TECHNICAL NOTES

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Planting Dates for Fall Cover Crops in the Irrigated Columbia Basin.

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The intent of this note is to provide NRCS and CD field staff with planting dates for estimating biomass cover for several fall seeded cover crops.

Introduction

Fall cover cropping can greatly reduce the amount of wind erosion if the crop is seeded early enough in the fall to acquire adequate biomass to protect the soil. Planting too late in the fall should be avoided because it places a financial burden on the grower, fails to protect the soil, and lowers the acceptance of this practice.

A few considerations to consider when developing a cover crop plan: Cover crops can aggravate a 'Green Bridge' problem. This problem occurs when a fall planted or volunteer grain crop is not fully destroyed before seeding a spring grain crop. Root diseases develop rapidly when the 'Green Bridge' is not properly managed. Secondly, cover crops can also interfere with rotation requirements for some crops. Cover crops can generate a tremendous amount of biomass, and this material can make spring planting very difficult for some equipment.

Biomass mathematical models were constructed from 2 years of field data and weather records at the WSU Othello Branch Experiment Station and the Willard Lange Farm near George, Washington. Each of the plantings was made in the fall using a double disk drill into a prepared seedbed. Seeding rates were 60 lb./ac for the grains and 8 lb./ac for the mustard and rape. Historic weather records were used in association with the biomass models to create seeding dates for several cover crops.

Results

This study was designed to quantify biomass accumulation to Growing Degree-Days (GDD). Growing Degree-Days are units of temperature needed for plant growth.

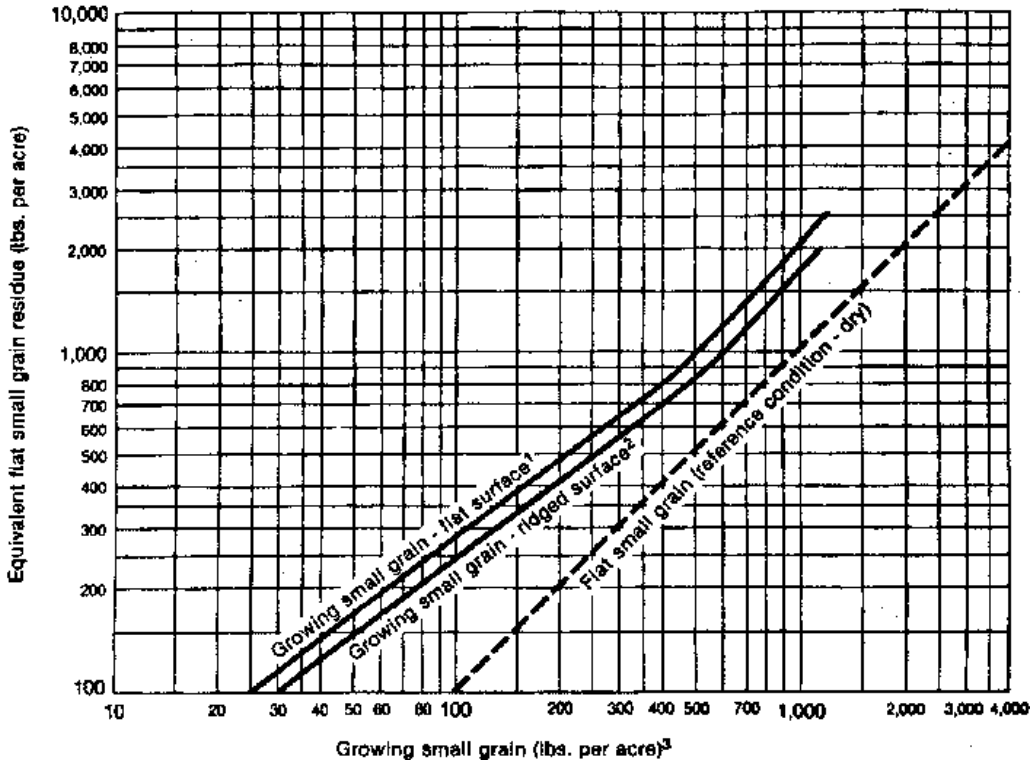
- **GDD = (max daily temp + min. daily temp)/2 - base temperature.**
- GDD cannot be less than zero.
- Wheat has a base temperature of 2.4C (36F), Rye and Triticale have a base temperature of 0C (32F), and Mustard and Rape have a base temperature of 5C (41F).

