

WASHINGTON STATE UNIVERSITY
EXTENSION

Optimum Nitrogen Rates for Timothy

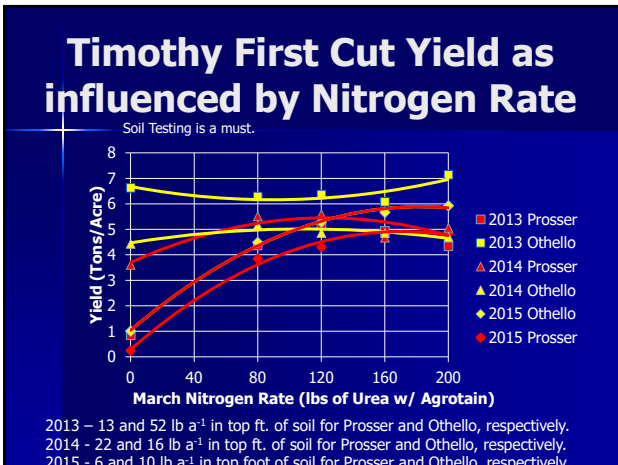
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AGRICULTURE YOUTH & FAMILIES HEALTH ECONOMY ENVIRONMENT ENERGY COMMUNITIES

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Nitrogen Recommendations

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Soil Test	lb. N in top foot	Pounds of Nitrogen Yield	Change in Yield	Total Value of Hay	Marginal Value of Hay	Marginal Cost of Fertilizer	Net Return to Nitrogen Fertilizer
6	0	1,0401	0.31052	360.5025			
10	10	1,50862	0.31052	389.5409	139.138 \$	5.00 \$	134.138
13	20	2,046012	0.48745	511.501	123.8629 \$	5.00 \$	118.8629
16	30	2,50936	0.638398	629.09	115.589 \$	5.00 \$	110.589
22	40	2,939506	0.429246	733.4015	107.3118 \$	5.00 \$	102.3118
50	50	3,33375	0.401144	833.4375	100.038 \$	5.00 \$	95.038
52	60	3,704792	0.371662	926.198	92.7628 \$	5.00 \$	87.7628
70	70	4,046732	0.34194	1011.683	85.488 \$	5.00 \$	80.488
80	80	4,35557	0.312838	1099.892	78.2095 \$	5.00 \$	73.2095
90	90	4,643906	0.283786	1160.8245	70.934 \$	5.00 \$	65.934
100	100	4,89794	0.254634	1224.485	63.6586 \$	5.00 \$	58.6586
110	110	5,12492	0.225532	1280.868	56.383 \$	5.00 \$	51.383
120	120	5,319902	0.19643	1329.9735	49.1075 \$	5.00 \$	44.1075
130	130	5,48723	0.167288	1371.8075	41.832 \$	5.00 \$	36.832
140	140	5,629456	0.138226	1406.364	34.5566 \$	5.00 \$	29.5566
150	150	5,73458	0.109124	1433.645	27.281 \$	5.00 \$	22.281
160	160	5,814602	0.080022	1453.6605	20.0055 \$	5.00 \$	15.0055
170	170	5,865222	0.05092	1466.3805	12.73 \$	5.00 \$	7.73
180	180	5,88734	0.021818	1471.813	5.4545 \$	5.00 \$	0.4545
190	190	5,880356	-0.007284	1470.014	-1.821 \$	5.00 \$	-6.821
200	200	5,84367	-0.036386	1460.9175	-9.096 \$	5.00 \$	-14.096

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2014 Othello Lodging and Economic Return w/o Quality

N Rate Applied 1 st Cutting	Area lodging (%)	Economic Return 1 st Cutting after Fert. w/o Quality (\$ acre ⁻¹)
0	11	1,119
80	48	1,208
120	92	1,213
160	90	1,190
200	91	1,140

16 lb. acre⁻¹ in top foot of soil in spring
Optimum economic yield 106 lb. acre⁻¹

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2014 Prosser Lodging and Economic Return w/o Quality

N Rate Applied 1 st Cutting	Area lodging (%)	Lodging Rating Scale (0 – 5)	Lodging Score Combined (0 – 5)	Economic Return 1 st Cutting after Fert. w/o Quality (\$ acre)
0	6	0.47	0.20	922
80	63	3.03	2.11	1,263
120	87	3.53	2.60	1,280
160	82	3.69	2.79	1,194
200	88	3.38	2.44	1,006

22 lb. acre⁻¹ in top foot of soil in spring
Optimum economic yield 106 lb. acre⁻¹

