# Oregon Seed Production

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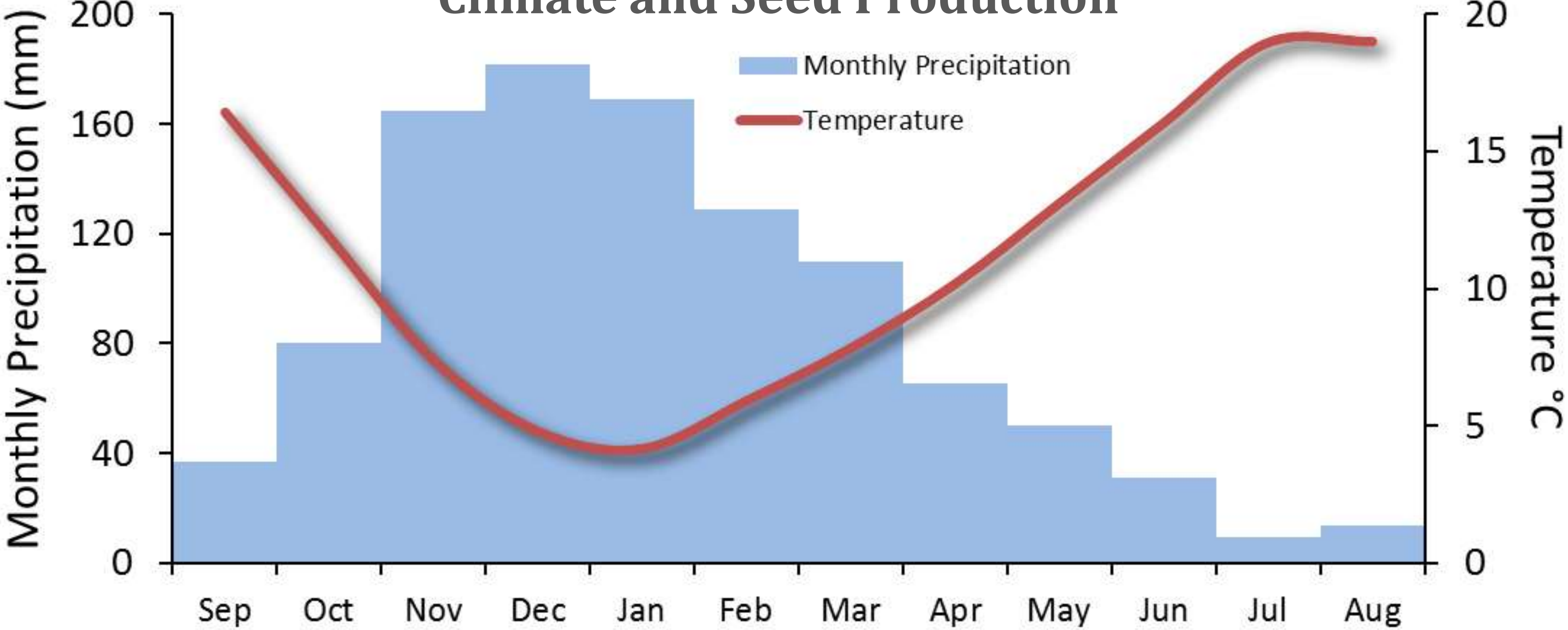
# Climate and Seed Production




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crop Development Sequence | Leaf G+D / Tiller G+D | Winter Quiescence / Vernalization | Leaf G+D / Tiller G+D | Stem Elongation | Flowering | Seed Filling | Summer Dormancy |
| Crop Management Sequence | Weed and Slug Control / N Application | | Weed Control / N Application | PGR | Rust Control | Harvest | Residue |

