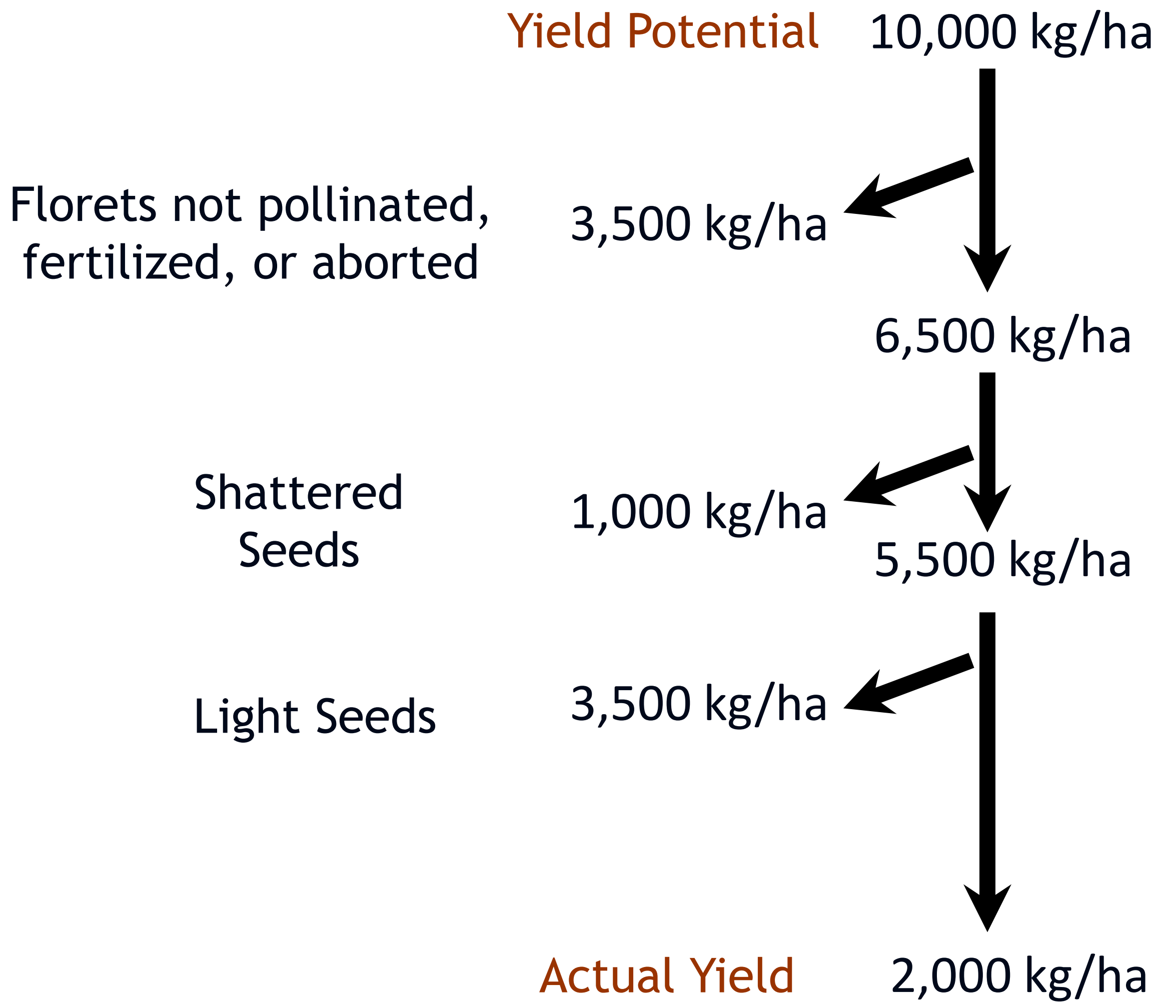
Advances in Pasture Seed Production

Thomas G Chastain

Oregon State University

Seed Yield Potential vs. Actual Yield

An example for perennial ryegrass



- Grass seed crops are biologically inefficient in the production of seed.
- Many flowers are produced by grasses yet relatively few of the flowers become seed.
- Our research efforts are aimed at capturing a greater proportion of yield potential in our grower’s harvests.

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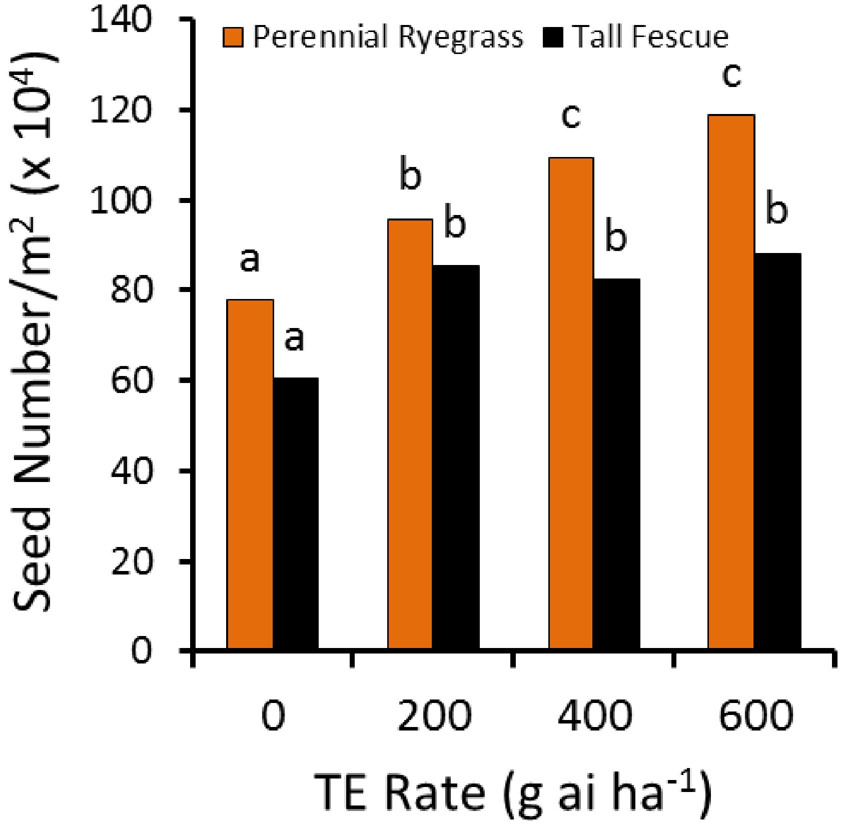
Plant Growth Regulators

