Dryland Small Grain Hay Production: Seeding Rates, Fertility, Timing, & Fertilizer Types

Hay Days Workshop

March 1, 2019, Morgan Hill at Tilton Ranch

Nick Clark – Agronomy & Nutrient Mgmt. Farm Advisor, Fresno, Kings, & Tulare Counties

(559) 852-2788

neclark@ucdavis.edu

680 N. Campus Dr., Ste. A; Hanford, CA 93230

University of California
Agriculture and Natural Resources

Presentation Outline

- Small grain development refresher and terminology
- Planting and establishment conditions
- Fertility requirements (N, P, & K)
- Fertilizing
- Conclusion

- https://anrcatalog.ucanr.edu/pdf/8208.pdf

Electronic slides will be available soon

UC CE

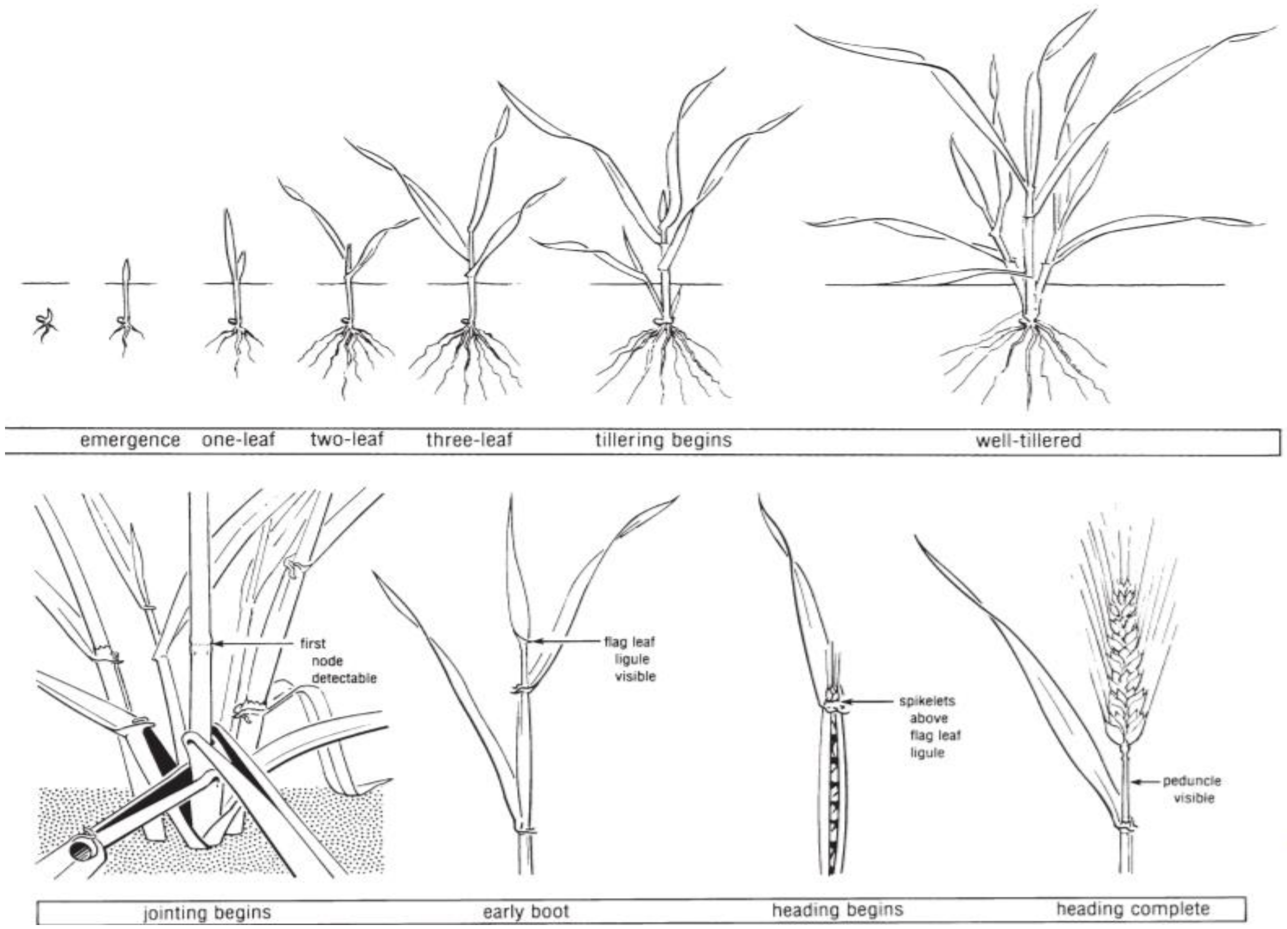
University of California
Agriculture and Natural Resources

