AGRI-FACTS
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Optimizing Barley Silage Production in Alberta

Over 800,000 acres of barley silage is grown annually in Alberta. With the currently expanding livestock industry, producers are looking more for information on optimizing silage yield and quality. The Agronomy Unit of Alberta Agriculture, Food and Rural Development conducted research trials at 10 to 12 locations across Alberta to examine new barley varieties and their nutrient requirements, from 1994 to 1996.

The barley varieties included in the study were AC Lacombe, Seebe, Tukwa, CDC Earl and Leduc. Leduc was used as the reference (or "check")variety. Duke was also used as a reference variety at irrigated and selected dryland locations. Each variety had nitrogen (N) fertilizer rates up to 180 lb/ac along with phosphorus (P), potassium (K) and sulphur (S) treatments. Yield and a number of quality factors were examined for each treatment at each location.

Three main agronomic traits of barley that producers are concerned about are yield, lodging resistance and disease resistance

Varieties

Irrigation

Generally, the highest yielding varieties under irrigation were Seebe, AC Lacombe and Tukwa. Lodging was frequently a problem for all varieties. Of the three semi-dwarf varieties, Tukwa tended to yield higher than CDC Earl followed by Duke. Generally, CDC Earl exhibited the least lodging followed by Duke, then Tukwa.

Three main agronomic traits of barley that producers are concerned about are yield, lodging resistance and disease resistance. If silage yield is a more important factor than lodging, then AC Lacombe would be a better choice. However, if lodging resistance is a more important factor, then CDC Earl would be a better choice.

When it came to disease, Leduc and AC Lacombe tended to have fewer disease problems. CDC Earl, when grown on barley stubble, tended to have much greater disease pressure that significantly affected both yield and quality.

Southern Alberta

In the dryland areas of the dark brown and thin black soil zones of southern and south central Alberta, AC Lacombe and Seebe tended to yield the best followed by Leduc and Tukwa. Frequently, CDC Earl was the lowest yielding variety, except at sites that had above normal growing season precipitation. Under drier conditions the yields of CDC Earl tended to be lower than the other varieties. Occasionally, at sites with higher disease pressure, Leduc would be one of the better yielding varieties.

Lodging was not a problem at any of the research locations in southern or south central Alberta. AC Lacombe followed by Seebe were generally the best variety choices for southern Alberta, under dryland conditions.

Central/Northern Alberta

In central and northern Alberta, in the black and gray wooded soil zones, Seebe tended to yield the best followed by Tukwa and AC Lacombe. All three varieties will lodge under higher rainfall or if soil nitrogen levels are high.

Nutrient requirements

Soil test

Nitrogen and phosphorus are frequently the two most limiting nutrients in crop production in Alberta. However, silage is often grown on

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land that is heavily manured. Therefore, before applying commercial fertilizer test the soil to determine the nutrient status of each field.

Soil samples need to be taken from the 0-6, 6-12 and 12-24 inch depths at 15 to 20 locations within a field. All depths should be checked for nitrate nitrogen ($N\text{-}NO_3^-$) and sulfate sulfur ($S\text{-}SO_4^-$). The 0-6 inch depth should be tested for phosphorus (P) and potassium (K). In heavily manured fields both these nutrients may be high. This information is needed to make informed and accurate fertilizer recommendations.

Nitrogen

As a general rule, soil N plus fertilizer N levels should add up to approximately 180 to 200 lb/ac to achieve optimum yield under irrigation.

For the dark brown and thin black soil zones, target soil N plus fertilizer N levels should add up to approximately 80 to 110 lb/ac to achieve optimum yield. The levels will depend on soil moisture and growing season precipitation.

In the black soil zone, soil N plus fertilizer N levels should add up to approximately 110 to 135 lb/ac to achieve optimum yield. In the gray wooded soil areas, soil N plus fertilizer N levels should add up to approximately 80 to 100 lb/ac to achieve optimum yield. Detailed charts for N fertilizer recommendations are in Table 1.

Phosphorus

For phosphorus, when silage yield of all varieties was grouped together, barley responded to phosphate fertilizer at 22 of the 32 research locations. At some locations, some varieties were more responsive to P fertilizer than other varieties. Frequently, the time of heading was delayed when soil P levels were low and treatments did not receive phosphate fertilizer. To optimize phosphate fertilizer application refer to the detailed phosphorus recommendations in Table 2.

Potassium and sulphur

Potassium and sulphur also are important nutrients in silage production. When soil test potassium is less than 300 lb/ac in the 0-6 inch depth, additional K fertilizer may be needed. For sulphur, if soil levels are less than 20 lb/ac in the combined 0-6 and 6-12 inch depths, additional S fertilizer may be needed.