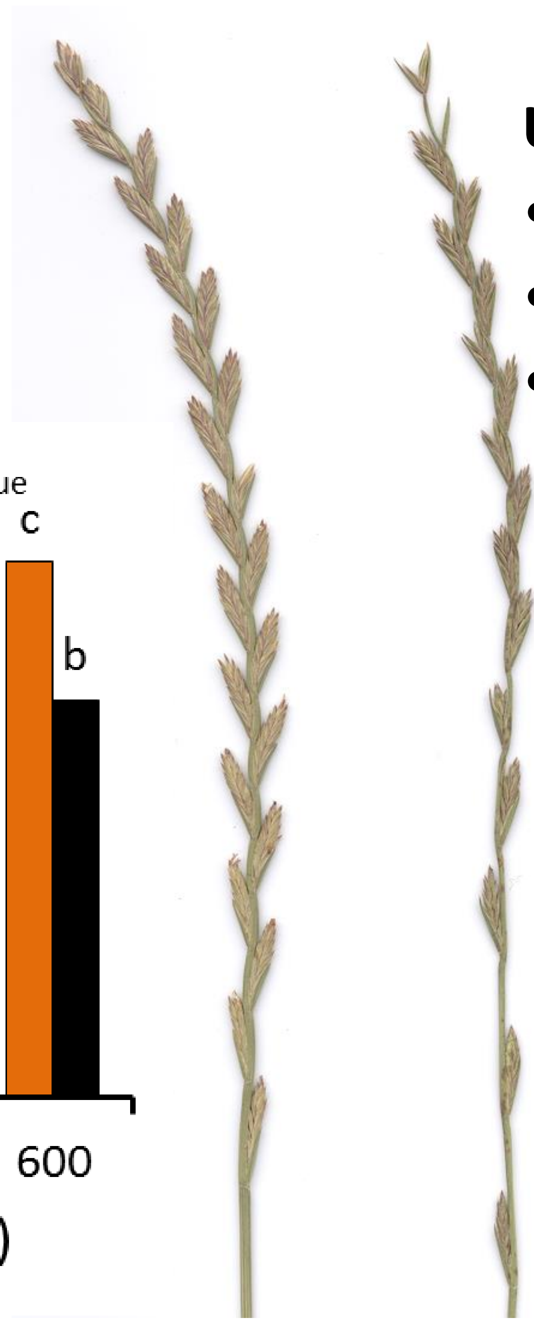
Trinexapac-ethyl treated

- Spike Length = 18.8 cm
- Spikelets/Spike = 22.3
- Seeds/Spike = 48.3

Untreated

- Spike Length = 21.6 cm
- Spikelets/Spike = 23.0
- Seeds/Spike = 40.8





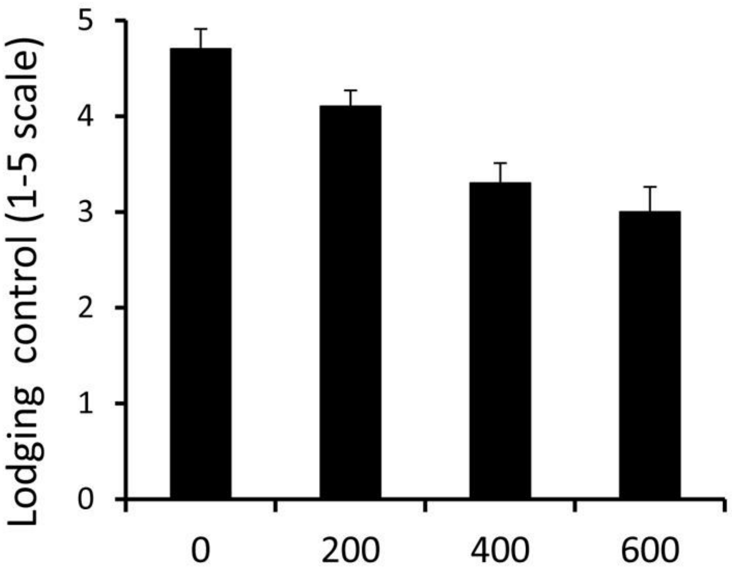
Effect of trinexapac-ethyl (TE) on perennial ryegrass spike morphology (Chastain et al, 2003)