Small Grains Development Stages

- **Planting:** Depends on moisture & heat
- **Emergence:** Coleoptile erupts soil surface
- **1st-4th leaf:** Leaves appear through whorl and unfurl
- **Tillering:** 2-4 branches initiate from stem below soil and emerge; ***head initiating***
- **Jointing (stem elongation):** Internodes lengthen; 1st node appears above soil surface; spikes forming
- **Boot:** Ligule of flag (last) leaf visible; spike swells and splits flag leaf sheath
- **Heading:** Spikes emerge from flag leaf collar
- **Flowering:** Flowers pollinated and anthers emerge
- **Grain fill:** Endosperm within seed expands and accumulates carbohydrates, mostly from flag leaf photosynthesis

Growth Stage Quantification

Growth stage	Scale		
	Zadoks	Feekes	Haun*
planting	00	—	—
emergence	10	1	0.0
first leaf	11	1	0.0–1.0
second leaf	12	1	1.1–2.0
third leaf	13	1	2.1–3.0
tillering	21–29	2–4	3.1–6.0
jointing	31	6	6.1–10.0
flag leaf	37–39	8	8.1–9.0
boot	40–47	9–10	9.1–10.0
heading	51–59	10.1–10.5	10.1–11.0
flowering	61–69	10.5.1–10.5.3	—
grain formation	71	10.5.4	—
milk	71–79	11.1	—
soft dough	85	11.2	—
hard dough	87	11.3	—
harvest ripe	92	11.4	—



UC ANR Small Grains Production Manual
Part 2, Table 1 & Figure 1

UC CE

University of California
Agriculture and Natural Resources

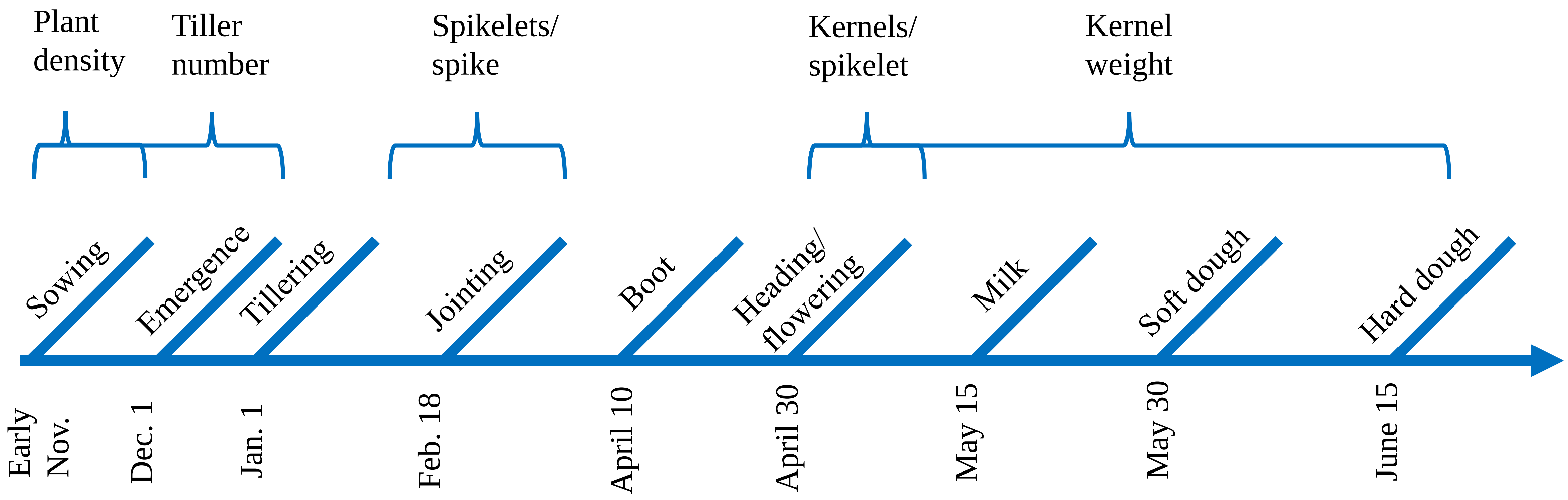
Yield Determination Factors and Their Determination

