
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION
2004
**SAMPLE COSTS TO PRODUCE
WINTER FORAGE**
(For Silage)

SAN JOAQUIN VALLEY - NORTH

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UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

**SAMPLE COSTS TO
PRODUCE WINTER FORAGE
San Joaquin Valley 2004**

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INTRODUCTION

Sample costs to produce winter forage for silage in the northern San Joaquin Valley are shown in this study. The study is intended as a guide only, and can be used to make production decisions, determine potential returns, prepare budgets and evaluate production loans. Practices described are based on the production practices considered typical for this crop and region, but will not apply to every farm situation. Sample costs for labor, materials, equipment and custom services are based on current figures. “Your Costs” columns in Tables 1 and 2 are provided for entering your farm costs.

The hypothetical farm operations, production practices, overhead, and calculations are described under the assumptions. For additional information or an explanation of the calculations used in the study call the Department of Agricultural and Resource Economics, University of California, Davis, California, (530) 752-3589 or the local UC Cooperative Extension office.

Sample Cost of Production Studies for many commodities are available from the Department of Agricultural and Resource Economics’ website <http://coststudies.ucdavis.edu> or by calling, UC Davis, (530) 752-4424. The studies can also be obtained from the local county UC Cooperative Extension offices.

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ASSUMPTIONS

The assumptions refer to Tables 1 through 7 and pertain to sample costs to produce winter forage for silage in the northern San Joaquin Valley. Practices described represent production practices and materials considered typical of a well-managed winter forage crop in the San Joaquin Valley. Costs, materials, and practices in this study will not be applicable to all situations. Cultural practices vary among growers within the region. **The use of trade names and cultural practices in this report does not constitute an endorsement or recommendation by the University of California nor is any criticism implied by omission of other similar products or cultural practices.**

Farm. The hypothetical farm consists of 300 non-contiguous acres of which 150 acres are rented and 150 owned by the grower. The 150 acres of rented land is double cropped beginning with winter forage followed by corn. Some annual costs are allocated to the winter forage (25%) and the corn (75%). The grower owned 150 acres includes 10 acres occupied by buildings and homestead, and 140 acres planted to other crops.

Production Operating Costs

Land Preparation. In the fall five tons of manure are broadcast on the field. The fields are disked twice to incorporate the manure and to prepare the seedbed. Borders or levees are pulled at planned intervals creating checks for irrigation.

Planting. The winter forage mix which includes oats, wheat, and barley is planted at a rate of 120 pounds per acre on flat ground. Planting normally occurs in the fall and in this study a custom operator drills the seed in October. Several types of cereals are used for winter forage in the region: forage mix blends, oats, forage triticale or forage wheat.

Fertilization. In October prior to land preparation, manure at five tons per acre is hauled and applied by a custom operator. Some dairies sell the manure, while others may give it away if the grower provides the hauling. In this study, we assume the dairy charges a minimum of \$3 per ton and the grower pays \$4.25 per ton for hauling and spreading. Hauling costs may vary depending upon distance hauled. In February, nitrogen (N) as urea is applied top dress at a rate of 60 pounds per acre. In some areas, phosphorous may be required for winter forages at planting. Growers should apply fertilizer or soil amendments only after soil tests determine nutrient and pH levels.

Irrigation. The irrigation cost includes the water (\$2.50 per acre inch) and labor expense (0.15 hours per acre per irrigation). A preplant irrigation of seven acre-inches is made in October. The amount of water applied preplant will vary depending on soil moisture from rainfall or remaining from the previous crop. Another seven acre-inches is applied in a single irrigation in March, although generally no water is required. The water is supplied by an irrigation district, although some growers may use or supplement with well water. Water prices vary among irrigations districts. The authors agreed that \$30 per acre-foot (\$2.50 per acre-inch) is a fair value for this study, based upon information from their respective counties.