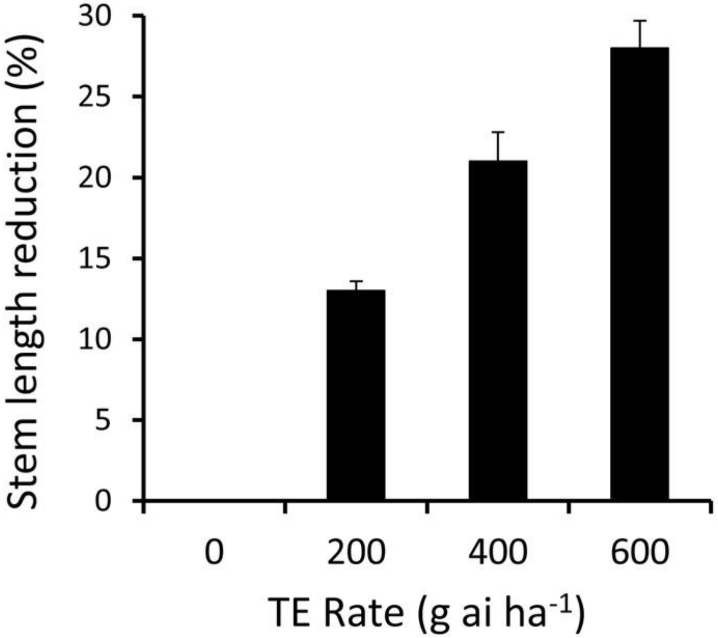
Plant Growth Regulators

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

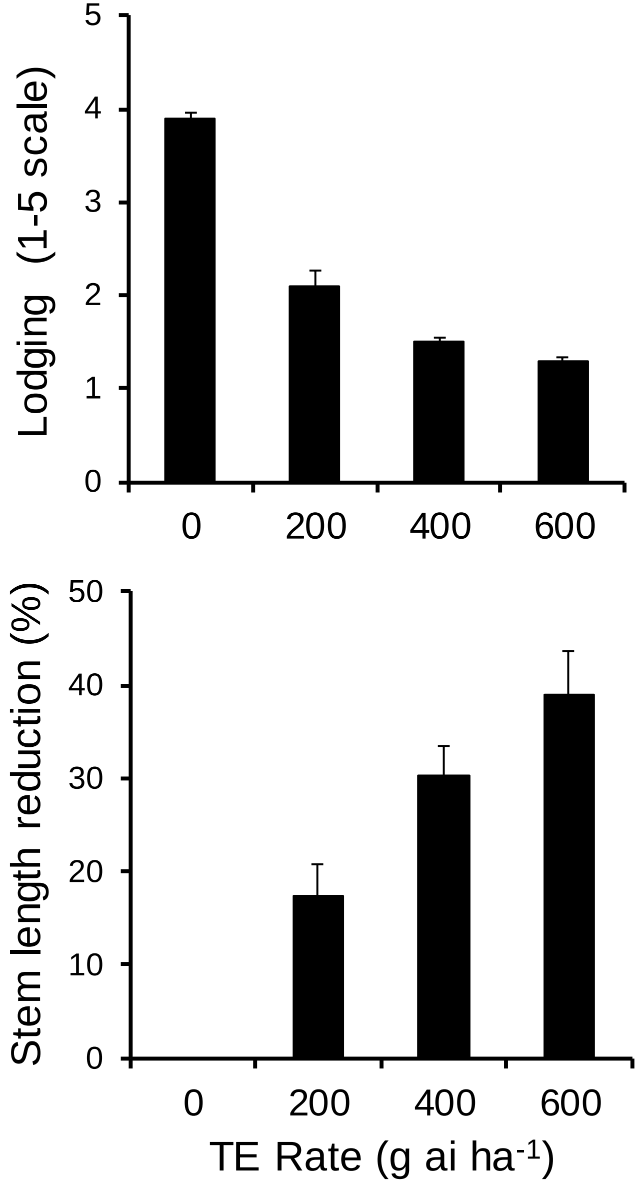
TE rate (g ai/ha)	Seed yield (kg/ha)
0	1462 a
200	1831 b
400	2090 c
600	2303 c

Perennial ryegrass seed (USDA photo)



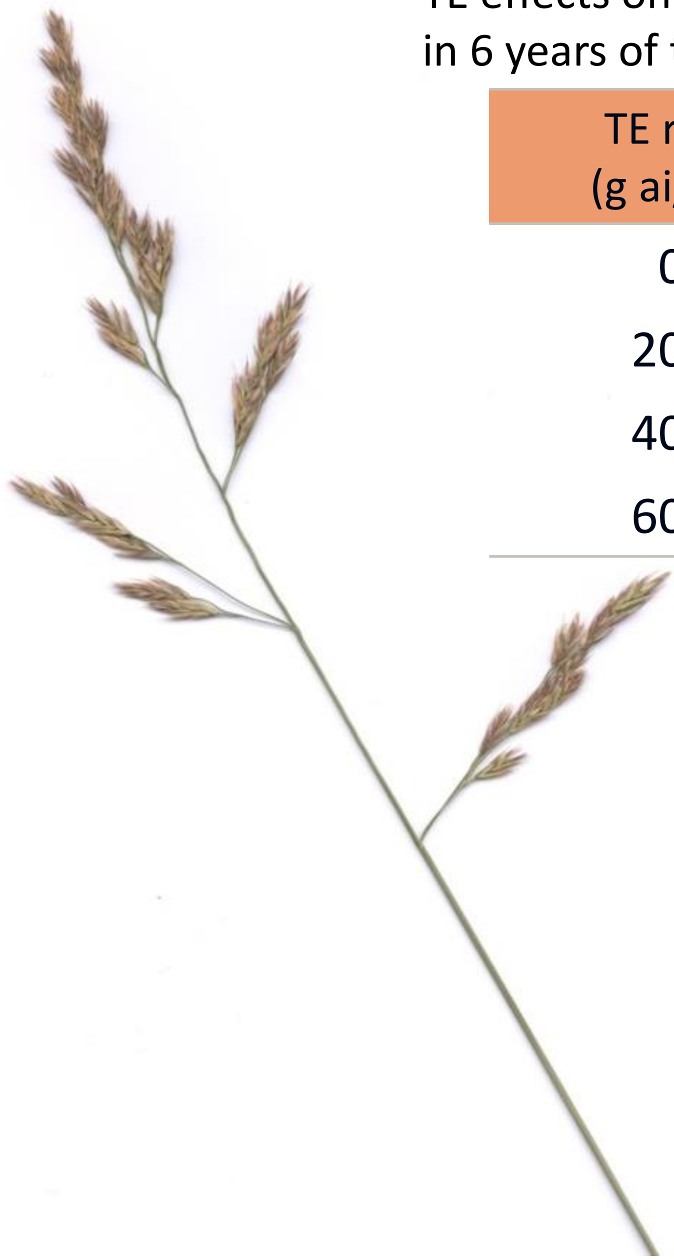


Plant Growth Regulators



TE effects on tall fescue seed production in 6 years of trials (Chastain et al., 2015).