Manured fields

In heavily manured fields, N, P, K and S levels may be high enough that additional commercial fertilizer may not be required. The maximum soil N level, after which no additional N fertilizer is needed, will vary from 100 to 250 lb N/ac in the combined 0 to 12 inch depth, depending on soil zone and silage yield potential.

Once soil P exceeds 90 to 100 lb/ac in the 0 to 6 inch depth, no additional yield or quality benefits will occur from adding additional P fertilizer.

For K, once soil levels exceed 300 to 350 lb/ac there is little benefit from adding K fertilizer; however, the chloride in the 0-0-60 potassium chloride fertilizer may occasionally provide some yield benefit through reduced incidence of disease. In this project, reduced disease or increased yield was not observed at any of the research sites.

Future direction

From this project, a new two-year project was started in 1998 to look at both barley and triticale silage. The major advantage of using triticale for silage is to break the disease levels that develop from growing barley in the same field year after year. Hopefully, research funding will soon be in place to look at a number of other crops for silage production that would work in well with barley crop rotations.

For more detailed information on our silage production projects, farmers in the brown, dark brown and irrigated soil areas can contact Ross McKenzie at (403) 381-5842 in Lethbridge, and farmers in the black and gray wooded soil areas can contact Jill DeMulder at (780) 422-0917 in Edmonton.

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Table 1.
Nitrogen fertilizer recommendations for optimum barley silage production.

Soil Zone	Dark Brown			Thin Black			Black			Gray Wooded			Irrigated		
Stored soil moisture level	*Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Soil Nitrogen (lb/ac in 0-24 inches)	Nitrogen fertilizer required (lb/ac)														
0-10	60	75	100	70	85	110	90	110	135	65	80	100	140	170	200
11-20	50	65	90	60	75	100	80	100	125	55	70	90	130	160	190
21-30	40	55	80	50	65	90	70	90	115	45	60	80	120	150	180
31-40	30	45	70	40	55	80	60	80	105	35	50	70	110	140	170
41-50	20	35	60	30	45	70	50	70	95	25	40	60	100	130	160
51-60	10	25	50	20	35	60	40	60	85	15	30	50	90	120	150
61-70	0	15	40	10	25	50	30	50	75	5	20	40	80	110	140
71-80		5	30	0	15	40	20	40	65	0	10	30	70	100	130
81-90		0	20		5	30	10	30	55		0	20	60	90	120
91-100			10		0	20	0	20	45			10	50	80	110
101-110			0			10		10	35			0	40	70	100
111-120						0		0	25				30	60	90
121-130									15				20	50	80
131-140									0				10	40	70
141-150													0	30	60
151-160														20	50
161-170														10	40
171-180														0	30
181-190															20
191-200															10
>200															0

Recommendations are given for each soil zone at three soil mosture levels. The numbers are approximate values and farmers should carefully consider weather, economic, agronomic and experience factors when deciding their rate.
Note: * Low = approximately 2 inches, Medium = approximately 4 inches, High = approximately 6 inches

Table 2.
Phosphate fertilizer recommendations for barley on a medium to fine textured soil with a neutral pH, based on the Kelowna method.

Soil Zone	Brown			Dark Brown			Thin Black			Black			Gray Wooded			Irrigated
Seedbed moisture	*Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet	
Soil test P (lb/ac)	P_2O_5 required (lb/ac)															
0-10	30	35	40	35	40	45	40	45	50	40	45	50	50	45	50	50
11-20	25	30	35	30	35	40	35	40	45	35	40	45	35	40	45	45
21-30	20	25	30	25	30	35	30	35	40	30	35	40	30	35	40	40
31-40	15	20	25	20	25	30	25	30	35	25	30	35	25	30	35	35
41-50	15	15	20	20	20	25	25	25	30	25	25	30	25	25	30	35
51-60	15	15	20	15	15	25	20	20	30	20	20	30	20	20	30	30
61-70	15	15	15	15	15	20	15	20	25	15	15	25	15	15	25	25
71-80	0	15	15	0	15	15	0	15	20	0	15	20	0	15	20	20
81-90		0	15		0	15		0	15		0	15		0	15	15
>90			0			0			0			0			0	0

Recommendations are give for each soil zone at three soil moisture condition levels at the time of seeding.
Note: * Seedbed soil moisture conditions at seeding: Dry = 25%, Moist = 50%, Wet = 75% of field capacity.