Leaf development follows a very linear relationship to Growing Degree-Days (Ball et al. 1995, Klepper et al. 1988, Sherman 1989, Stannard et al. 1998). Biomass accumulation does not follow a linear relationship because tillers account for a large percentage of the biomass. Tiller counts that we had in this experiment ranged from as low 4 tillers/plant to as high as 37 tillers/plant on a 6-leaf stage plant, oats and rye, respectively. Tillering is a product of several factors: Growing Degree-Days, Nutrients, Light, Plant Spacing, water, and crop genetics. Nutrients, light, plant spacing, and water were not limiting in this study allowing the study to focus more on the relationship of Growing Degree-Days to biomass accumulation.

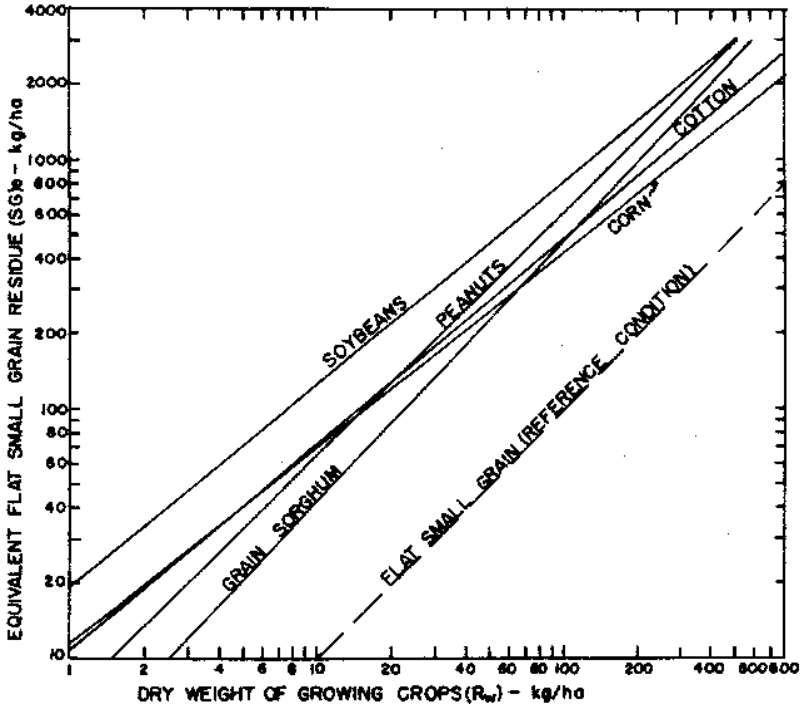
Because biomass accumulation is exponential, this study clearly shows that seeding of fall cover crops should not delayed.

How to use this Technical Note.