TE rate (g ai/ha)	Seed yield (kg/ha)
0	1455 a
200	2052 b
400	1984 b
600	2079 b

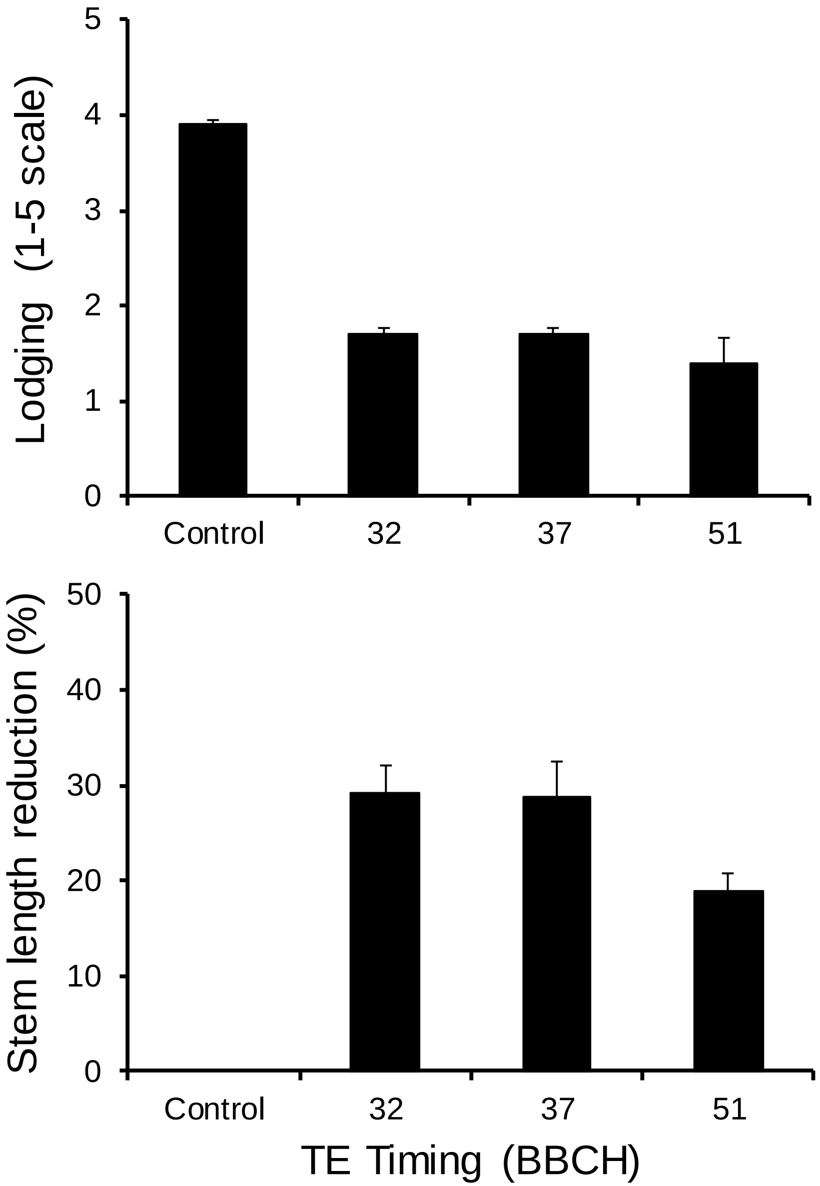


Tall fescue panicle
(TG Chastain photo)

Plant Growth Regulators

TE timing effects on perennial ryegrass (9 years) and tall fescue (6 years) seed yield (Chastain et al., 2014, 2015).

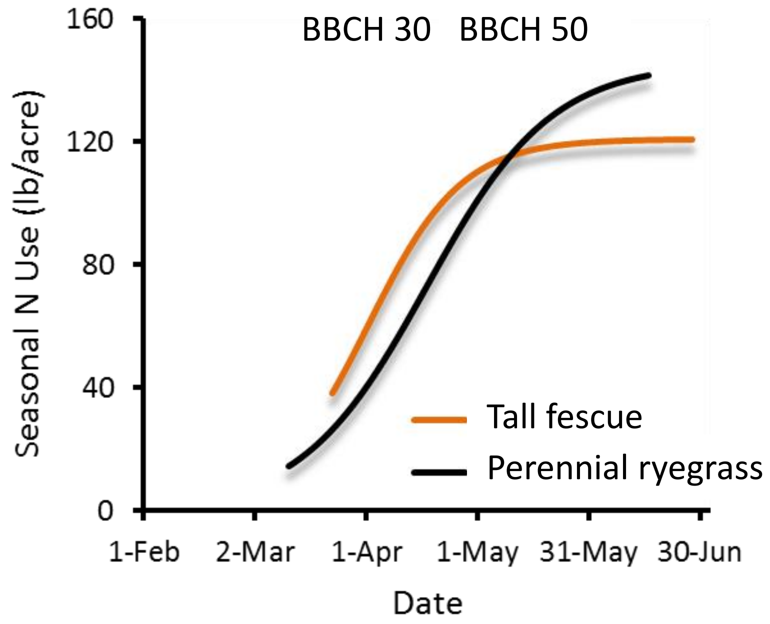
TE timing	Perennial ryegrass	Tall fescue
BBCH scale	-------------kg/ha--------------	
29	1770 b	--
32	1981 c	1988 a
37	1814 bc	2109 a
51	1958 c	2105 a
59	1518 a	--



Nitrogen Management

- Nitrogen - most important nutrient in grass seed production.
- Spring is most important N application timing.
- Daily N use peaks for both crops during early stem elongation (BBCH 30).
- For best N use efficiency, N application should precede stem elongation.
- Spring N uptake in tall fescue is complete prior to inflorescence emergence (BBCH 50) while perennial ryegrass N use continues later in the season.

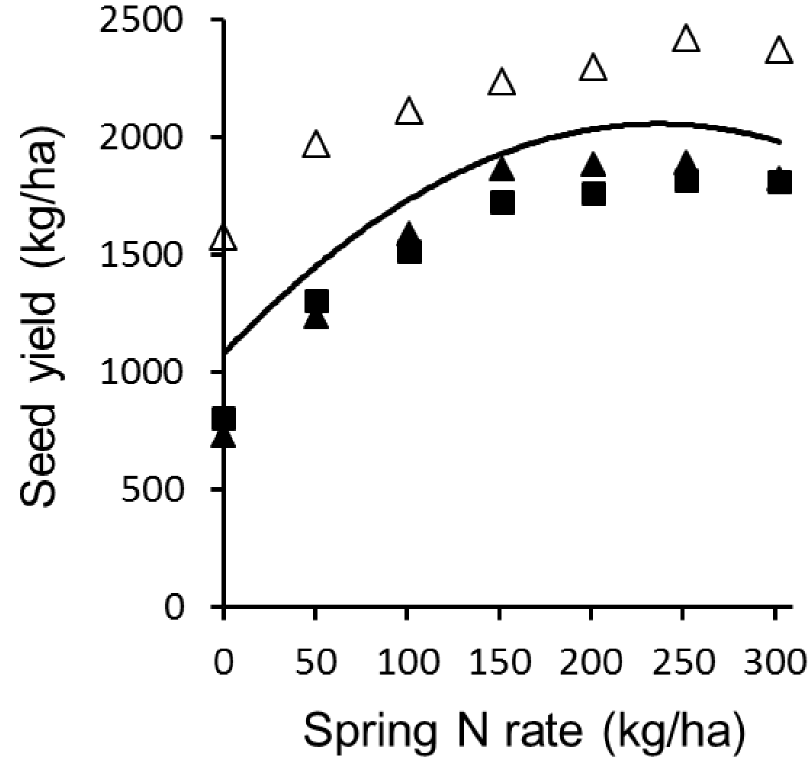
Anderson et al. (2014)