Pest Management. The pesticides, rates, and application practices mentioned in this cost study are listed in the *UC IPM Pest Management Guidelines*. **Pesticides mentioned in this study are not recommendations, but those commonly used in the region.** For information and pesticide use permits, contact the local county Agricultural Commissioner's office. For information on other pesticides available, pest identification, monitoring, and management, visit the UC IPM website at www.ipm.ucdavis.edu. **Pest control**

costs can vary considerably each year depending upon local conditions and pest populations in any given year. Adjuvants are recommended for many pesticides for effective control and are an added cost. The adjuvants in this study are not included. Pesticide costs will vary by grower location and the grower's purchasing volume or use. Material costs are shown at full retail from a single chemical dealer.

Pest Control Adviser (PCA). Written recommendations are required for many commercially applied pesticides and are available from licensed pest control advisers. In addition the PCA or an independent consultant will monitor the field for agronomic problems including irrigation and nutrition. Growers may hire private PCA's or receive the service as part of a service agreement with an agricultural chemical and fertilizer company. PCA costs are not shown in this study.

Weeds. Buctril, MCPA, or Clarity are post-emergent herbicides to control broadleaf weeds. They (Buctril in this study) are generally applied in January or when weeds are very small. The herbicides are applied commercially by ground rig.

Harvest. In this study, the winter forage is harvested for silage in April. The grower has the forage custom swathed, chopped, hauled, and packed. The forage is wilted to about 70% moisture before the custom harvester chops, and packs the forage into a silage pit. A rate of \$7 per ton for swathing, chopping, and packing in a silage pile is used in this study. Delivery up to 15 miles cost \$0.15 per mile per ton or for this study \$2.25 per ton. Silage packed in bags cost an additional \$5.00 per ton.

Yields. The crop is assumed to yield 17 tons per acre at 30% dry matter (DM). The yield is an average high yield based on grower inputs. Grower yields will vary depending on the forage type and/or mixture, and growing conditions.

Returns. A price of a \$22 per ton for silage is used to calculate returns above several cost levels. The returns used in this study are from the March 2004 USDA prices for green chopped wheat forage. Table 4 indicates the effects on grower returns based on varying yields and returns.

Pickup/ATV. The pickup and the all terrain vehicle (ATV) each travel 7.12 miles per acre for winter forage production use or a total of 2,137 miles per vehicle per year. Costs are estimated and not based on any specific data.

Labor. Labor rates of \$13.05 per hour for machine operators and \$9.79 for general labor includes payroll overhead of 45%. The basic hourly wages are \$9.00 for machine operators and \$6.75 for general labor. The overhead includes the employers' share of federal and California state payroll taxes, workers' compensation insurance for field crops (code 0171), and a percentage for other possible benefits. Workers' compensation costs will vary among growers, but for this study the cost is based upon the average industry final rate as of January 1, 2004 (California Department of Insurance). Labor for operations involving machinery are 20% higher than the operation time given in Table 1 to account for the extra labor involved in equipment set up, moving, maintenance, work breaks, and field repair.

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by the American Society of Agriculture Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum PTO horsepower, and fuel type. Prices for on-farm delivery of diesel and gasoline are \$1.45 and \$1.88 per gallon, respectively. The fuel prices are averaged based on four California delivery locations plus \$0.24 per gallon, which is one-half the

difference between the high and low price for regular gasoline in 2003 from the California State Automobile Association Monthly Survey. The cost includes a 2.25% sales tax (effective September 2001) on diesel fuel and 7.25% sales tax on gasoline. Gasoline also includes federal and state excise tax, which can be refunded for on-farm use when filing your income tax. The fuel, lube, and repair cost per acre for each operation in Table 1 is determined by multiplying the total hourly operating cost in Table 6 for each piece of equipment used for the selected operation by the hours per acre. Tractor time is 10% higher than implement time for a given operation to account for setup, travel and down time.

Interest On Operating Capital. Interest on operating capital is based on cash operating costs and is calculated monthly until harvest at a nominal rate of 6.89% per year. A nominal interest rate is the typical market cost of borrowed funds. The interest cost of post harvest operations is discounted back to the last harvest month using a negative interest charge.