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# Soils and Seed Production

**Flood plains**

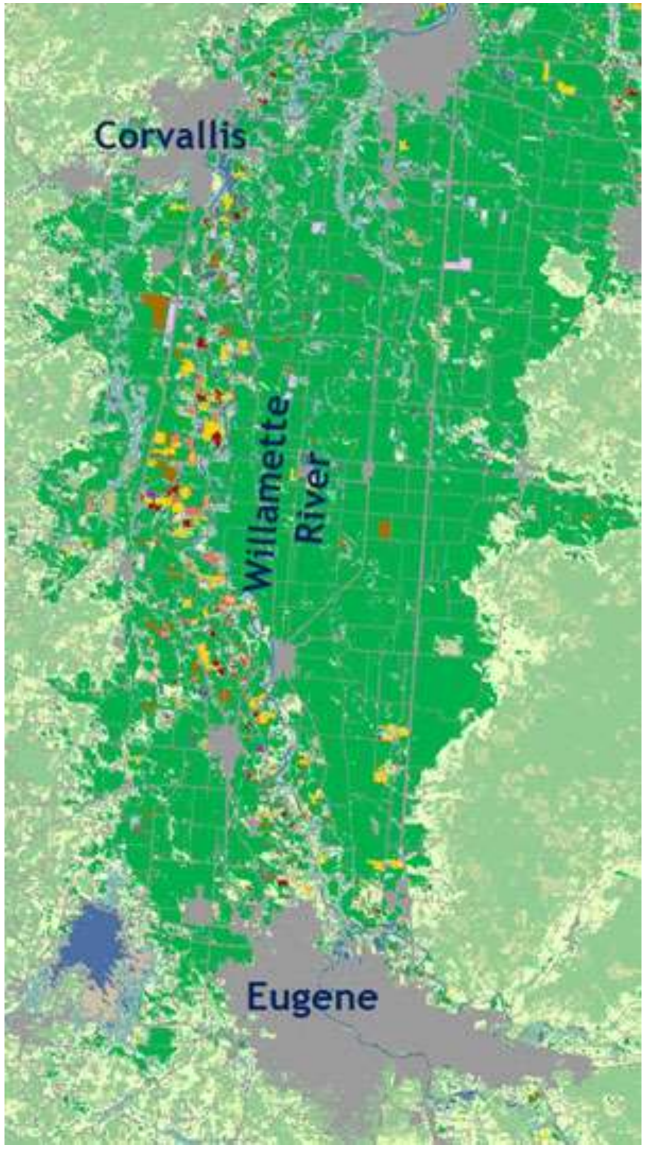
- Most cropping choices.
- High productivity soils (Chehalis, Newberg) - vegetable, sugarbeet, grass, and legume seed crops.

**Alluvial terraces**

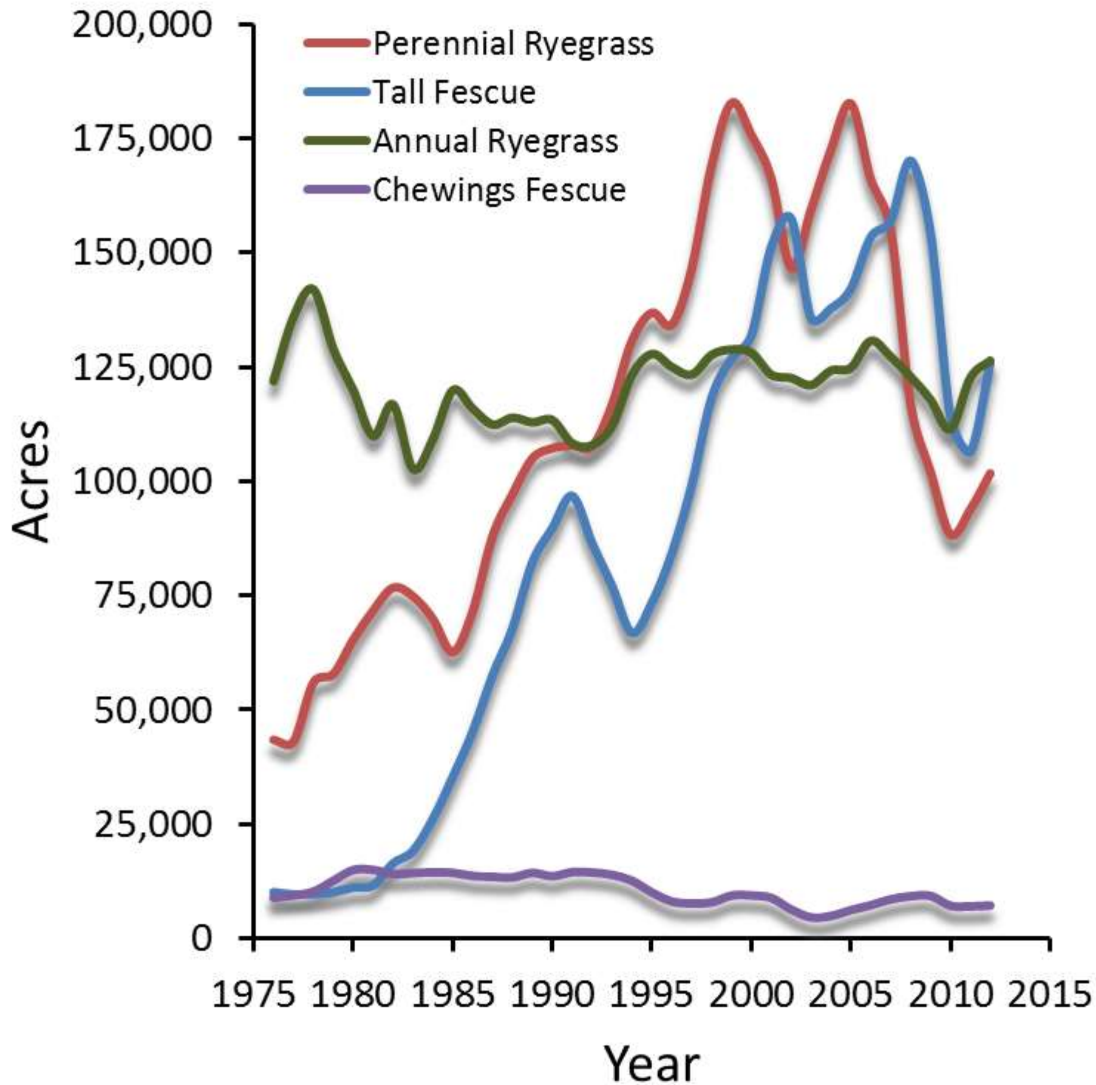
- Fewer cropping choices.
- High productivity soils (Woodburn, Willamette) - grass and legume seed crops.
- Low productivity soils (Dayton, Conser) - annual ryegrass without drainage.