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2015 Prosser Lodging and Economic Return w/o Quality

N Rate Applied 1 st Cutting	Area lodging (%)	Lodging Rating Scale (0 – 5)	Lodging Score Combined (0 – 5)	Economic Return 1 st Cutting after Fert. w/o Quality (\$ acre)
0	0	0.00	0.00	74
80	0	0.00	0.00	869
120	9	0.63	0.09	1088
160	65	3.38	2.15	1188
200	64	3.38	2.49	1169

10 lb. acre⁻¹ in top foot of soil in spring
Optimum economic yield 174 lb. acre⁻¹

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2015 Othello Lodging and Economic Return w/o Quality

N Rate Applied 1 st Cutting	Area lodging (%)	Lodging Rating Scale (0 – 5)	Lodging Score Combined (0 – 5)	Economic Return 1 st Cutting after Fert. w/o Quality (\$ acre)
0	0.0	0.00	0.00	262
80	13.1	1.75	0.33	1054
120	48.8	4.13	2.00	1289
160	76.9	4.13	3.23	1416
200	71.3	4.38	3.21	1435

10 lb. acre⁻¹ in top foot of soil in spring
Optimum economic yield 187 lb. acre⁻¹

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Upper Leaves N Concentration

- The upper leaves optimum nitrogen concentration to maximize profit is 3.15% at the vegetative stage, stems six inches in length and 3.36% at the early boot stage when stems were 26 inches in length.

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Percent N in Leaf at Veg. Stage	N Fertilizer (lbs./a) from Optimum	Percent N in Leaf at Boot Stage	N Fertilizer (lbs./a) from Optimum
2	-129	2	-128
2.1	-124	2.1	-137
2.2	-119	2.2	-143
2.3	-112	2.3	-147
2.4	-103	2.4	-147
2.5	-93	2.5	-144
2.6	-82	2.6	-139
2.7	-70	2.7	-130
2.8	-57	2.8	-119
2.9	-42	2.9	-104
3	-26	3	-87
3.1	-8	3.1	-67
3.2	11	3.2	-44
3.3	31	3.3	-18
3.4	52	3.4	11
3.5	75	3.5	43

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Steps to use SPAD meter

1. When spreading fertilizer double spread fertilizer on a strip of the field at least 10 feet wide and mark in a way to find later for your reference reading
2. Check field with SPAD meter when stems inside timothy plant are about 6" long. Do SPAD meter readings at this stage has been near the first week in May in the Basin.

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Steps to use SPAD meter

3. Collect at least 20 readings in each field, 20 in double spread area and find avg. for each
4. Divide the avg. field reading by avg. of double spread area reading, this is RCM
5. Read recommendation from table using RCM and apply N through sprinkler if necessary.
6. At harvest time core bales and submit sample to lab and see what protein has come back with. It should be around 9%.

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Fertilizer recommendations for RCMveg & RCMboot readings

RCMveg	N Fertilizer (lbs./a) from Optimum	RCMboot	N Fertilizer (lbs./a) from Optimum
0.5	-136	0.5	-116
0.55	-126	0.55	-121
0.6	-114	0.6	-120
0.65	-100	0.65	-114
0.7	-84	0.7	-102
0.75	-66	0.75	-84
0.8	-45	0.8	-61
0.85	0	0.85	0
0.9	3	0.9	1
0.95	30	0.95	40
1	59	1	85

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Other N Considerations

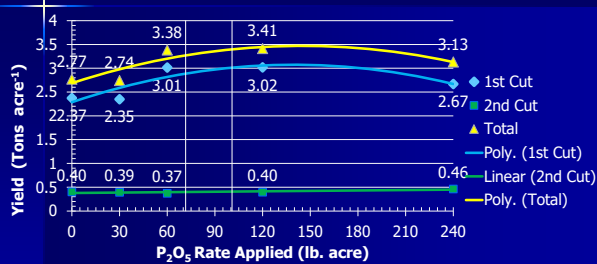
- For 2 cut hay systems, apply 1/3 of first cut N rate after the hay crop is removed. For 3 cut systems apply 1/4 of 1st cut rate for cuts 2 and 3.
- Schedule mid- and late-season nitrogen applications to coincide with irrigation or rainfall events.

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Phosphorus

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First Year Yields of Timothy in 2022 as Influenced by Phosphorus Application



60 lbs acre⁻¹ of P₂O₅ increased 1st cutting yield and total yield by 0.64 tons acre⁻¹

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Table 3. Phosphorus (lbs P₂O₅/acre) recommendations for grass and legume pastures in the interior Columbia Basin (Shewmaker, 2010).