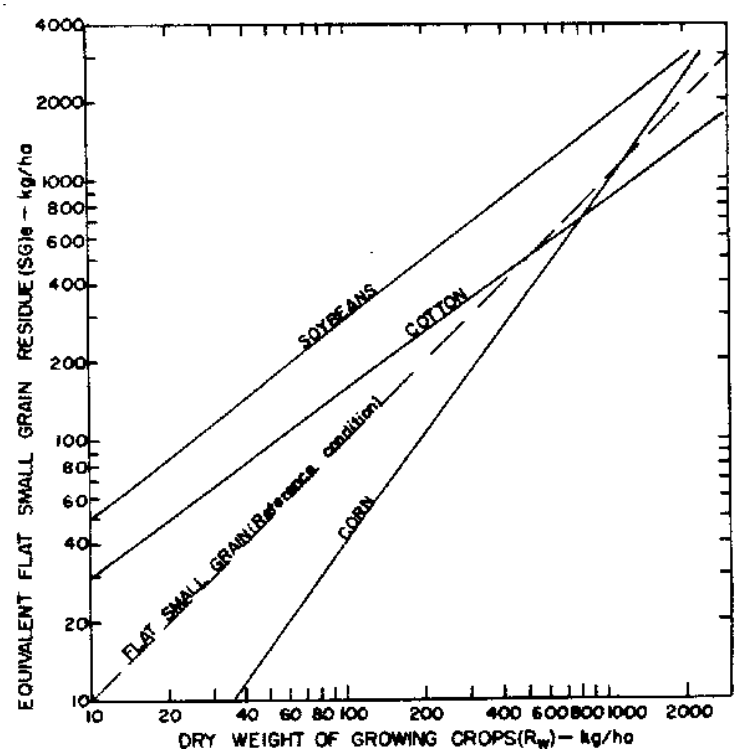
1. Select the table with the community with weather patterns most similar to your site.
2. Determine the amount of biomass needed going into the winter to protect the soil.
3. Look down the appropriate "Biomass Column" and determine which cover crop best meets your needs. The planting dates for each cover crop equates to the last seeding date for "X" amount of biomass.
4. Increasing the seeding rate can offset a delayed seeding date. A rule of thumb growers' use – for every day of delay, increase the seeding rate of the small grains 1 lb./day. This rule of thumb works fairly well for 21 days. For example, if the seeding date is September 10th, the producer could wait until September 30th to seed but he would need to increase his seeding rate by 20 lb./ac.
5. Increasing the seeding rate or seeding earlier will be needed for fields that are seeded into unprepared seedbeds where depth of seed placement is not controlled.
6. A graph is provided to convert live-growing grain to equivalent small grain residue. No models have been developed to convert biomass of rape or mustard to small grain equivalent residue. However, two additional graphs are also attached and these will provide a very rough idea of how equivalent small grain residue relates to broadleaf crop biomass.



Conversion chart for growing small grain to equivalent small grain residue.



Conversion chart for growing corn, cotton, and soybean in rows <u>perpendicular</u> to flow to quantity of equivalent flat, small grain residue [1].



Conversion chart for growing corn, cotton, and soybean in rows <u>parallel</u> to flow to quantity of equivalent flat, small grain residue [1].

References

1. Armbrust, D.V. and L. Lyles. 1985. Equivalent wind-erosion protection from selected growing crops. Agron. J. 77:703-707.

2. Ball, D.A., B. Klepper, D.J. Rydrych. 1995. Comparative above-ground development rates for several annual grass weeds and cereal grains. Weed Sci. 43:410-416.

3. Davidson, H.R. and C.A. Campbell. 1983. The effect of temperature, moisture and nitrogen on the rate of development of spring wheat as measured by degree days (Triticum aestivum, mathematical models) Can. J. Plant Sci. 63:833-846.

4. Klepper, B., R.W. Rickman, J.F. Zuzel, S.E. Waldman. 1988. Use of growing degree days to ptoject sample dates for cereal crops. Agron. J. 80:850-852.

5. Morrison, M.J., P.B.E. McVetty, and C.F. Shaykewich. 1989. The determination and verification of a baseline temperature for the growth of Westar summer rape. Can J. Plant Sci. 69:455-464.

6. Sherman, H. 1989. Computerized 'crystal ball' for wheat growth. Agr. Res. 37:15.

7. Stannard, M.E., E.R. Branchaw, R.L. Gillespy, L.A. Mitchell. 1998. Modeling Growth of Fall Seeded Cover Crops for the Irrigated Columbia Basin. 1998 PM-10 Progress Report. WSU.

8. USDA NRCS. 1988. Flat small grain equivalents of growing small grain. National Agonomy Manual.

9. Washington State University. Public Access Weather System (PAWS).

Seeding Date Tables for Several Localities in Washington.