**Hill soils**

- Fewest cropping choices.
- Grass seed crops on intermediate (Jory and Steiwer) and low productivity soils (Nekia, Hazelair).



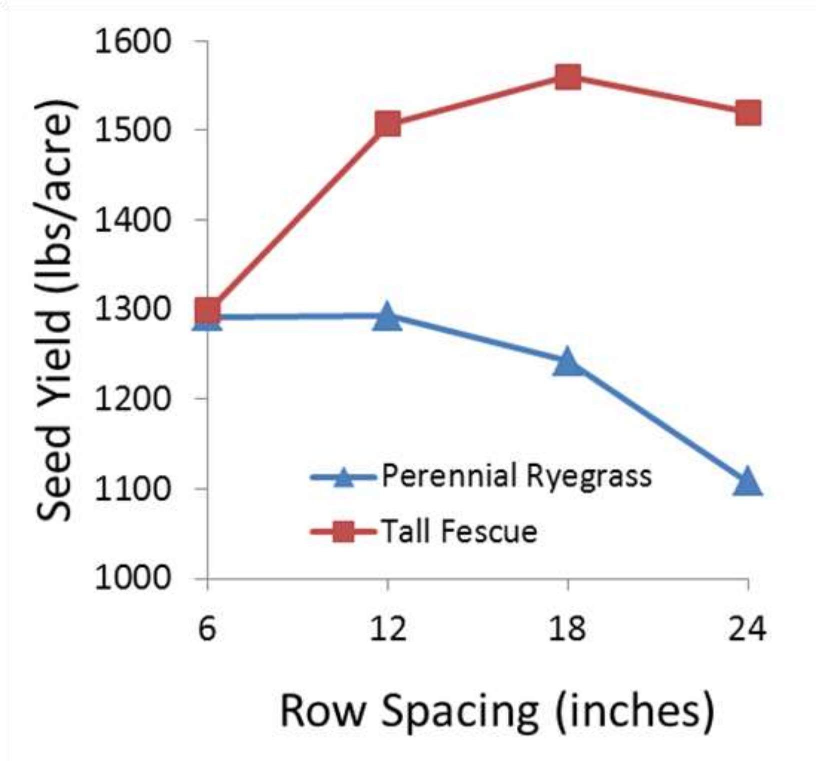
# Trends in grass seed production in the Willamette Valley




- Perennial ryegrass and tall fescue seed crop acreages have increased dramatically over time and have declined again with the recent economic downturn.
- Acreages of other grass seed crops such as annual ryegrass and Chewings fescue have remained stable over time.

## Stand Establishment

- **Conventional seeding.** A seedbed is prepared by tillage and sown using a drill or air-seeder.




Double-disc drill (top), newly emerged field of annual ryegrass (bottom).

## Stand Establishment

- **Carbon Seeding (Charcoal Banding)** A seedbed is prepared by tillage. A 1-inch wide band of activated carbon and water slurry is applied over seed during drilling at 25 lbs/acre.
- A non-selective herbicide (diuron) is applied over the field but the seed is protected from this chemical by the carbon band.
- Replanting to augment a poor stand is difficult due to residual diuron.

Carbon seeding – photo by Scott Setniker (top), carbon bands in grass seed field (bottom).

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# Stand Establishment

- **Direct seeding (no-till planting).** Crop is sown without preparation of a seedbed. Direct seeding of perennial grass seed crops is a relatively new practice.
- Mixed results in stand establishment have been noted. Slugs, wet soil conditions, and other problems have contributed to poor stands with this method.

No-till drill (top), no-till stand of perennial ryegrass seedlings showing poor seedbed conditions (bottom)

## Stand Establishment

- **Row Spraying.** Rows are created by herbicide application in volunteer annual ryegrass stand.
- Sprayed rows produce better seed yield than the solid stand volunteer establishment system.

| Row spray | Stand remaining (%) | Seed yield (lbs/acre) |
|---|---|---|
| No rows | 100 | 1614 |
| Rows | 75 | 1750 |
| | 50 | 1885 |
| | 25 | 1903 |


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# Nutrient Management

- **Nitrogen.** N is needed for development of grass seed crops at two distinct times – fall and spring.
- Fall N supports formation of tillers in fall that contribute to seed yield in the following spring.  Perennial ryegrass does not need fall N.
- Spring N supports the development of a canopy of stems and leaves needed to capture solar energy and $CO_2$ and to convert this energy and carbon into harvested seed.