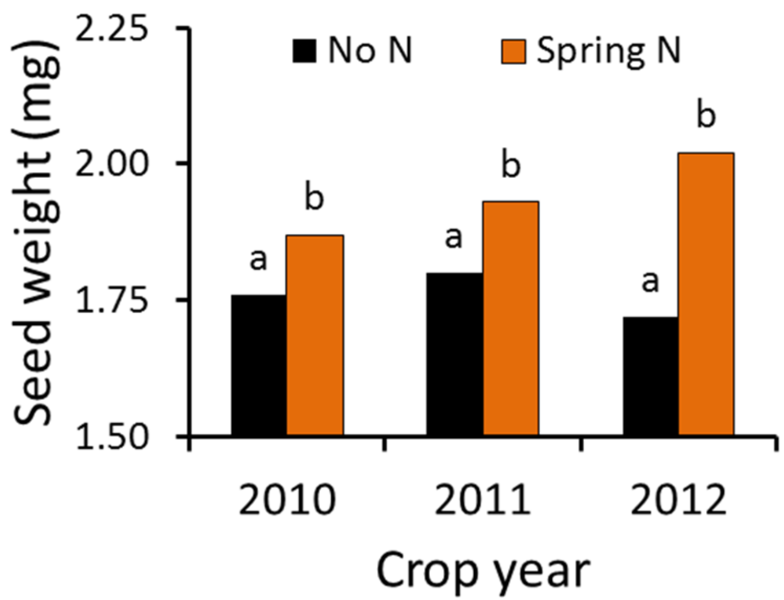


Fertilizer application tall fescue (TG Chastain photo)

Nitrogen Management

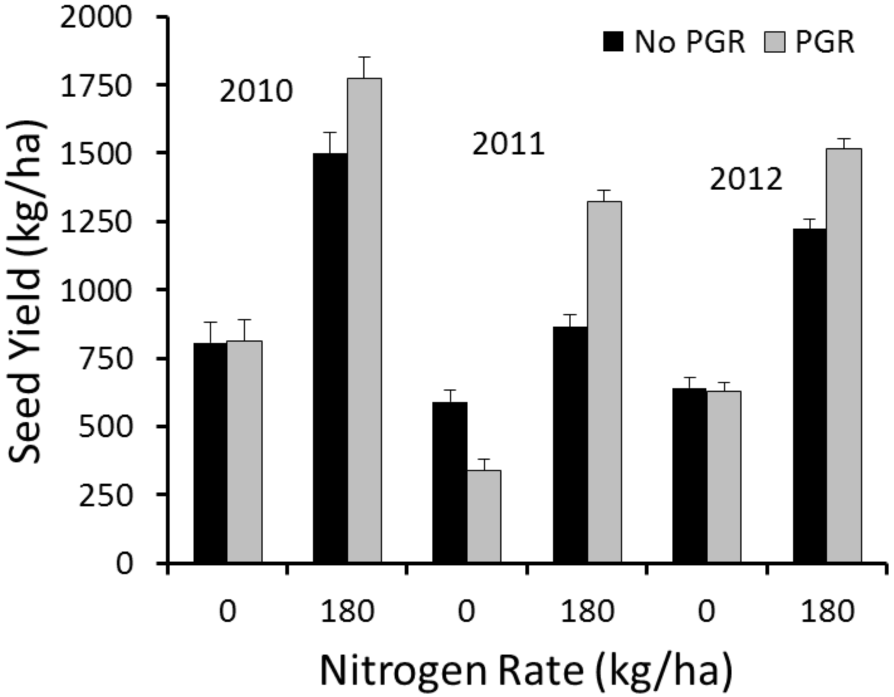
- Optimum spring N application for perennial ryegrass ranged from 130-180 kg N/hectare. Values are averaged over 12 site years.
- Stimulation of spike production accounted for most of the variation in seed yield due to N application.
- Seed weight was increased by N.

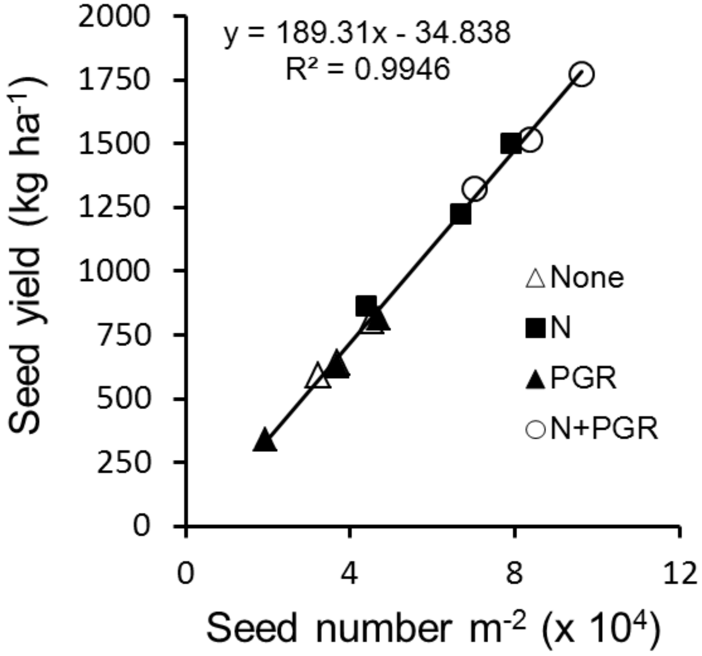




Spring N application effects on seed weight in perennial ryegrass (Chastain et al., 2014)

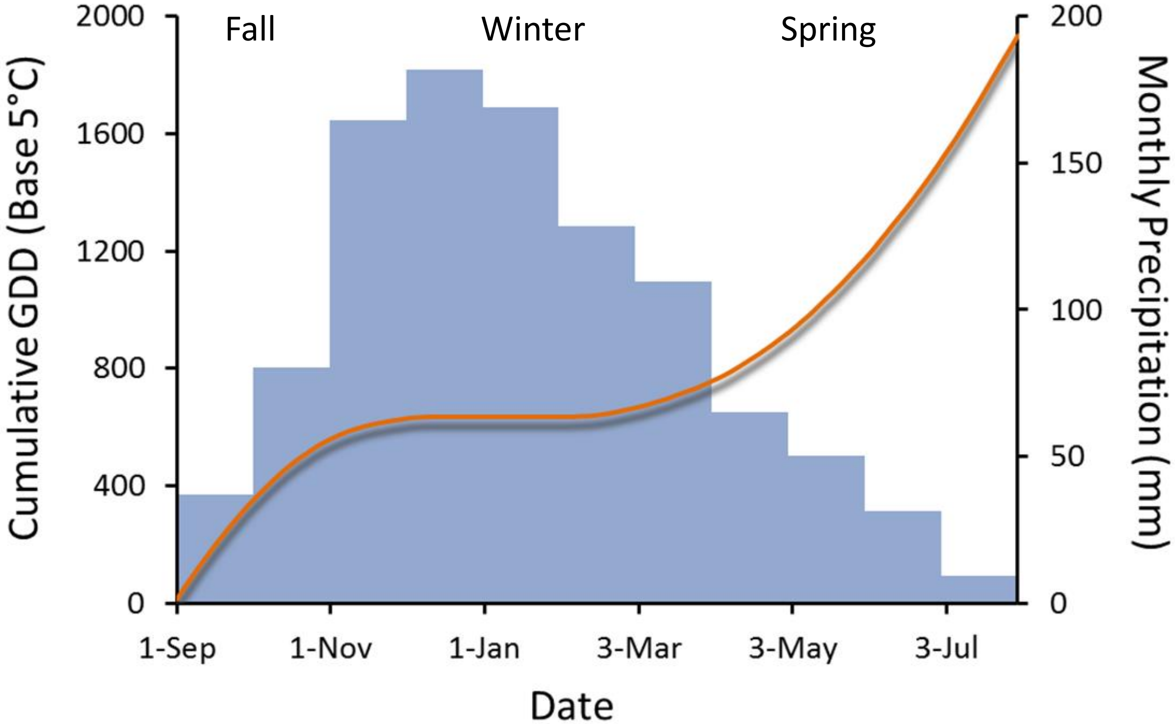
Interaction of Plant Growth Regulators and Nitrogen