Connell	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	25-Sep	21-Sep	17-Sep	13-Sep	11-Sep	10-Sep	9-Sep
Aroostock Rye	3-Oct	28-Sep	23-Sep	19-Sep	17-Sep	15-Sep	14-Sep
Breaker Triticale	29-Sep	24-Sep	20-Sep	15-Sep	13-Sep	11-Sep	10-Sep
Celia Triticale	29-Sep	24-Sep	19-Sep	15-Sep	12-Sep	10-Sep	9-Sep
White Mustard	23-Sep	19-Sep	16-Sep	13-Sep	11-Sep	10-Sep	9-Sep
Rape	19-Sep	16-Sep	13-Sep	9-Sep	8-Sep	7-Sep	6-Sep
Moro Winter Wheat	25-Sep	21-Sep	17-Sep	13-Sep	11-Sep	10-Sep	8-Sep
Stephens Wheat	24-Sep	20-Sep	15-Sep	12-Sep	9-Sep	8-Sep	7-Sep

Ephrata	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	24-Sep	21-Sep	17-Sep	14-Sep	12-Sep	10-Sep	9-Sep
Aroostock Rye	1-Oct	27-Sep	22-Sep	18-Sep	16-Sep	14-Sep	13-Sep
Breaker Triticale	28-Sep	23-Sep	19-Sep	15-Sep	13-Sep	11-Sep	10-Sep
Celia Triticale	27-Sep	22-Sep	18-Sep	14-Sep	12-Sep	10-Sep	9-Sep
White Mustard	23-Sep	20-Sep	17-Sep	14-Sep	13-Sep	12-Sep	11-Sep
Rape	20-Sep	17-Sep	14-Sep	11-Sep	9-Sep	8-Sep	7-Sep
Moro Winter Wheat	24-Sep	20-Sep	17-Sep	13-Sep	11-Sep	10-Sep	9-Sep
Stephens Wheat	23-Sep	19-Sep	15-Sep	12-Sep	10-Sep	8-Sep	7-Sep

Lind	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	22-Sep	18-Sep	14-Sep	10-Sep	8-Sep	7-Sep	5-Sep
Aroostock Rye	30-Sep	25-Sep	20-Sep	16-Sep	13-Sep	12-Sep	10-Sep
Breaker Triticale	26-Sep	21-Sep	17-Sep	12-Sep	10-Sep	8-Sep	7-Sep
Celia Triticale	26-Sep	20-Sep	16-Sep	11-Sep	9-Sep	7-Sep	6-Sep
White Mustard	19-Sep	16-Sep	13-Sep	10-Sep	8-Sep	7-Sep	6-Sep
Rape	16-Sep	13-Sep	9-Sep	6-Sep	4-Sep	3-Sep	2-Sep
Moro Winter Wheat	21-Sep	17-Sep	13-Sep	10-Sep	7-Sep	6-Sep	5-Sep
Stephens Wheat	20-Sep	16-Sep	12-Sep	8-Sep	6-Sep	4-Sep	3-Sep

Moses Lake	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	20-Sep	16-Sep	12-Sep	8-Sep	6-Sep	4-Sep	3-Sep
Aroostock Rye	28-Sep	23-Sep	19-Sep	14-Sep	12-Sep	10-Sep	9-Sep
Breaker Triticale	24-Sep	19-Sep	15-Sep	10-Sep	8-Sep	6-Sep	5-Sep
Celia Triticale	24-Sep	19-Sep	14-Sep	9-Sep	7-Sep	5-Sep	4-Sep
White Mustard	17-Sep	14-Sep	11-Sep	8-Sep	6-Sep	5-Sep	4-Sep
Rape	14-Sep	10-Sep	7-Sep	4-Sep	2-Sep	1-Sep	31-Aug
Moro Winter Wheat	19-Sep	15-Sep	11-Sep	8-Sep	5-Sep	4-Sep	3-Sep
Stephens Wheat	18-Sep	14-Sep	10-Sep	6-Sep	4-Sep	2-Sep	1-Sep