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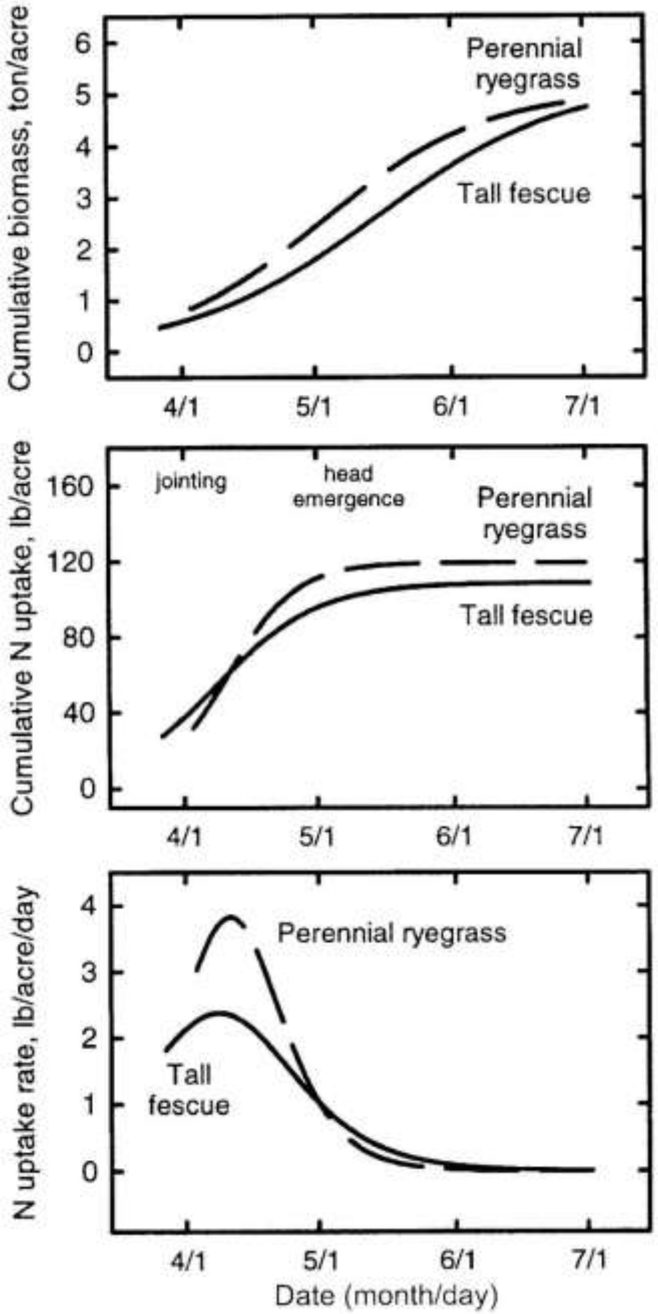
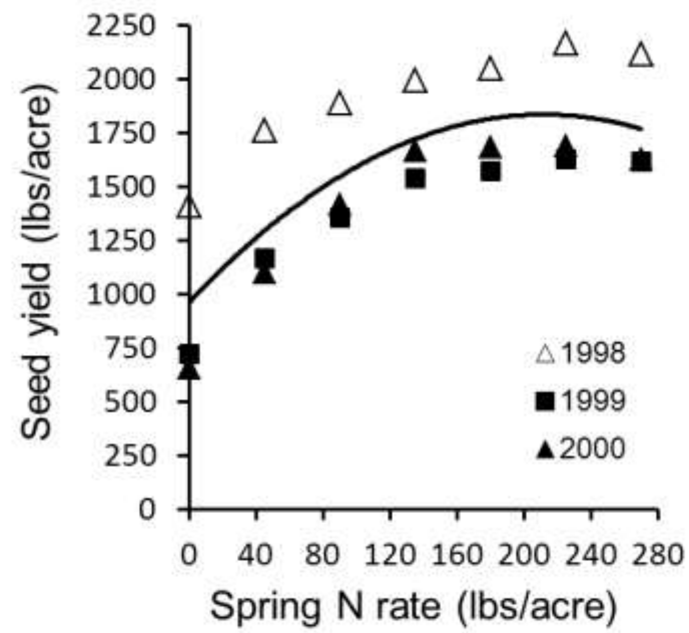
# Nutrient Management