Risk. Production risks should not be minimized. While this study makes every effort to model a production system based on typical, real world practices, it cannot fully represent financial, agronomic and market risks, which affect the profitability and economic viability of winter forage production.

Cash Overhead

Cash overhead consists of various cash expenses paid out during the year that are assigned to the whole farm, not to a particular operation. Overhead costs are allocated 25% to the forage crop and 75% to the second crop.

Property Taxes. Counties charge a base property tax rate of 1% on the assessed value of the property. In some counties special assessment districts exist and charge additional taxes on property including equipment, buildings, and improvements. For this study, county taxes are calculated as 1% of the average value of the property. Average value equals new cost plus salvage value divided by 2 on a per acre basis.

Insurance. Insurance for farm investments varies depending on the assets included and the amount of coverage. Property insurance provides coverage for property loss and is charged at 0.676% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs \$816 for the entire farm or \$2.81 per producing acre. Twenty-five percent of the cost or \$0.70 per acre is allocated to the winter forage.

Office. Costs are estimated at \$35 per acre for the ranch and are not based on any specific information, except that there is a cost involved for bookkeeping, payroll, tax preparation, and telephone. Twenty-five percent of the office expenses are allocated to the winter forage.

Land Rent. Rent for an annual single crop ranges from \$180 to \$225 per acre. Being the field is double cropped, \$215 per acre is used in this study with 25% or \$53.75 being charged to the winter forage crop.

Investment Repairs. Annual repairs on investments or capital recovery items that require maintenance are calculated as 2% of the purchase price. Repairs are not calculated for land and establishment costs.

Non-Cash Overhead

Non-cash overhead is calculated as the capital recovery cost for equipment and other farm investments. Overhead costs where applicable are applied 25% to the forage crop and 75% to the second crop.

Capital Recovery Costs. Capital recovery cost is the annual depreciation and interest costs for a capital investment and is the amount of money required each year to recover the difference between the purchase price and salvage value (unrecovered capital). The capital recovery costs are equivalent to the annual payment on a loan for the investment with the down payment equal to the discounted salvage value. This is a more complex method of calculating ownership costs than straight-line depreciation and opportunity costs, but more accurately represents the annual costs of ownership because it takes the time value of money into account (Boehlje and Eidman). The formula for the calculation of the annual capital recovery costs is $((\text{Purchase Price} - \text{Salvage Value}) \times \text{Capital Recovery Factor}) + (\text{Salvage Value} \times \text{Interest Rate})$.

Salvage Value. Salvage value is the estimated value of an investment at the end of its useful life. For farm machinery the value is a percentage of the new cost of the investment (Boehlje and Eidman). The value is calculated from equations developed by ASAE based on equipment type and years of life. The life in years is estimated by dividing the wear out life, as given by ASAE, by the annual hours of use in the operation. For other investments including irrigation systems, buildings, and miscellaneous equipment, the value at the end of its useful life is zero. The salvage value for land is the purchase price because land does not depreciate.

Capital Recovery Factor. Capital recovery factor is the amortization factor or annual payment whose present value at compound interest is 1. The amortization factor is a table value that corresponds to the interest rate and equipment life.

Interest Rate. The interest rate of 6.23% used to calculate capital recovery cost is the USDA-ERS's ten year average of California's agricultural sector long-run rate of return to production assets from current income.

Tools. Includes shop equipment/tools and other tools used on the farm and does not recognize any specific inventory.

Irrigation System. The permanent irrigation system consists of wells, pumps and motors, and buried mainline with alfalfa valves. The maintenance costs are included in the land rental price.

Land. Cropland with district water suitable for winter forage production typically ranges in value among counties from \$3,000 to \$12,000 per acre. The land in this study that is owned by the grower cost \$5,000 per acre. Being the winter forage is on rented land, land ownership costs are not shown.

Equipment. Although, farm equipment is purchased new or used, the study shows the current purchase price for new equipment. The new purchase price is adjusted to 60% to indicate a mix of new and used equipment. Equipment costs are composed of three parts: non-cash overhead, cash overhead, and operating costs. Both of the overhead factors have been discussed in previous sections. The operating costs consist of repairs, fuel, and lubrication and are discussed under operating costs.

