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Spring Annual Forage Hay Production in North-Central Idaho

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Forage Feed Quality and Cattle Nutrition Considerations

The cost of feed to winter a beef cow is the number one expenditure associated with annual cow production costs. In fact, nationwide economic studies show that winter feed costs total 60% of the cost to own a cow for a year. This is true for cattle producers in the north-central region of Idaho, where they must feed cows for a period of 4–6 months depending on their location. A challenge for cattle producers in north-central Idaho (NCI) is producing or purchasing forage with adequate crude protein and energy levels that provides the nutrient requirements for late-gestating pregnant cows, cows at parturition and early lactation, and fall calving cows that are nursing calves and returning to estrus for rebreeding.

Forage analysis of grass hay grown in Idaho and Lewis Counties over a 30-year period from 1987 to 2017 indicates that the typical grass hay produced in the region contains a crude protein level of between 6% and 8%. The Total Digestible Nutrients (TDN) content of this same grass hay normally ranges from 44% to 48% with a Relative Feed Value (RFV) falls in the mid- to upper 80s, which merits a Poor-Quality Grade.

According to the 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). Meeting the nutrient requirements of both pregnant and lactating cows and heifers while on winter feed is a challenge for NCI cattle producers. Comparing the nutrient content of regionally grown grass hay with the cow and heifer requirements outlined in Table 1 indicates a need for supplementation or the production of higher-quality forages to meet the nutrient requirements.

Adding protein and energy supplements to the diet can be very expensive for producers which, in turn, increases winter feed costs. On a cost-per-pound-of-protein basis, the cheapest protein source is a legume hay, such as alfalfa, whose current cost is $0.42 per pound. The most expensive are protein tubs, which currently cost $2.30 per pound. Because legume forages are not commonly grown in NCI and thus are harder to obtain, most producers opt for protein tubs, which are convenient but expensive.

Table 1. The CP and TDN requirements for beef cows and heifers.

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

One of the goals of the spring-planted annual forage trial is to determine if forages of higher quality than timothy hay can be produced that will supplement winter feed rations and lower total feed costs in addition to providing a viable alternative to planting a spring cereal crop. Results show that spring-planted forage crops can provide an increase in forage quality while maintaining yield per acre, compared to locally grown grass hay (Table 2).

In Table 2, the average CP concentration of 9.2% is higher than the best grass hay typically grown in NCI. The concentration average meets the nutrient requirements for cows and heifers in all stages of the production cycle as indicated in Table 1, except for classes that are ninety days postpartum or in early lactation. The TDN concentration of spring-planted forages averaged 57.1%, which is approximately 10% higher than the average grass hay produced in NCI. The TDN average thus meets the nutrient requirements for all the classes of cows outlined in Table 1, but is slightly below the requirements for heifers in the last third of gestation and 90 days postpartum. The average RFV for spring-planted forages was 95. Local grass hay normally has an RFV score in the mid to upper 80s. A 95 score improves the Quality Grade from Poor to Fair.

The results indicate that utilizing spring-planted forages in a winter beef cattle feed ration satisfies the nutrient requirements of most classes of cows and heifers and reduces the cost of supplementing rations with protein and energy supplements. Spring-planted forage use thus benefits forage and cattle producers, whose incorporation presents a viable option in forage production systems and crop rotations. Cattle producers also need to consider feeding spring-planted forages in their winter-feeding rations.

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.

Agronomic Considerations for Spring Forages in North-Central Idaho

Seeding. Plant cool-season spring forage crops as soon as the ground is workable in the spring, typically mid-April to mid-May, and at seeding rates similar to spring-planted cereal-grain crops (1.2 million seeds/acre). As with a spring grain crop, do not plant in overly wet soils, which increases the risk of soil compaction and the development of soilborne disease issues. Fungicidal seed treatment provides additional protection from some soilborne diseases. Delay planting until after the first flush of weeds appear in order to provide preplant weed control.

Fertility. Comparatively less nitrogen is required to produce a spring cereal forage crop than a typical NCI spring grain crop. To achieve a successful spring cereal grain crop in NCI, apply 60–80 lbs N/A (nitrogen/acre) at planting, targeting 100–120 lb of plant-available nitrogen. **Plant-available nitrogen** is the total of nitrogen applied and residual nitrogen as determined by soil tests. Yields (Table 2) were achieved by targeting 90 lb of plant-available nitrogen through soil tests to determine residual fertility and then supplementing the difference with a banded fertilizer application at planting. Phosphorous (P) and sulfur (S) were supplemented when deficient on soil tests at 20 lbs/A (P) and 23 lbs/A (S).

Weed control. Control weeds prior to planting through cultivation or a preplant herbicide application. Early season postplant herbicides can be used in single-species hay stands. Adequate weed control in these trials was achieved postplant using 16 oz/acre of 2,4-D amine. Mixed legume/cereal stands will receive preplant treatment only. Learn the herbicide history of a field site to protect your chosen forage variety or varieties from residual herbicide damage, especially when adding a broadleaf such as forage pea. Additionally, carefully read and follow the herbicide label to avoid use of products not labeled for animal forage use.