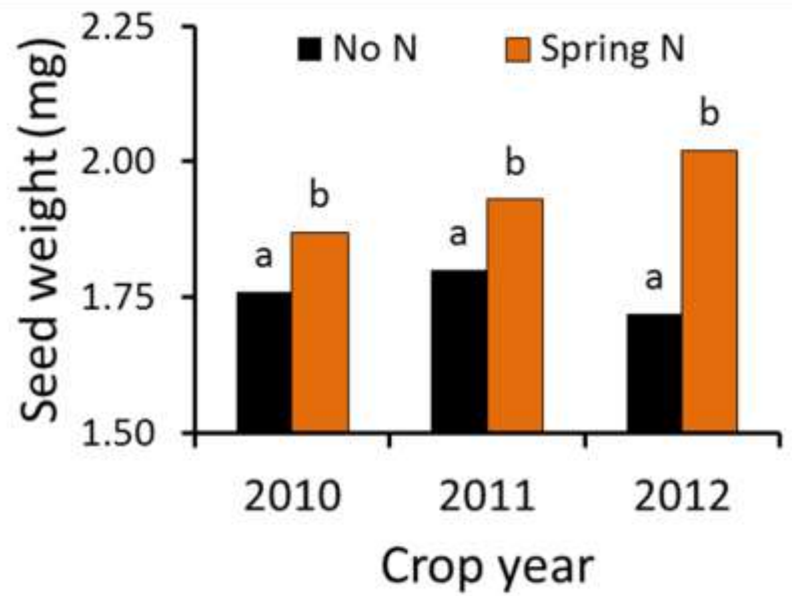
- Spring N uptake precedes development of the crop canopy (biomass).
- Uptake of spring N in tall fescue and perennial ryegrass seed crops is complete prior to head (inflorescence) emergence.
- For best uptake of N by the plant, spring N must be applied prior to stem elongation(jointing).
- Late application of N will not influence seed yield.

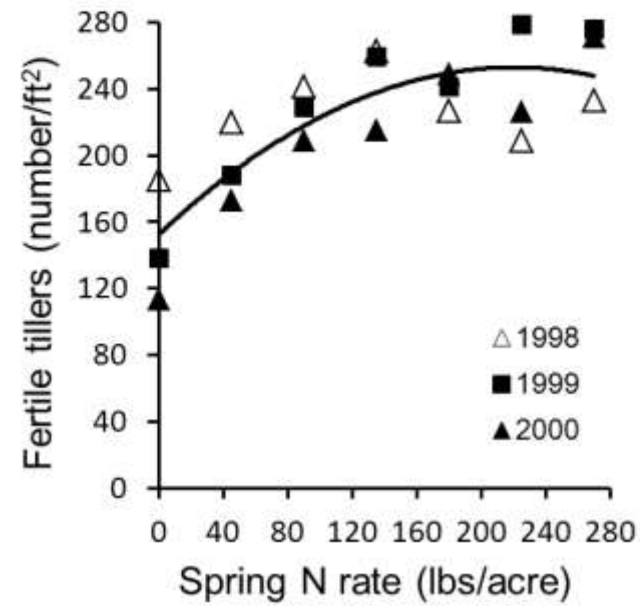


## Nutrient Management

- Optimum spring N application for perennial ryegrass ranged from 120-160 lbs N/acre.
- Stimulation of fertile tiller production accounted for most of the variation in seed yield due to spring N application.
- Seed weight is increased by spring N.



## Nutrient Management

- **Lime**. Applied to the seedbed when pH is low (below pH 5.5).
- As stands age, soil pH declines in response to successive N fertilizer applications. Top-dress application of lime when pH in surface 2 inches of soil is below 5.5.


Lime application truck

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# Nitrogen and Lodging

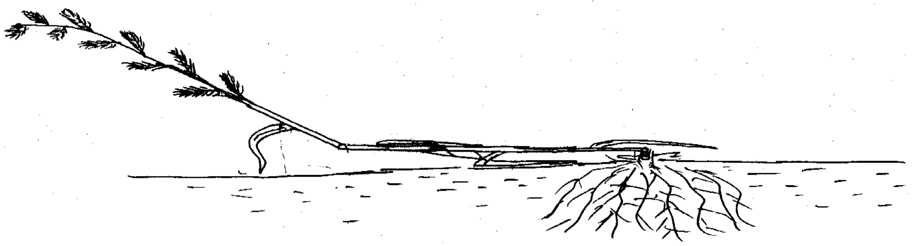

Lodged crop

No lodging

Spring N and lodging in perennial ryegrass seed production.

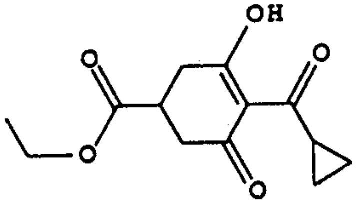
# Lodging Control

- Under certain conditions, the tiller cannot support the weight of the developing inflorescence and seed.  The tiller lodges or falls to the ground.
- Lodging during flowering restricts pollination and reduces fertilization.
- Seed filling is reduced due to self-shading of the lodged crop.  Seed number is reduced by lodging.