<u>The product of</u>

- Plant density, — Seed rate, germ %, emergence/survival %
- Tiller number, — Plant density, cultivar, sowing date, moisture, nutrients, temperature
- Spikes/plant,
- Spikelets/spike, — Weed competition, heat, nutrient deficiency/toxicity, drought, and disease stress @ stem elongation initiation
- Kernels/spikelet, and — Heat, nutrient deficiency/toxicity, drought, and disease stress during flowering
- Kernel weight — Heat, nutrient deficiency/toxicity, drought, and disease stress from flowering to hard dough

= Grain Yield

Central Coast Region Yield Factor Timeline*



UC ANR Small Grains Production Manual
*Part 2, Table 2 "Optimal conditions…common wheat…average weather…"

UC CE

University *of* California
Agriculture and Natural Resources

Planting

Irrigated

- 130 lbs/acre drilled
  - Barley, oats, wheat, or blends
- Pre-irrigated
- Early-late November
- 1-1.5 inches wheat
- 1-2 inches barley & oats

Dryland

- 70-90 lbs/acre drilled
  - Barley, oats, wheat, or blends
- Depending on rain
- Early-late November
- 1.5-2 inches wheat
- 1.5-2 inches barley & oats

Growing region	Wheat, triticale, and oats	Barley
Intermountain (winter grain)	mid-Oct. to early Nov.	mid-Oct. to early Nov.
Intermountain (spring grain)	early April to early May	early April to early May
Northern Sacramento Valley	early Oct. to mid-Nov.	mid-Nov to Feb. 1
Sacramento Valley, Delta, Northern San Joaquin Valley	late Oct. to Jan. 1	mid-Nov. to Feb. 1
Southern San Joaquin Valley, Southern Desert Valleys	mid-Nov. to mid-Jan.	Dec. to Feb.
Coastal, irrigated	mid-Nov. to mid-Dec.	mid-Nov. to mid-Dec.
Coastal, dryland	early Nov. to mid-Dec.	early Nov. to mid-Jan.

