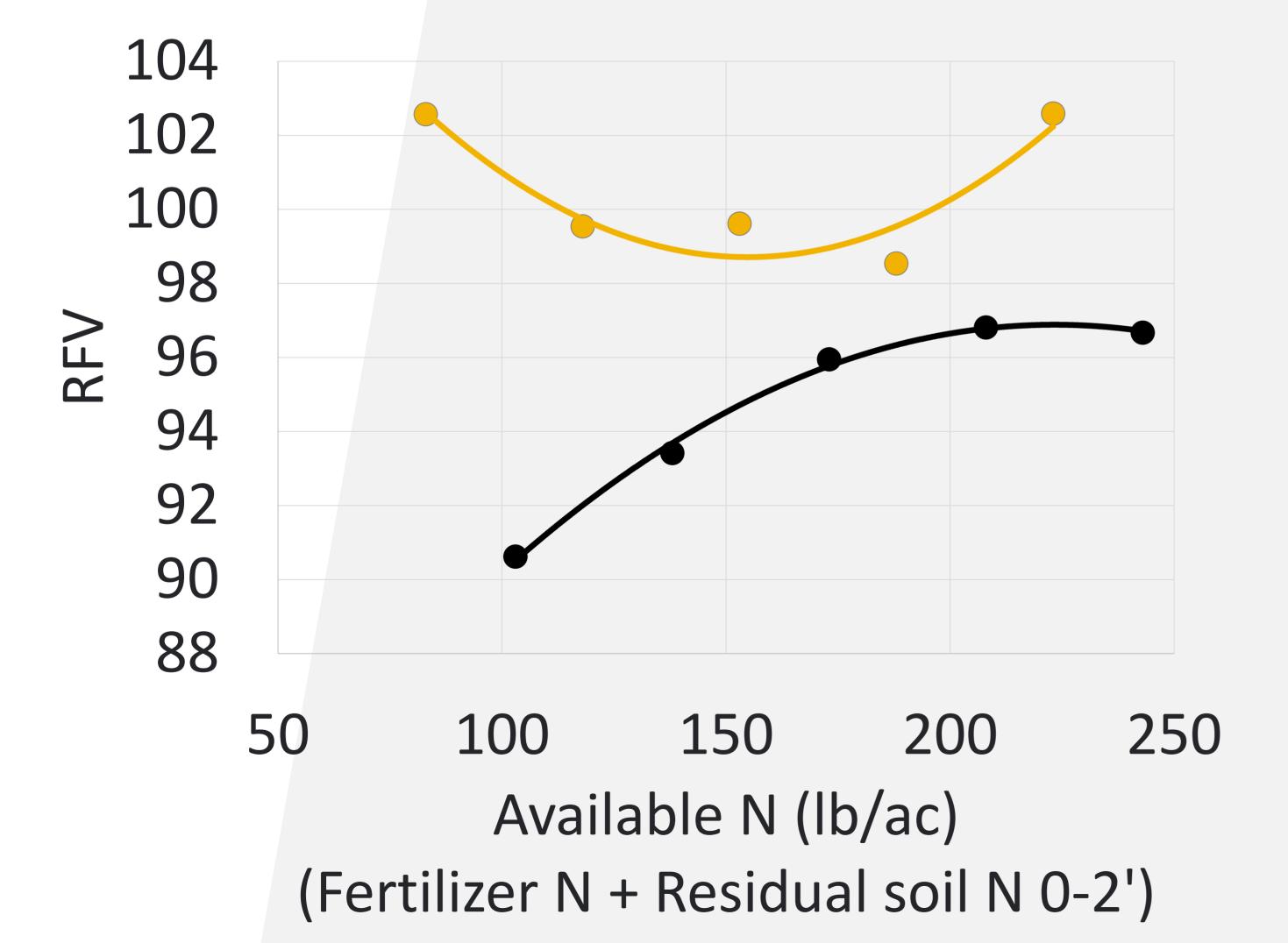


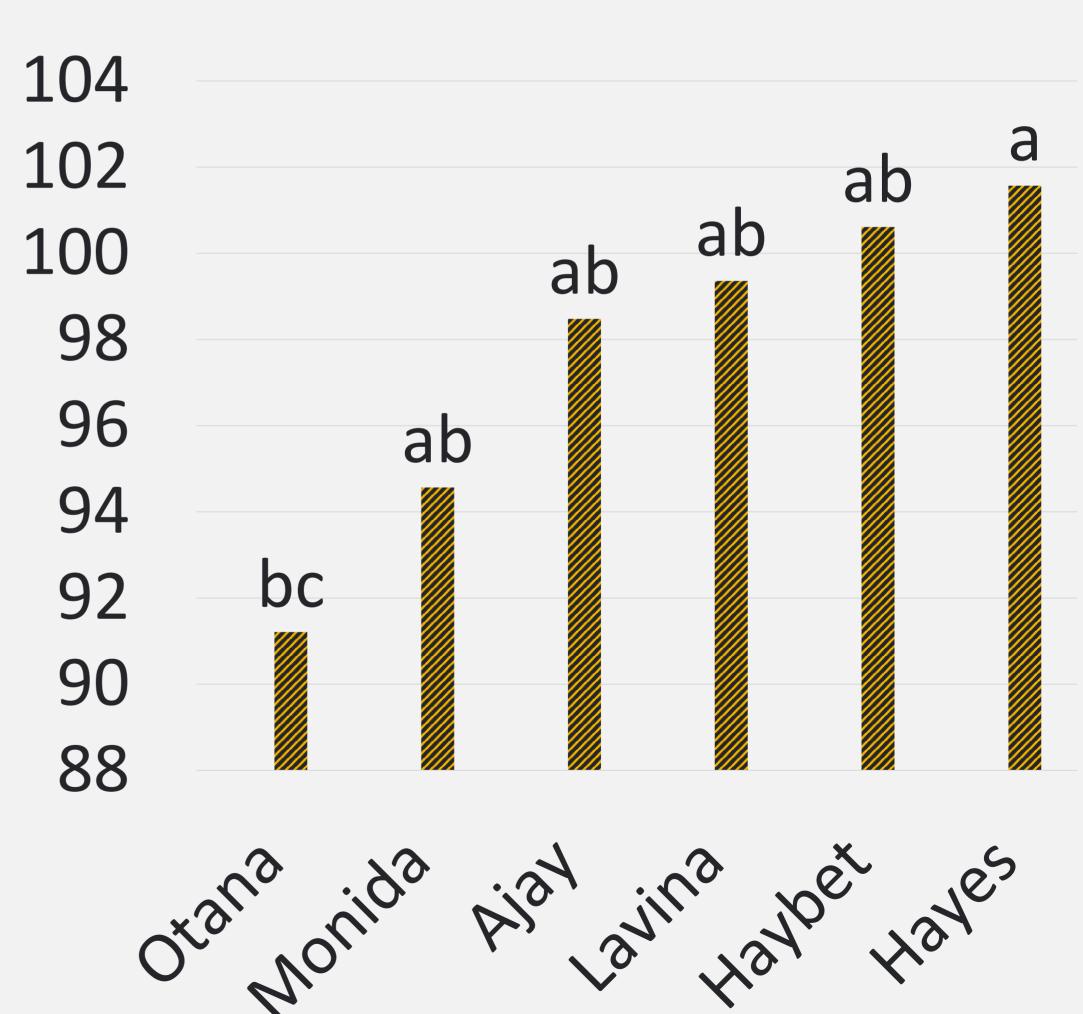


RFV=100 is equivalent to full bloom alfalfa RFV 150 – 200 desirable for high quality lactating dairy cow forages.

RELATIVE FEED VALUE (RFV) FORAGE N







CRUDE PROTEIN- DOUG FINKLNBERG RESULTS

Table 2. Spring annual forage results from Idaho and Lewis Counties, ID.*

Entry	Forage Type	Yield Dry Ton/Acre	CP %	TDN**	RFV***
Otana	Oats	3.17 a****	9.1 abc	55.9 de	90 cd
Proleaf 234	Oats	3.04 a	9.0 bc	55.0 e	87 d
Everleaf 114	Oats	2.85 ab	9.5 ab	57.6 abc	97 b
Proleaf 234/Flex	Oats/Pea	2.84 ab	9.8 a	57.7 abc	86 d
Everleaf 126	Oats	2.82 ab	9.1 bc	56.6 cd	94 bc
Stockford	Barley	2.53 bc	8.8 c	57.1 bc	106 a
NZA 4.14	Oats	2.49 bc	9.3 abc	58.1 ab	98 b
Stockford/Flex	Barley/Pea	2.40 c	9.1 bc	58.4 a	105 a
Average		2.77	9.2	57.1	95

^{*}Trials ran between 2018 and 2020 (April and May plantings) at two locations and during five site-years, as conditions allowed. Entries were replicated at least three times per trial. Samples were run at Dairyland Labs using NIR and Wet Chemistry analysis.

^{**}Total Digestible Nutrients

^{***}Relative Feed Value

^{****}Within-column means, followed by the same letters, are not different, according to a least significant difference test.

FALL FORAGE STUDY AND FIELD DAYS



Variety	Cereal Type
Progas	Hybrid Rye
Aviator	Hybrid Rye
SH-05	Hybrid Rye
Evina	Wheat
Hoodie	Barley
Forerunner	Triticale

Forage Field Day

Aberdeen: May 19

Rexburg: May 20





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QUESTIONS?

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FUTURE IDEAS OF STUDY INVESTIGATING DUAL USE OF ANNUAL FORAGES FOR EITHER FORAGE OR GRAIN?

MIXING BARLEY WITH A LEGUME FOR HIGHER PROTEIN?

SPRING VS WINTER VARIETIES?





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