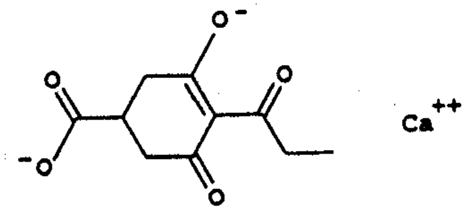


Lodged ryegrass tillers (top), diagram of a lodged tiller (bottom)

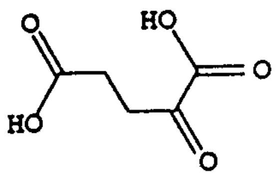
# Acylcyclohexanedione PGRs



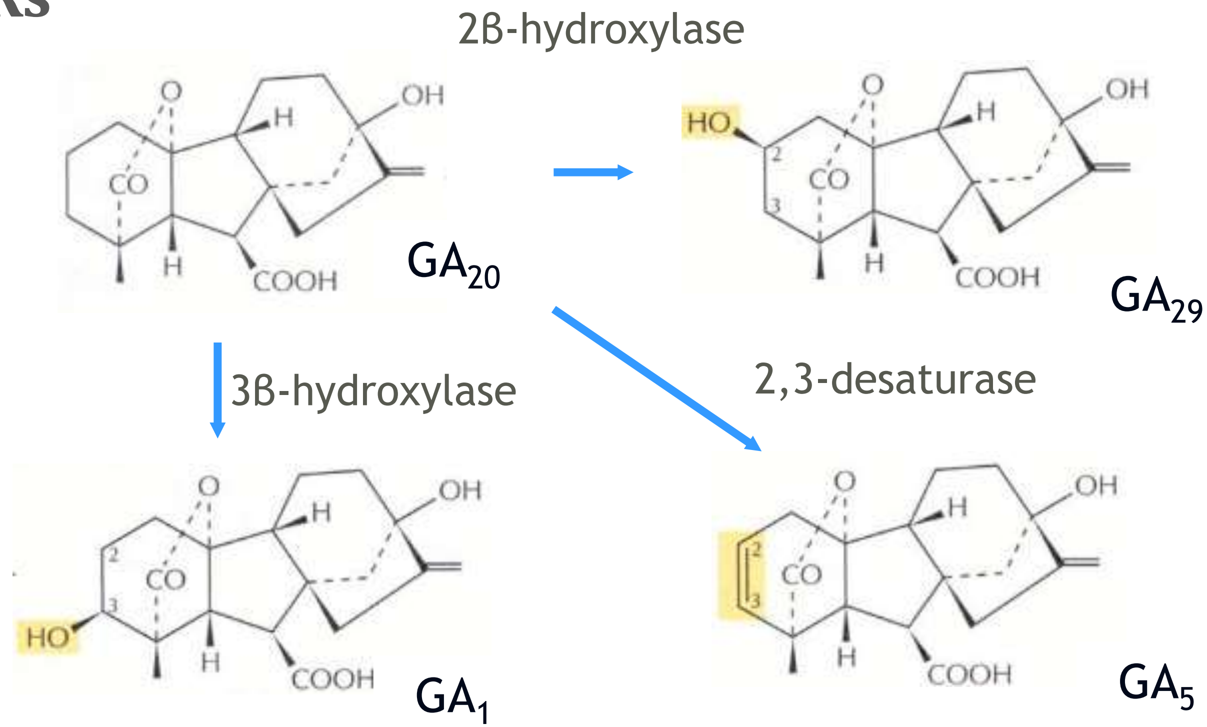
Trinexapac-ethyl (Palisade)



Prohexadione-calcium (Apogee)



2-oxoglutaric acid




- Trinexapac-ethyl (TE) and prohexadione-calcium (PC) plant PGRs are inhibitors of the 3-β hydroxylation of $GA_{20}$ to $GA_1$. $GA_1$ promotes stem elongation, $GA_5$ promotes flowering, $GA_{29}$ is inactive.
- The PGRs are structurally similar to 2-oxoglutaric acid, a cofactor in the hydroxylation reaction.

# Acylcyclohexanedione PGRs


Perennial ryegrass spikes

- While TE and PC shorten stems and reduce lodging, seed yield may be increased even with low incidence of lodging.
- TE and PC increase the efficiency of carbon partitioning to seed.