Table Values. Due to rounding, the totals may be slightly different from the sum of the components.

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UC COOPERATIVE EXTENSION
Table 1. COSTS PER ACRE to PRODUCE WINTER FORAGE
 SAN JOAQUIN VALLEY 2004

Operation	Operation	Cash and Labor Cost per acre					Total Cost	Your Cost
	Time (Hrs/A)	Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/Rent			
Cultural:								
Fertilize: Manure	0.00	0	0	38	0	38		
Land Prep: Disk 2X	0.22	3	7	0	0	10		
Land Prep: Make Borders	0.04	1	1	0	0	1		
Irrigate: Pre-Irrigation	0.15	1	0	18	0	19		
Plant	0.00	0	0	26	10	36		
Fertilize: N Topdress (Urea)	0.00	0	0	23	7	29		
Weed: Post-Emergent (Buctril)	0.00	0	0	23	7	29		
Irrigate 1X	0.15	1	0	18	0	19		
Pickup Truck Use	0.24	4	2	0	0	5		
TOTAL CULTURAL COSTS	0.80	11	9	142	25	187		
Harvest:								
Harvest: Swath, Chop, Pack, Haul	0.00	0	0	0	157	157		
TOTAL HARVEST COSTS	0.00	0	0	0	157	157		
Interest on operating capital @ 6.89%						7		
TOTAL OPERATING COSTS/ACRE		11	9	142	183	351		
CASH OVERHEAD: *								
Liability Insurance						1		
Office Expense						8		
Land Rent						54		
Property Taxes						1		
Property Insurance						1		
Investment Repairs						2		
TOTAL CASH OVERHEAD COSTS						66		
TOTAL CASH COSTS/ACRE						417		
NON-CASH OVERHEAD: *								
		Per producing acre		-- Annual Cost --				
				Capital Recovery				
Building		87		7		7		
Shop Tools		16		1		1		
Fuel tanks		5		0		0		
Equipment		5		8		8		
TOTAL NON-CASH OVERHEAD COSTS		162		16		16		
TOTAL COSTS/ACRE						433		

*25% of total costs allocated to winter forage

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Table 2. COSTS AND RETURNS PER ACRE to PRODUCE WINTER FORAGE
 SAN JOAQUIN VALLEY 2004

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Winter Forage	17	ton	22.00	374	
TOTAL GROSS RETURNS				374	
OPERATING COSTS					
Fertilizer:					
Manure/Spread	5.00	ton	7.50	38	
Urea (46-0-0)	60.00	lb N	0.38	23	
Irrigation:					
Water	14.00	acin	2.50	35	
Seed:					
Winter Forage Mix	120.00	lb	0.22	26	
Custom:					
Plant	1.00	acre	10.00	10	
Air Application: Urea	1.00	acre	6.75	7	
Ground Application: Herbicide	1.00	acre	9.00	9	
Swath, Chop, Pack	17.00	ton	7.00	119	
Haul (15 miles)	17.00	ton	2.25	38	
Herbicide:					
Buctril 2EC	1.00	pint	20.36	20	
Labor (machine)	0.60	hrs	13.05	8	
Labor (non-machine)	0.30	hrs	9.79	3	
Fuel - Gas	0.60	gal	1.88	1	
Fuel - Diesel	3.31	gal	1.45	5	
Lube				1	
Machinery repair				2	
Interest on operating capital @ 6.89%				7	
TOTAL OPERATING COSTS/ACRE				351	
NET RETURNS ABOVE OPERATING COSTS				23	
CASH OVERHEAD COSTS: *					
Liability Insurance				1	
Office Expense				8	
Land Rent				54	
Property Taxes				1	
Property Insurance				1	
Investment Repairs				2	
TOTAL CASH OVERHEAD COSTS/ACRE				66	
TOTAL CASH COSTS/ACRE				417	
NON-CASH OVERHEAD COSTS (Capital Recovery)*					
Building				7	
Shop Tools				1	
Fuel Tanks				0	
Equipment				7	
TOTAL NON-CASH OVERHEAD COSTS/ACRE				16	
TOTAL COSTS/ACRE				433	
NET RETURNS ABOVE TOTAL COSTS				-59	