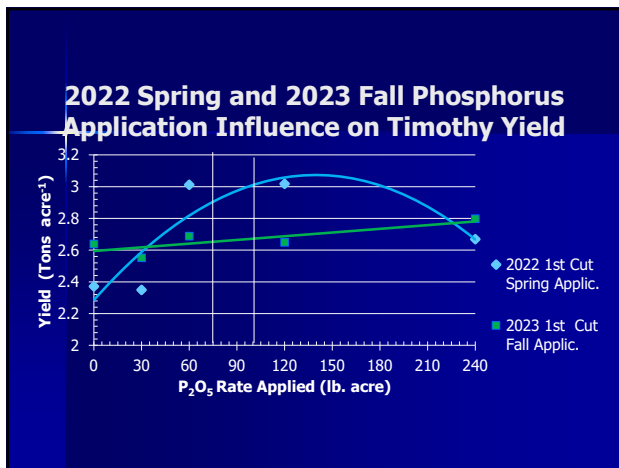
Soil Test P ^a (ppm or mg/kg)	P Recommendation ^{b,c}			
	Irrigated (lb P ₂ O ₅ /acre)	Rainfed (lb P ₂ O ₅ /acre)	Irrigated (kg P ₂ O ₅ /ha)	Rainfed (kg P ₂ O ₅ /ha)
0 to 3	100 to 125	60 to 100	112 to 125	67 to 112
4 to 7	75 to 100	40 to 60	84 to 112	45 to 67
8 to 10	50 to 75	20 to 40	56 to 84	22 to 45
11 to 15	0 to 50	10 to 20	0 to 56	11 to 22
15 and above	0	0	0	0

^a Soil test P is based on a 12-inch (30.4 cm) sample depth and sodium bicarbonate soil extract (Olsen method).

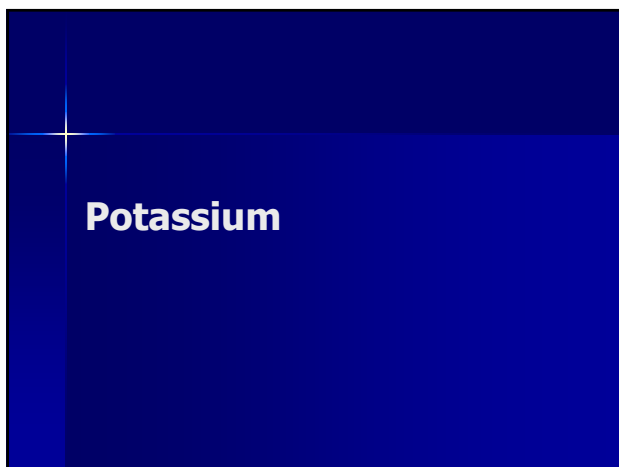
^b Fertilizer labels are expressed in percent P₂O₅. To convert P₂O₅ to P, multiply by 0.44.

^c Refer to local fertilizer guides for more specific recommendations.

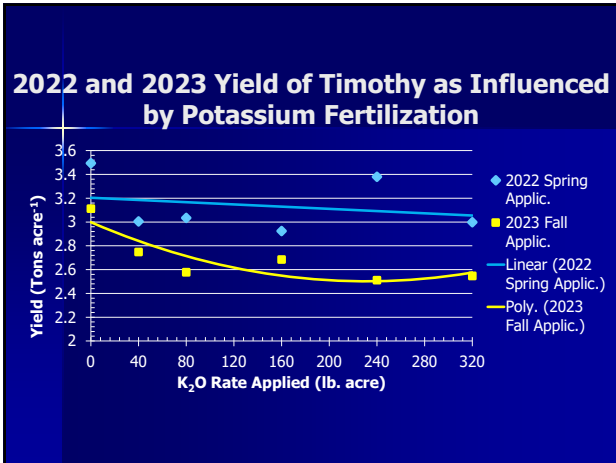
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Summary

- Soil nitrate levels in the spring have a strong influence on optimum N application
- We have developed an excel spreadsheet to help with N applications if you know lbs/acre of N in the first foot
- Spring applications of P appears to be more effective than fall applications

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Summary

- Timothy appears to be very efficient in mining sufficient K even in low testing soils.
- More research is needed in fertility of P and K in grass crops.
- Research dollars to do research for forage grasses is extremely difficult to obtain.

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