Othello	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	22-Sep	18-Sep	14-Sep	10-Sep	8-Sep	7-Sep	6-Sep
Aroostock Rye	30-Sep	25-Sep	21-Sep	16-Sep	14-Sep	12-Sep	11-Sep
Breaker Triticale	27-Sep	22-Sep	17-Sep	12-Sep	9-Sep	8-Sep	7-Sep
Celia Triticale	26-Sep	21-Sep	16-Sep	12-Sep	9-Sep	7-Sep	6-Sep
White Mustard	19-Sep	16-Sep	13-Sep	10-Sep	8-Sep	7-Sep	6-Sep
Rape	16-Sep	12-Sep	9-Sep	6-Sep	4-Sep	3-Sep	2-Sep
Moro Winter Wheat	22-Sep	18-Sep	14-Sep	10-Sep	8-Sep	6-Sep	5-Sep
Stephens Wheat	21-Sep	16-Sep	12-Sep	8-Sep	6-Sep	4-Sep	3-Sep

Prosser	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	25-Sep	21-Sep	17-Sep	14-Sep	11-Sep	10-Sep	9-Sep
Aroostock Rye	4-Oct	29-Sep	24-Sep	19-Sep	17-Sep	15-Sep	14-Sep
Breaker Triticale	30-Sep	25-Sep	20-Sep	16-Sep	13-Sep	11-Sep	10-Sep
Celia Triticale	29-Sep	24-Sep	19-Sep	15-Sep	12-Sep	10-Sep	9-Sep
White Mustard	22-Sep	19-Sep	16-Sep	13-Sep	11-Sep	9-Sep	8-Sep
Rape	19-Sep	15-Sep	12-Sep	9-Sep	7-Sep	6-Sep	5-Sep
Moro Winter Wheat	25-Sep	21-Sep	17-Sep	13-Sep	11-Sep	9-Sep	8-Sep
Stephens Wheat	24-Sep	20-Sep	15-Sep	11-Sep	9-Sep	7-Sep	6-Sep

Quincy	Biomass Produced						
	89 lb/a (100 kg/ha)	178 lb/a (200 kg/ha)	357 lb/a (400 kg/ha)	714 lb/a (800 kg/ha)	1070 lb/a (1200 kg/ha)	1427 lb/a (1600 kg/ha)	1784 lb/a (2000 kg/ha)
Alpowa Spring Wheat	21-Sep	17-Sep	14-Sep	10-Sep	8-Sep	7-Sep	6-Sep
Aroostock Rye	29-Sep	24-Sep	20-Sep	16-Sep	13-Sep	11-Sep	10-Sep
Breaker Triticale	25-Sep	21-Sep	16-Sep	12-Sep	9-Sep	8-Sep	6-Sep
Celia Triticale	25-Sep	20-Sep	15-Sep	11-Sep	8-Sep	7-Sep	5-Sep
White Mustard	19-Sep	16-Sep	13-Sep	10-Sep	8-Sep	7-Sep	6-Sep
Rape	16-Sep	13-Sep	10-Sep	6-Sep	5-Sep	4-Sep	3-Sep
Moro Winter Wheat	21-Sep	16-Sep	13-Sep	10-Sep	8-Sep	6-Sep	5-Sep
Stephens Wheat	20-Sep	16-Sep	12-Sep	8-Sep	6-Sep	4-Sep	3-Sep

Richland	Biomass Produced						
	89 lb/a (100 kg/ha)	178 lb/a (200 kg/ha)	357 lb/a (400 kg/ha)	714 lb/a (800 kg/ha)	1070 lb/a (1200 kg/ha)	1427 lb/a (1600 kg/ha)	1784 lb/a (2000 kg/ha)
Alpowa Spring Wheat	3-Oct	29-Sep	25-Sep	21-Sep	19-Sep	18-Sep	17-Sep
Aroostock Rye	10-Oct	5-Oct	30-Sep	26-Sep	23-Sep	22-Sep	21-Sep
Breaker Triticale	6-Oct	1-Oct	27-Sep	22-Sep	20-Sep	18-Sep	17-Sep
Celia Triticale	5-Oct	30-Sep	26-Sep	21-Sep	19-Sep	17-Sep	16-Sep
White Mustard	30-Sep	27-Sep	23-Sep	20-Sep	19-Sep	18-Sep	17-Sep
Rape	26-Sep	23-Sep	20-Sep	17-Sep	15-Sep	14-Sep	13-Sep
Moro Winter Wheat	2-Oct	28-Sep	24-Sep	21-Sep	19-Sep	17-Sep	16-Sep
Stephens Wheat	1-Oct	27-Sep	23-Sep	19-Sep	17-Sep	15-Sep	14-Sep