*25% of total costs allocated to winter forage

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Table 3. MONTHLY CASH COSTS PER ACRE to PRODUCE WINTER FORAGE
 SAN JOAQUIN VALLEY 2004

Beginning OCT 03	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Ending SEPT 04	03	03	03	04	04	04	04	04	04	04	04	04	
Fertilize: Manure	38												38
Land Prep: Disk 2X	10												10
Land Prep: Make Borders	1												1
Irrigate: Pre-Irrigation	19												19
Plant	36												36
Weed: Post-Emergent (Buctril)				29									29
Fertilize: N Topdress (Urea)					29								29
Irrigate 1X						19							19
Pickup Truck Use	0	0	0	0	0	0	0	0	0	0	0	0	5
TOTAL CULTURAL COSTS	105	0	0	30	30	19	0	0	0	0	0	0	187
Harvest:													
Harvest: Swath, Chop, Pack, Haul							157						157
TOTAL HARVEST COSTS							157						157
Interest on operating capital	1	1	1	1	1	1	2	0	0	0	0	0	7
TOTAL OPERATING COSTS/ACRE	105	1	1	31	30	20	160	0	0	0	0	0	351
OVERHEAD:*													
Liability Insurance							1						1
Office Expense	1	1	1	1	1	1	1						8
Land Rent (25% of Annual Rent)								54					54
Property Taxes					1					1			1
Property Insurance					1								1
Investment Repairs	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL CASH OVERHEAD COSTS	1	1	1	1	2	1	2	54	0	1	0	0	66
TOTAL CASH COSTS/ACRE	107	2	2	32	33	22	162	54	1	1	1	1	417

*25% total costs allocated to winter forage

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Table 4. RANGING ANALYSIS

SAN JOAQUIN VALLEY 2004

COSTS PER ACRE TO PRODUCE WINTER FORAGE AT VARYING YIELDS

	YIELD (ton/acre)							
	Total Yield:	13	14	15	16	17	18	19
OPERATING COSTS:								
Cultural Cost		187	187	187	187	187	187	187
Harvest Cost		120	130	139	148	157	167	176
Interest on operating capital		6	6	6	6	7	7	7
TOTAL OPERATING COSTS/acre		314	323	332	342	351	360	370
Operating Cost/ton		24.15	23.07	22.13	21.38	20.65	20.00	19.47
CASH OVERHEAD COSTS								
TOTAL CASH COSTS/acre		380	389	398	408	417	426	435
Cash Costs/ton		29.23	27.79	26.53	25.50	24.53	23.67	22.89
NON-CASH OVERHEAD COSTS								
TOTAL COSTS/acre		396	405	414	424	433	442	451
Total Costs/ton		30.46	28.93	27.60	26.50	25.47	24.56	23.74

NET RETURNS PER ACRE ABOVE OPERATING COSTS

\$/ton	YIELD (ton/acre)						
	13	14	15	16	17	18	19
14.00	-132	-127	-122	-118	-113	-108	-104
16.00	-106	-99	-92	-86	-79	-72	-66
18.00	-80	-71	-62	-54	-45	-36	-28
20.00	-54	-43	-32	-22	-11	0	10
22.00	-28	-15	-2	10	23	36	48
24.00	-2	13	28	42	57	72	86
26.00	24	41	58	74	91	108	124

NET RETURN PER ACRE ABOVE CASH COST

\$/ton	YIELD (ton/acre)						
	13	14	15	16	17	18	19
14.00	-198	-193	-188	-184	-179	-174	-169
16.00	-172	-165	-158	-152	-145	-138	-131
18.00	-146	-137	-128	-120	-111	-102	-93
20.00	-120	-109	-98	-88	-77	-66	-55
22.00	-94	-81	-68	-56	-43	-30	-17
24.00	-68	-53	-38	-24	-9	6	21
26.00	-42	-25	-8	8	25	42	59