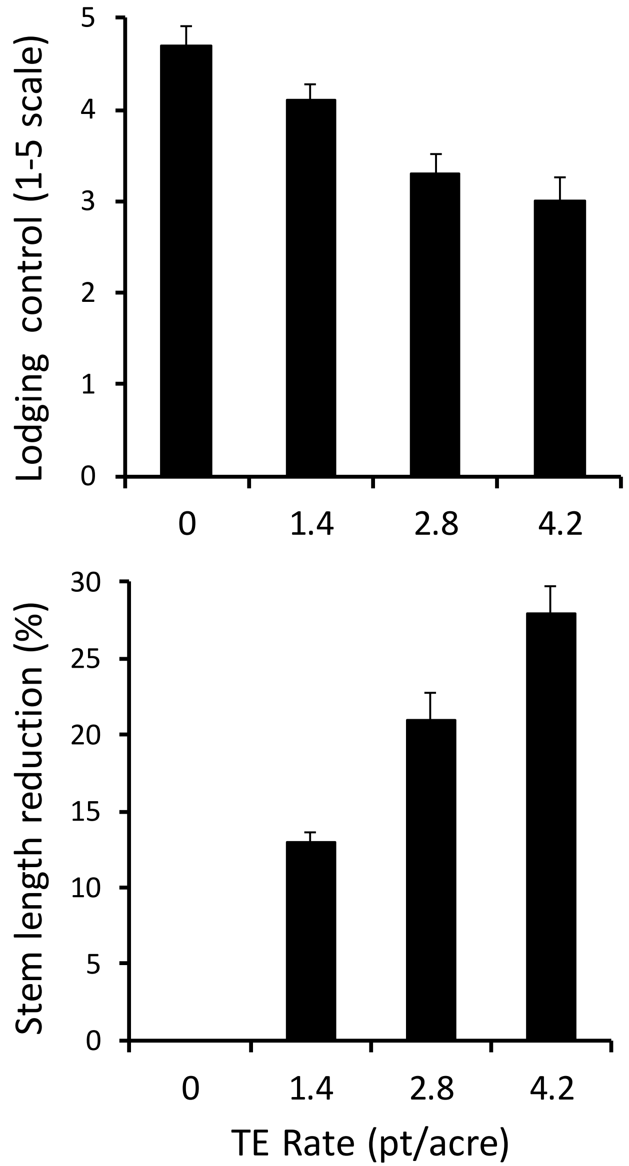
| Acylcyclohexanedione effects |
|---|
| Increased floret number |
| Increased seed set |
| Increased seed number |
| Increased seed yield |
| Increased harvest index |
| Mixed effects on seed weight |
| Decreased stem length |
| Decreased lodging |

# Acylcyclohexanedione PGRs

- The efficacy of TE and PC applications is influenced by rate, and other factors.

TE effects on perennial ryegrass seed production in 9 years of trials (Chastain et al., 2014).

| TE rate (pt/acre) | Seed yield (lbs/acre) |
|---|---|
| 0 | 1305 a |
| 1.4 | 1635 b |
| 2.8 | 1868 c |
| 4.2 | 2056 c |

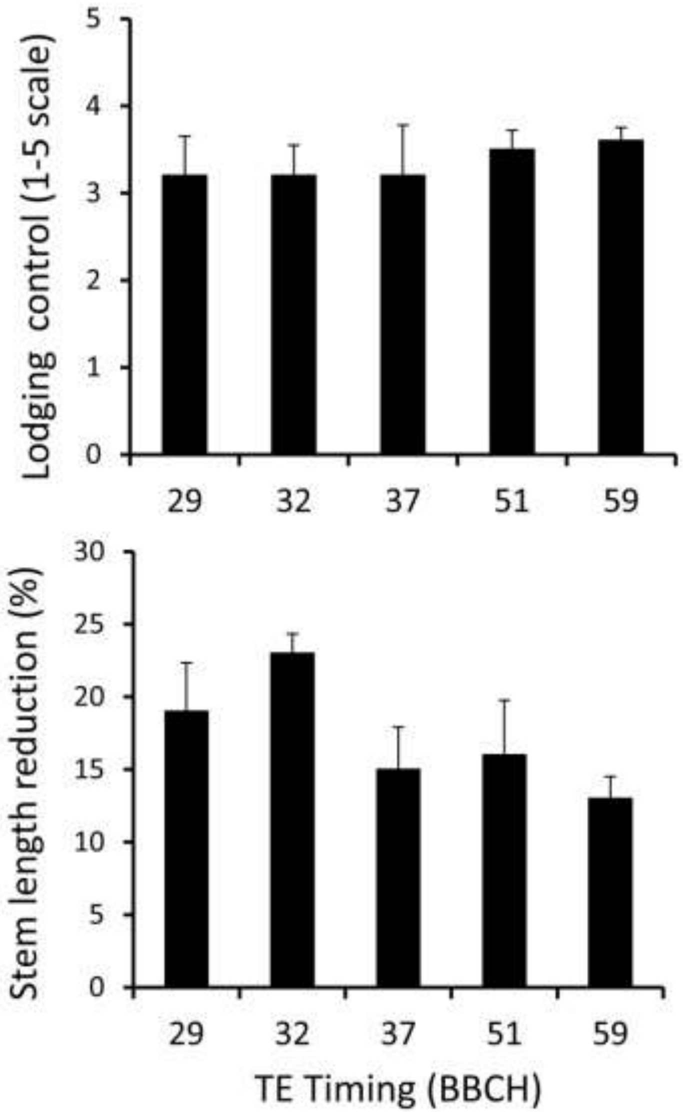


# Acylcyclohexanedione PGRs

- The seasonal timing of TE and PC is important for optimal seed yield.

TE effects on perennial ryegrass seed production in 9 years of trials (Chastain et al., 2013).

| TE timing (BBCH scale) | Seed yield (kg/ha) |
|---|---|
| 29 | 1770 b |
| 32 | 1981 c |
| 37 | 1814 bc |
| 51 | 1958 c |
| 59 | 1518 a |

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# Harvest Practices

- Since pollination and seed maturation are not uniform processes in grass seed crops, a range of seed maturity is found in a field.
- Seed moisture content is the most reliable indicator of seed maturity and harvest timing in grass seed crops.
- Harvesting within the correct range of seed moisture contents will maximize harvestable seed yield and minimize losses of seed during harvest. For perennial ryegrass, this range is 35 to 43% seed moisture.