Irrigation

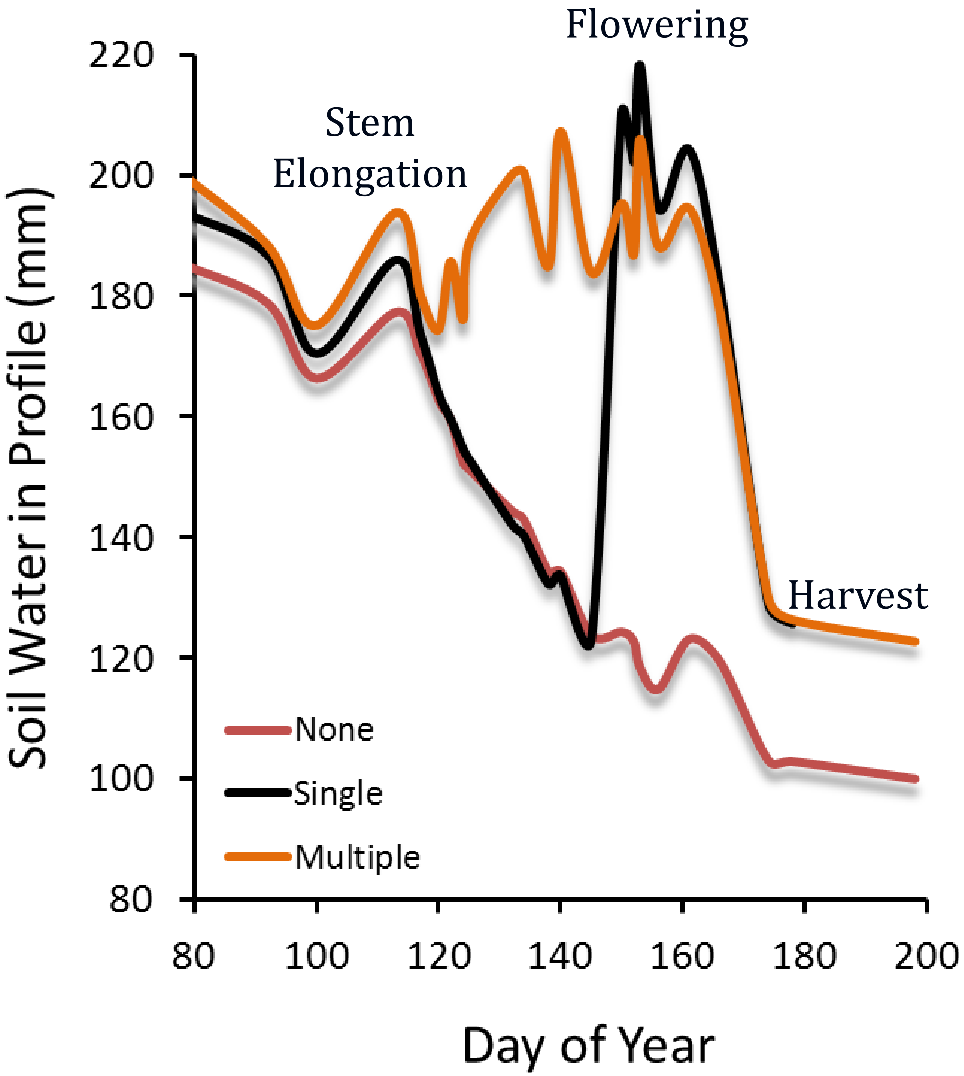
- Most grass seed crops have been produced without irrigation in the Willamette Valley.
- Recent increases in the amount of irrigated land (now 113,850 hectares).
- Spring irrigation is beneficial and increases seed yield in perennial ryegrass and tall fescue.
- Fall irrigation does not affect seed yield.



Seasonal Irrigation Timing	Water application (mm)	Seed yield (kg/ha)
None	0	1620a
Fall	127	1591a
Spring	102	1726b

Seasonal irrigation timing effects on seed yield in perennial ryegrass (Chastain et al, 2014).

Spring Irrigation



Spring irrigation frequency effects on seed yield in perennial ryegrass (Chastain et al, 2014).

Spring Irrigation Frequency	Water application (mm)	Seed yield (kg/ha)
None	0	1639a
Single	92-95	1903b
Multiple	113-219	2042c