Ritzville	Biomass Produced						
	89 lb/a (100 kg/ha)	178 lb/a (200 kg/ha)	357 lb/a (400 kg/ha)	714 lb/a (800 kg/ha)	1070 lb/a (1200 kg/ha)	1427 lb/a (1600 kg/ha)	1784 lb/a (2000 kg/ha)
Alpowa Spring Wheat	18-Sep	14-Sep	10-Sep	7-Sep	5-Sep	3-Sep	2-Sep
Aroostock Rye	26-Sep	21-Sep	17-Sep	12-Sep	10-Sep	8-Sep	7-Sep
Breaker Triticale	22-Sep	18-Sep	13-Sep	9-Sep	6-Sep	4-Sep	3-Sep
Celia Triticale	22-Sep	17-Sep	12-Sep	8-Sep	5-Sep	3-Sep	2-Sep
White Mustard	16-Sep	13-Sep	9-Sep	6-Sep	4-Sep	3-Sep	2-Sep
Rape	12-Sep	9-Sep	6-Sep	3-Sep	1-Sep	31-Aug	30-Aug
Moro Winter Wheat	18-Sep	14-Sep	10-Sep	6-Sep	4-Sep	2-Sep	1-Sep
Stephens Wheat	17-Sep	13-Sep	8-Sep	4-Sep	2-Sep	1-Sep	30-Aug

Walla Walla	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	3-Oct	29-Sep	25-Sep	21-Sep	19-Sep	18-Sep	17-Sep
Aroostock Rye	10-Oct	5-Oct	30-Sep	26-Sep	24-Sep	22-Sep	21-Sep
Breaker Triticale	6-Oct	1-Oct	27-Sep	22-Sep	20-Sep	18-Sep	17-Sep
Celia Triticale	6-Oct	1-Oct	26-Sep	21-Sep	19-Sep	17-Sep	16-Sep
White Mustard	30-Sep	27-Sep	24-Sep	21-Sep	19-Sep	18-Sep	17-Sep
Rape	27-Sep	23-Sep	20-Sep	17-Sep	15-Sep	14-Sep	13-Sep
Moro Winter Wheat	3-Oct	29-Sep	25-Sep	21-Sep	19-Sep	17-Sep	16-Sep
Stephens Wheat	2-Oct	27-Sep	23-Sep	19-Sep	17-Sep	16-Sep	14-Sep

Wilson Creek	Biomass Produced						
	89 lb/a (100 kg/ha)	**178 lb/a** (200 kg/ha)	**357 lb/a** (400 kg/ha)	**714 lb/a** (800 kg/ha)	**1070 lb/a** (1200 kg/ha)	**1427 lb/a** (1600 kg/ha)	**1784 lb/a** (2000 kg/ha)
Alpowa Spring Wheat	20-Sep	16-Sep	12-Sep	9-Sep	7-Sep	5-Sep	4-Sep
Aroostock Rye	28-Sep	23-Sep	19-Sep	14-Sep	12-Sep	10-Sep	9-Sep
Breaker Triticale	24-Sep	19-Sep	15-Sep	11-Sep	8-Sep	6-Sep	5-Sep
Celia Triticale	24-Sep	19-Sep	14-Sep	10-Sep	7-Sep	5-Sep	4-Sep
White Mustard	18-Sep	15-Sep	12-Sep	9-Sep	7-Sep	6-Sep	5-Sep
Rape	15-Sep	11-Sep	8-Sep	5-Sep	3-Sep	2-Sep	1-Sep
Moro Winter Wheat	20-Sep	16-Sep	12-Sep	8-Sep	6-Sep	5-Sep	3-Sep
Stephens Wheat	19-Sep	15-Sep	10-Sep	7-Sep	4-Sep	3-Sep	2-Sep