Harvest considerations. Harvest timing balances optimal nutrition, optimal dry tonnage, and good harvest conditions. CP concentration in cereal forages declines rapidly after stem elongation but tonnage increases until after heading. Our results were achieved by harvesting between seed head emergence and the beginning of flowering. Avoid swathing during periods of wet and/or humid weather to prevent quality loss due to microbial activity, molds, and in extreme cases spontaneous combustion of baled hay.

Cool-season forages in rotations. Annual crop rotations in NCI tend to be dominated by winter and spring wheat production. Including a cool-season forage oat or barley crop benefits these rotations by breaking up some wheat-disease and -pest cycles. While better than a continuous wheat rotation, a broad-leafed crop should also be included to disrupt these diseases and pests more completely. Since cool-season forages are harvested in early to mid-July, more soil water will be left for the following crop when compared with a spring grain crop allowed to mature and harvest. Additionally, the comparatively early harvest of cool-season forages allows for additional weed-control opportunities not possible in grain crops. Late summer flushes of weeds can be sprayed, grazed, or cultivated prior to fall activities.

Economic Considerations for Spring Forages in North-Central Idaho

Decision time. The Annual Forage study was designed to test annual forage adaptability and productivity on NCI farms. The harvested forages were tested for nutrient and feeding characteristics to see if they benefit ranchers who feed cattle. The answer to both of these tests is “Yes.” The next step is to decide if these crops make sense on your farm. An enterprise budget is an important tool in this process.

An enterprise budget provides information on a crop’s profitability, production costs and timing, market prices, and the use assets (machinery, land, and financing). To learn more about the production and marketing costs itemized by an enterprise budget, see Farm-Direct Marketing #2: Costs and Enterprise Selection (PNW 202) (https://extension.oregonstate.edu/sites/extd8/files/documents/pnw202.pdf). Data from Northern Idaho Crop Budgets on the University of Idaho Ag Biz site (https://www.uidaho.edu/cals/idaho-agbiz/crop-budgets) were used to create budgets for the annual forage crops tested in this study. The posted budgets at this site are useful in this purpose: for producers to supply their own data to the enterprise budget framework to make better decisions.

The annual forage crop enterprise budget produces crops as small square bales. The production method was chosen because the United States Department of Agriculture (USDA) Hay Reports (https://www.ams.usda.gov/market-news/hay-reports) tracks a nearby market of premium grass hay in small squares, a reliable pricing data source. Data was normalized to match the common units in enterprise budgets. Since trial results were reported as dry matter above, the moisture content of dry matter weights was adjusted to 16% moisture as an average for baled hay. More moisture in the reported yields mean that the adjusted protein levels are lower since the protein weight is now part of a heavier moisture fraction. With the protein adjusted for 16% moisture baled hay, the protein differential between the annual forages and USDA Prairie/Meadow Grass, Premium grade (Colorado Direct Hay Report 2021) was used to determine prices for baled annual forage. The yield, protein, and price results for six site years of the study are reported in Table 3.

These yields and prices were used for baled hay in budgets for baled annual forages. The enterprise budget for Otana oats is included here (Table 4). It had the highest Return to Risk of the treatments. For a complete spreadsheet and PDF files of budgets for all treatments, outcome summary, annual forage calendar, and input and machinery prices and data, see https://www.uidaho.edu/cals/idaho-agbiz/crop-budgets, Annual Forage Budgets for Northern Idaho.

Sensitivity analysis measures the market price needed to cover costs given a certain yield and the yields needed to cover costs given a certain price. It helps farmers judge the risk associated with producing the crop. For example, the base yield for Otana oats of 3.46 ton/acre requires a market price of $108.31/ton to breakeven on total costs (Table 5). Operating cost, ownership cost, and total cost breakeven for base yield and for plus or minus 10% yields are listed.

Similarly, the base market price of $140.46/ton of baled Otana oats requires a yield of 2.67 ton/acre to cover total costs. Operating cost, ownership cost, and total cost breakeven for base market price and for plus or minus 10% market price are listed.

Table 3. Yields, protein, and prices.

Entry	Yield Dry Ton/ Acre	Protein %	Baled Hay Ton/ Acre	Baled Hay % Protein	Baled Hay Price $/Ton F.O.B.*
Otana Oats	3.17	9.1	3.46	8.3	140.46
Proleaf 234 Forage Oats	3.04	9.0	3.32	8.3	140.46
Everleaf 114 Forage Oats	2.85	9.5	3.11	8.7	147.23
Proleaf 234 Oats and Flex Peas	2.84	9.8	3.11	9.0	152.31
Everleaf 126 Forage Oats	2.82	9.1	3.08	8.3	140.46
Stockford Barley	2.53	8.8	2.76	8.1	137.08
NZA 4.14 Forage Oats	2.49	9.3	2.72	8.6	145.54
Stockford Barley and Flex Peas	2.40	9.1	2.62	8.3	140.46
Average for All Forages	2.77	9.2	3.02	8.4	143.00

* F.O.B. Free on Board, price at point of sale.