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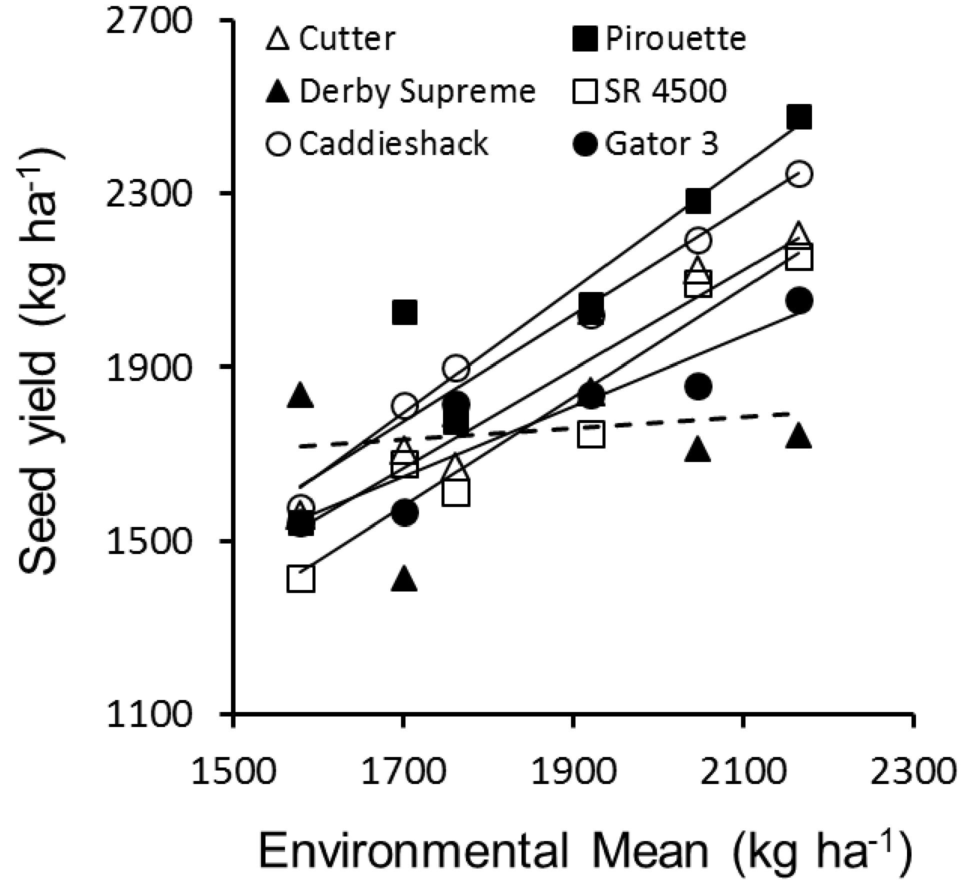
Spring Irrigation

- Seed yield responses to irrigation varied among cultivars and year.
- Spring irrigation increased yield in all tall fescue cultivars and in all but one of the cultivars of perennial ryegrass tested.
- Derby Supreme perennial ryegrass seed yield remained the same across irrigation environments that increased yield of other cultivars.

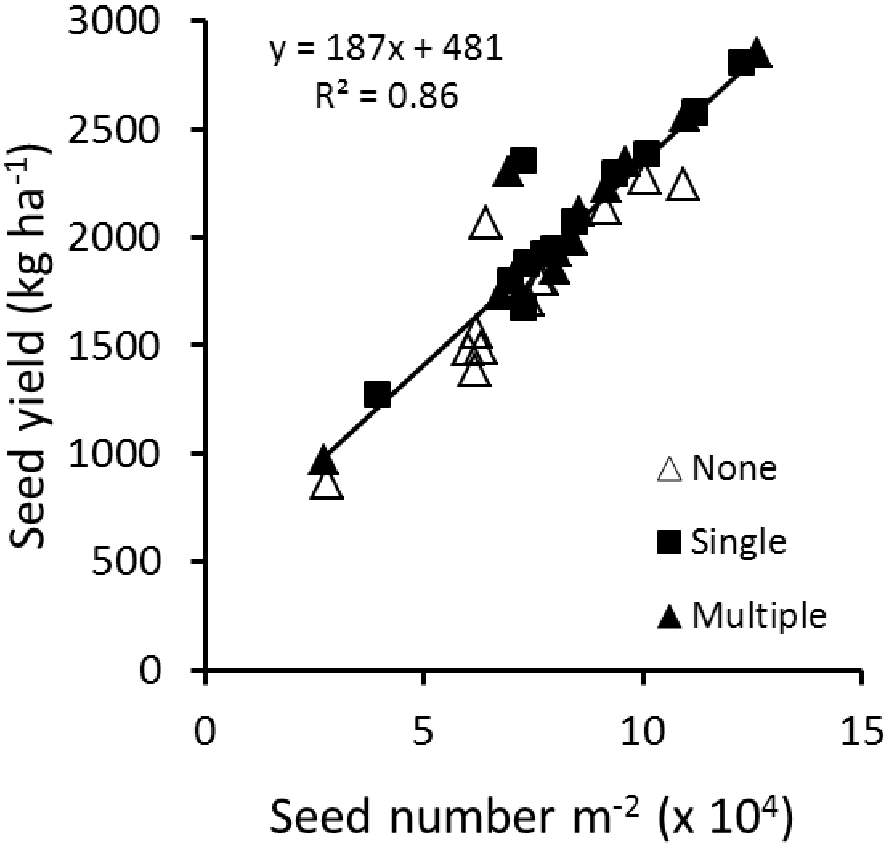


Regression of seed yield in perennial ryegrass cultivars on spring irrigation environments (Chastain et al, 2014).

Spring Irrigation

- Seed number increased at the same rate regardless of irrigation treatment, cultivar, or year.
- Irrigation-induced seed yield increases were likely the result of reduced seed abortion.

Spring irrigation effects on seed number and seed yield in tall fescue (Huettig et al, 2013).