NET RETURNS PER ACRE ABOVE TOTAL COST

\$/ton	YIELD (ton/acre)						
	13	14	15	16	17	18	19
14.00	-214	-209	-204	-200	-195	-190	-185
16.00	-188	-181	-174	-168	-161	-154	-147
18.00	-162	-153	-144	-136	-127	-118	-109
20.00	-136	-125	-114	-104	-93	-82	-71
22.00	-110	-97	-84	-72	-59	-46	-33
24.00	-84	-69	-54	-40	-25	-10	5
26.00	-58	-41	-24	-8	9	26	43

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**Table 5. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT,
and BUSINESS OVERHEAD COSTS**
SAN JOAQUIN VALLEY 2004

ANNUAL EQUIPMENT COSTS

Yr Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead		Total
					Insur- ance	Taxes	
04 125 HP MFWD Tractor	82,819	10	24,463	9,539	363	536	10,438
04 215 HP Trac Tractor	156,780	10	46,310	18,058	686	1,015	19,760
04 Disk – Border	1,500	12	208	169	6	9	183
04 Disk – Finish 21’	22,900	12	3,172	2,580	88	130	2,799
04 Pickup 1/2 Ton	28,000	5	12,549	4,473	137	203	4,813
TOTAL	291,999		82,702	34,820	1,280	1,874	37,997
60% of New Cost*	175,199		52,021	20,892	768	1,136	22,796

*Used to reflect a mix of new and used equipment

ANNUAL INVESTMENT COSTS

Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insur- ance	Taxes	Repairs	
Building 2,400 sqft	65,000	25		5,196	220	325	1,200	6,941
Fuel Tanks 2-300 gal	3,500	20		311	12	18	70	411
Shop Tools	12,000	20	1,200	1,034	45	66	240	1,385
TOTAL INVESTMENT	80,500		1,200	6,541	276	408	1,510	8,736

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm	Price/ Unit	Total Cost
Liability Insurance	290.00	acre 2.81	815
Office Expense	290.00	acre 35.00	10,150
Rent @ 25% of \$215	150.00	acre 53.75	8,063

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Table 6. HOURLY EQUIPMENT COSTS
SAN JOAQUIN VALLEY 2004

Yr Description	COSTS PER HOUR							Total Costs/Hr.
	Actual Hours Used	Capital Recovery	Cash Overhead		Operating		Total Oper.	
			Insur- ance	Taxes	Repairs	Fuel & Lube		
04 125 HP MFWD Tractor	1199.6	4.77	0.18	0.27	3.76	12.10	15.86	21.08
04 215 HP Trac Tractor	1599.0	6.78	0.26	0.38	4.07	20.81	24.88	32.29
04 Disk – Border	166.0	0.61	0.02	0.03	0.24	0.00	0.24	0.90
04 Disk – Finish 21’	165.7	9.34	0.32	0.47	3.63	0.00	3.63	13.77
04 Pickup 1/2 Ton	184.9	14.52	0.44	0.66	1.81	5.40	7.21	22.83

UC COOPERATIVE EXTENSION
Table 7. OPERATIONS WITH EQUIPMENT
 SAN JOAQUIN VALLEY 2004

Operation	Operation Month	Equipment		Material	Rate/acre	Unit
		Tractor	Implement			
Apply Manure	October	Custom		Manure	5.00	ton
Disc 2X	October	215 HP Trac	Finish Disc			
Make Borders	October	215 HP Trac	Border Disc			
Pre-Irrigate	October			Water	7.00	acin
Plant	October	Custom		Forage	120.00	lb
Fertilize: Topdress N	February	Custom		46-0-0	60.00	lb N
Weed: Post Emergent	January	Custom		Buctril	1.00	pint
Irrigate	March			Water	7.00	acin
Harvest: Swath, Haul, Pack	April	Custom				