Table 4. Production costs for annual forage crops, northern Idaho.

Item	Quantity Per Acre	Unit	Price or Cost/ Unit	Value or Cost/ Acre
Gross Returns				
Otana Oats	3.46	ton	$140.46	$485.99
Variable Costs				
Seed				**$19.20**
Otana Oats	80	lb	$0.24	$19.20
Fertilizer: *A typical recommendation might include the following:*				$63.15
Nitrogen	80	lb	$0.59	$47.20
Phosphorous	15	lb	$0.71	$10.65
Sulfur	10	lb	$0.53	$5.30
Pesticides: *Consult a certified pesticide applicator or the* PNW Pest Management Handbooks				**$6.00**
Roundup	22	oz	$0.13	$2.68
Ammonium Sulfate (liquid)	50	oz	$0.01	$0.57
M90	1.5	oz	$0.22	$0.33
2,4-D Amine	16	oz	$0.14	$2.24
Machinery:				**$36.11**
Fuel	3.57	gal	$2.55	$9.11
Lubricants	1	acre	$1.31	$1.31
Machinery Repairs	1	acre	$11.76	$11.76
Machinery Labor	0.70	hour	$20.00	$13.93
Custom and Consultants:				**$30.97**
Custom Haul and Stack	3.5	ton	$8.95	$30.97
Other:				**$13.32**
Baling Twine	3.46	ton	$3.85	$13.32
Operating Interest[1]				$4.22
Total Variable Costs				**$172.97**
Net Returns Above				**$313.02**
Ownership Costs:				
Machinery depreciation		acre	$22.37	$22.37
Machinery interest on investment		acre	$15.16	$15.16
Machinery taxes, insurance, housing, licenses		acre	$4.61	$4.61
Land Cost		acre	$127.34	$127.34
***Based on share rent percentage:**				
Landlord	33%			
Tenant	67%			
Cash Rent				$0.00
Overhead[2]				$8.00
Management fee[3]				$24.30
Total Fixed Costs				**$201.77**
Total Costs per Acre				**$374.75**
Total Costs per Unit				**$108.31**
Returns to Risk				**$111.25**

[1]Calculated as 5.75% interest on operating capital for 6 months.
[2]Covers legal, accounting, and utility fees. Calculated as 2.5% of operating expenses.
[3]The management fee is calculated as a 5% of gross revenue.

The budgets for the other annual forages included in the study are very similar to the Otana oat budget. The variables that change in the budgets include yield, market price, and seed cost. Table 6 summarizes these variables along with gross returns, costs, and returns to risk for the annual forage crops.

Yield is important to the profitability of small, square-baled annual forage crops (Table 6). Otana oats are the top yielder in this study and have the highest return to risk. Protein is an important factor in market price. The mixture of Proleaf 234 oats and Flex forage peas has the highest protein (9.0%) and the highest market price ($152.31).

Table 5. Break-even analysis.

	-10%	Base Yield	+10%
Price	3.1	3.46	3.8
Operating Cost Breakeven	$55.55	$49.99	$45.45
Ownership Cost Breakeven	$64.80	$58.32	$53.01
Total Cost Breakeven	$120.34	$108.31	$98.46
Yield (ton/acre)	$126.41	$140.46	$154.51
Operating Cost Breakeven	1.37	1.23	1.12
Ownership Cost Breakeven	1.60	1.44	1.31
Total Cost Breakeven	2.96	2.67	2.43

Table 6. The 2020 annual forage budgets for northern Idaho: small, square-baled summary of gross returns, variable and total costs, and returns to risk ($/acre/year).

By Crop	Yield (ton)	Price (per ton)	Protein %	Gross Returns ($/ac)	Total Variable Costs ($/ac)	Total Cost of Operation	Return to Risk ($/ac)
Otana Oat	3.46	$140.46	8.3	486	173	$375	111
Proleaf 234 Forage Oats	3.32	$140.46	8.3	466	188	$384	82
Everleaf 114 Forage Oats	3.11	$147.23	8.7	458	186	$380	78
Proleaf 234 Oats and Flex Peas	3.11	$152.31	9.0	474	180	$379	94
Everleaf 126 Forage Oats	3.08	$140.46	8.3	433	186	$370	63
Stockford Barley	2.76	$137.08	8.1	378	169	$332	47
NZA 4.14 Forage Oats	2.72	$145.54	8.6	396	181	$352	44
Stockford Barley and Flex Peas	2.62	$140.46	8.3	368	172	$332	36
Average for All Forages	3.02	$143.00	8.3	432	175	$359	73

ac = acre

Further Reading

Colorado Direct Hay Report. 2021. USDA AMS Livestock, Poultry and Grain Market News (2 April). Greeley, CO: Colorado Department of Agriculture Market News.

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ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater—To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

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