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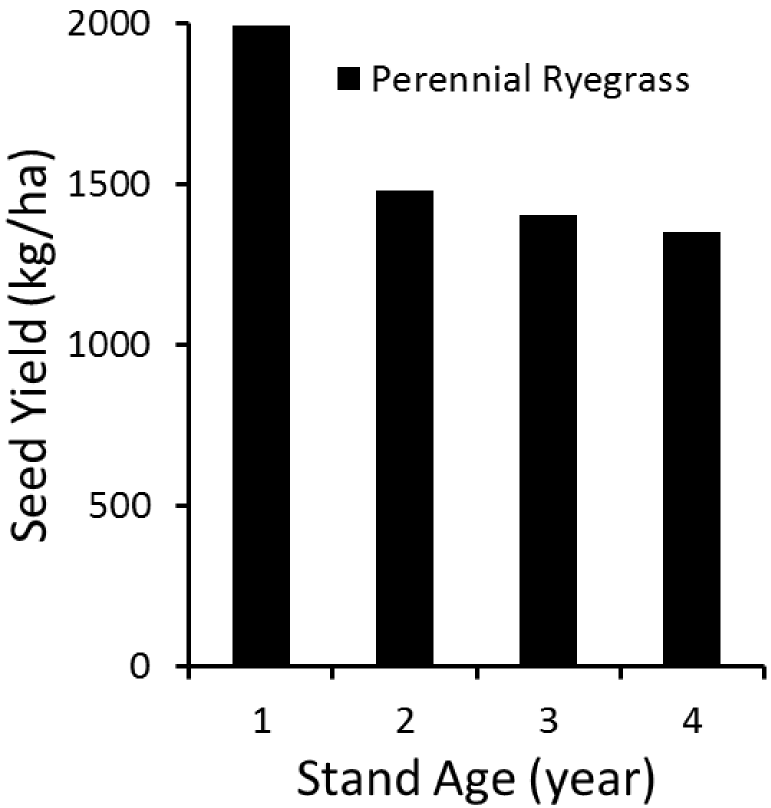
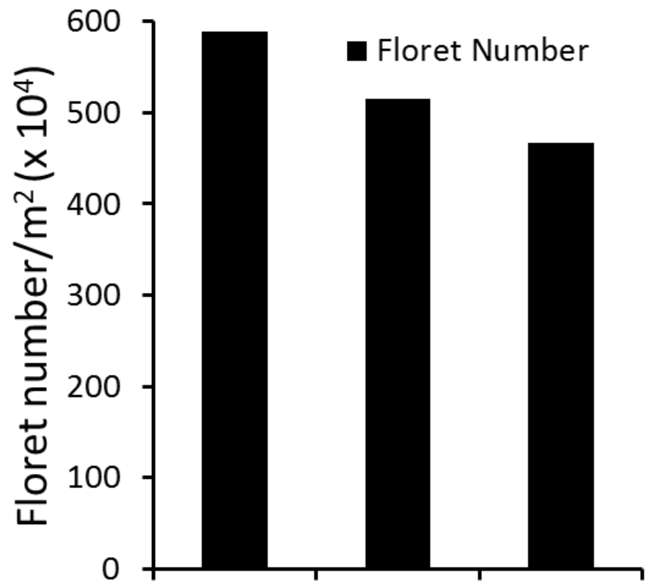
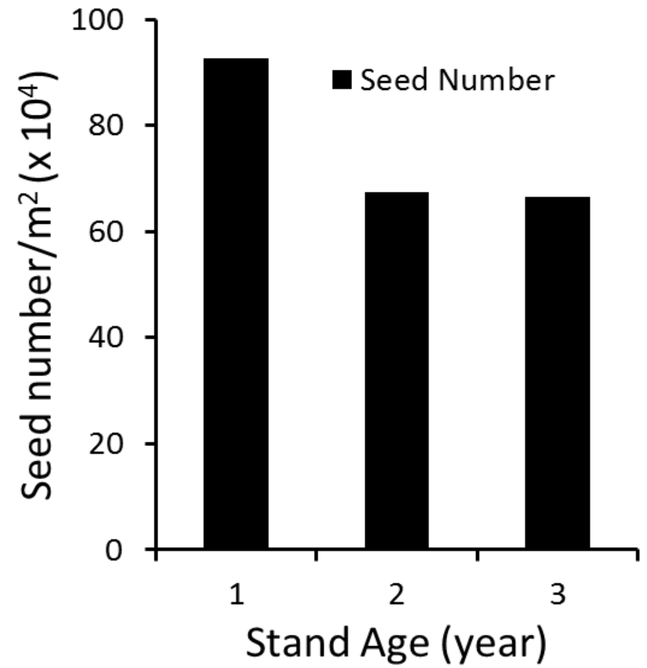
Stand Age

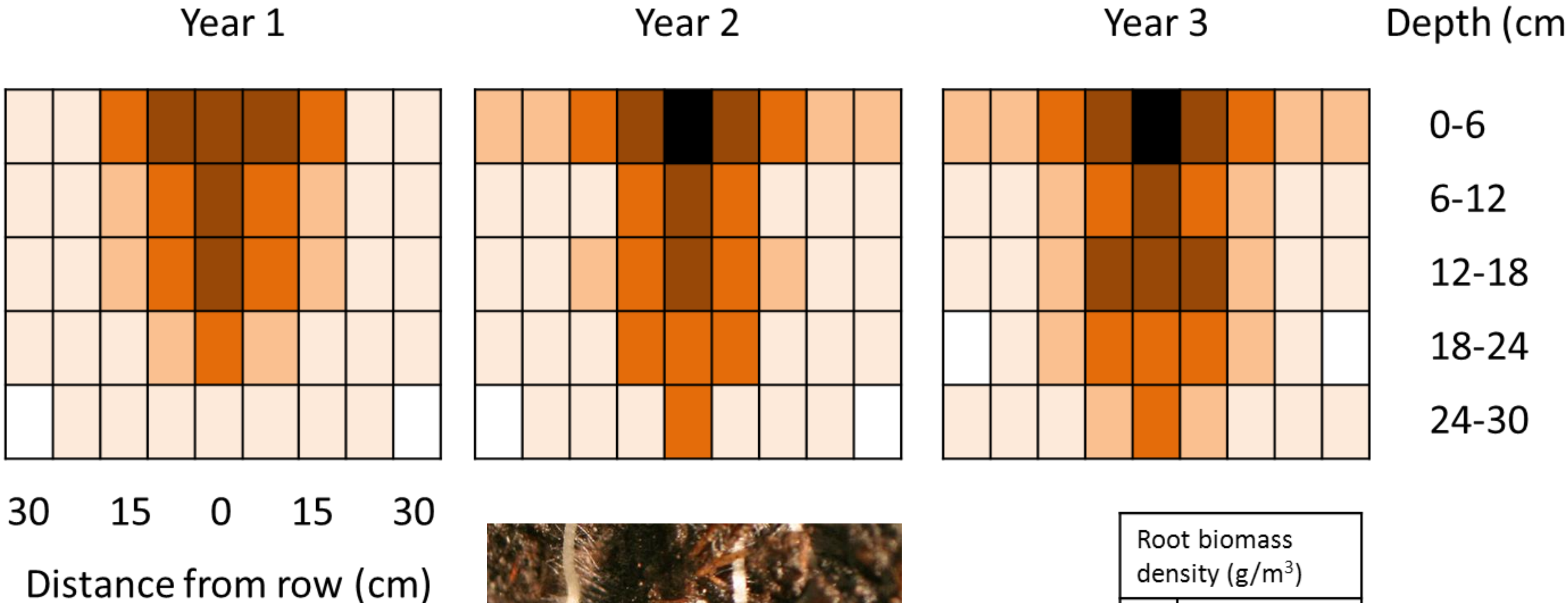
- Seed yield declines as the stand ages in grass seed crops.
- Reductions in the number of florets and seeds produced account for some of the decline in seed yield in perennial ryegrass.







Stand Age and Roots in Perennial Ryegrass



Perennial ryegrass roots
(TG Chastain photo)

Root biomass density (g/m^3)	
	0-25
	25-250
	250-500
	500-1250
	1250-5000
	5000+

The Next Big Challenge - Seed Shattering

- The loss of seed as a result of shattering can be an important constraint to yield.
- In perennial ryegrass, shattering is estimated to cause seed yield losses of 10-20% or more.
- Much work has been done to solve this problem, but to date, only harvest timing strategies using seed moisture as a guide, have shown efficacy and even with the best timing, seed shattering is still too high.

Shattered grass seed on the ground (TG Chastain photo)

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