Perennial ryegrass spikes showing range of maturity in a field (TB Silberstein photo)

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# Harvest Practices

- **Windrow-Combine Harvest** - a two step process.
- *Step 1*. The standing crop is cut with a swather at high seed moisture content and dried in windrows until ready for combining (several days to 2 weeks depending on the weather conditions).
- *Step 2*. The swathed crop is threshed at 12% seed moisture content by using combines with pickup attachments.


Swather/windrower cutting crop into swath/windrows (top), Combine with pickup attachment threshes seed (bottom)

## Post Harvest Residue Management

- The stubble and straw remaining in grass seed fields after harvesting seed is known as residue. Management of the post-harvest residues is an important practice in grass seed production.
- Field burning has been an effective, economical and controversial method of crop residue removal and pest control in grass seed crops for more than 50 years.

Combine harvest in grass seed field (top), field burning smoke (bottom)

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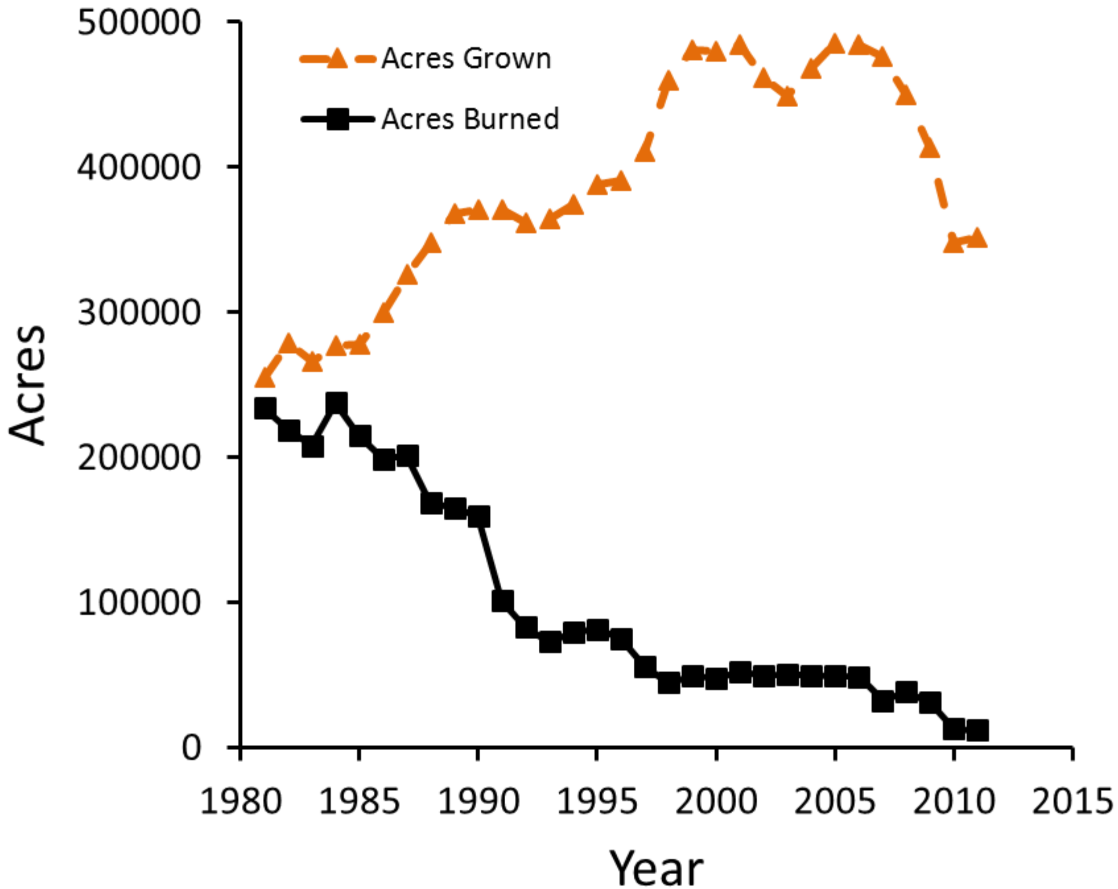
# Post Harvest Residue Management

- Grass seed growers have greatly reduced open-field burning in the Willamette Valley as the primary residue management method.
- This reduction has taken place even as the acreage of grass seed crops has reached record levels of production.

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# Post Harvest Residue Management

Burning Alternatives:

- **Clean non-thermal** Straw removal by baling. Stubble management with a flail mower may or may not be employed.
- **Full straw load** No straw removal, straw decomposes in field. Straw length may be reduced by flail mower and/or by combine straw chopper.


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# Seed Yield Trends in the Willamette Valley