UC ANR Small Grains Production Manual
Part 3, Table 1

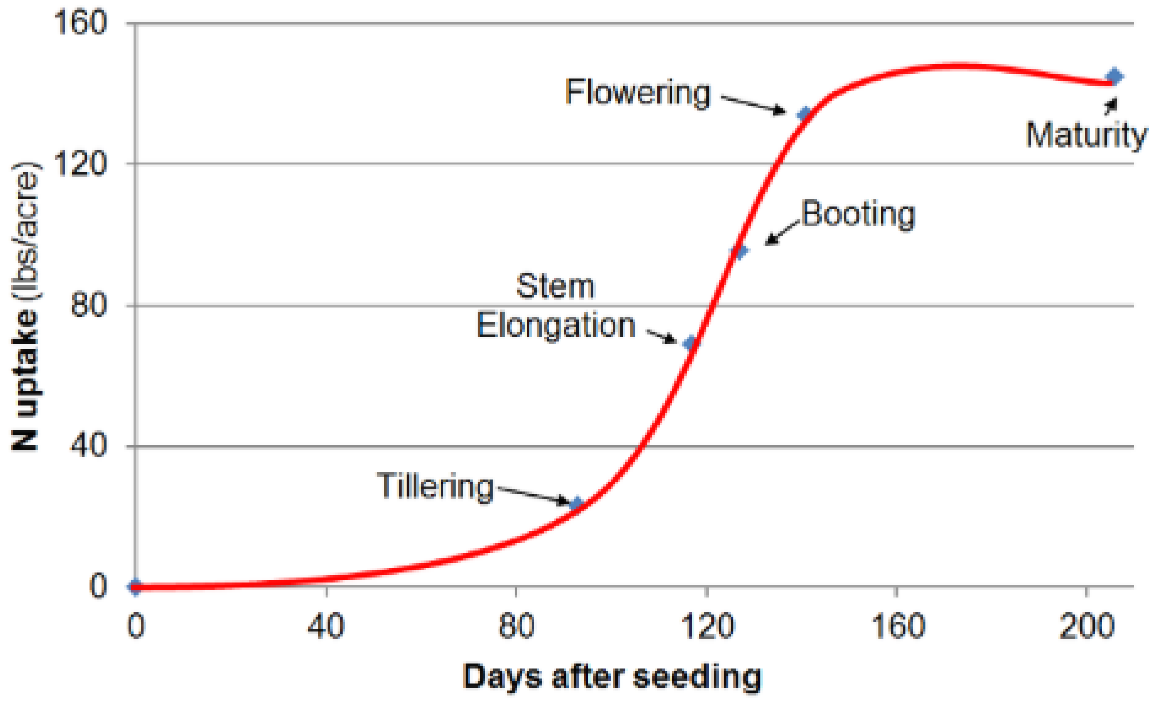
Fertilizing

- Irrigated
  - 20-25 lbs P/acre as 11-52-0 preplant
  - 100 lbs N/acre as urea preplant
  - 50-100 lbs N/acre as urea topdress splits before flowering
- Dryland
  - 20-25 lbs P/acre as 11-52-0 @ planting
  - Variable, depending on yield potential, lbs N/acre as urea preplant
  - 50 lbs N/acre as urea topdress within 5 days of rain, before flower if there's yield potential

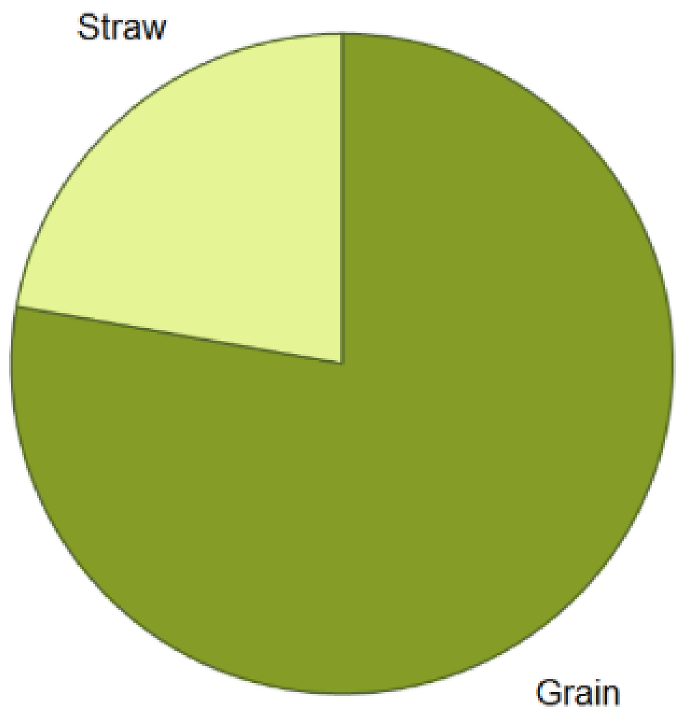
Notes about the slide

N Uptake and Partitioning

Seasonal N Uptake



Nitrogen Partitioning



CDFA FREP Fertilization Guidelines – Wheat
https://apps1.cdfa.ca.gov/fertilizerresearch/docs/Wheat.html

UCCE

University of California
Agriculture and Natural Resources

Estimating N Requirement Based on Yield Potential

Common wheat

Location	Years	Removal (lbs N/ton at 12% moisture) Mean	Range	Source
Sacramento Valley	2015	45.5	39.7 - 52.7	[3]
Delta	2015	48.3	33.9 - 43.1	
San Joaquin V.	2015	45.4	39.7 - 52.7	
Sacramento V.	2014	40.2	32.1 - 49.3	
Delta	2014	41.4	39.5 - 43.3	
San Joaquin V.	2014	40.7	33 - 45.9	
Sacramento V.	2013	42.8	38.7 - 48.6	
Delta	2013	42.9	41 - 44.8	
San Joaquin V.	2013	43.0	36.3 - 52.4	
Weighted Average		**43.0**	**32.1 - 52.7**	

Crop N Requirement Estimation

Yield (T/acre)	N in grain (lbs)	N in straw (lbs)	N above ground (lbs)
2	86	22	108
3	129	32	161
4	172	43	215
5	215	54	269

CDFA FREP Fertilization Guidelines – Wheat
https://apps1.cdfa.ca.gov/fertilizerresearch/docs/Wheat.html

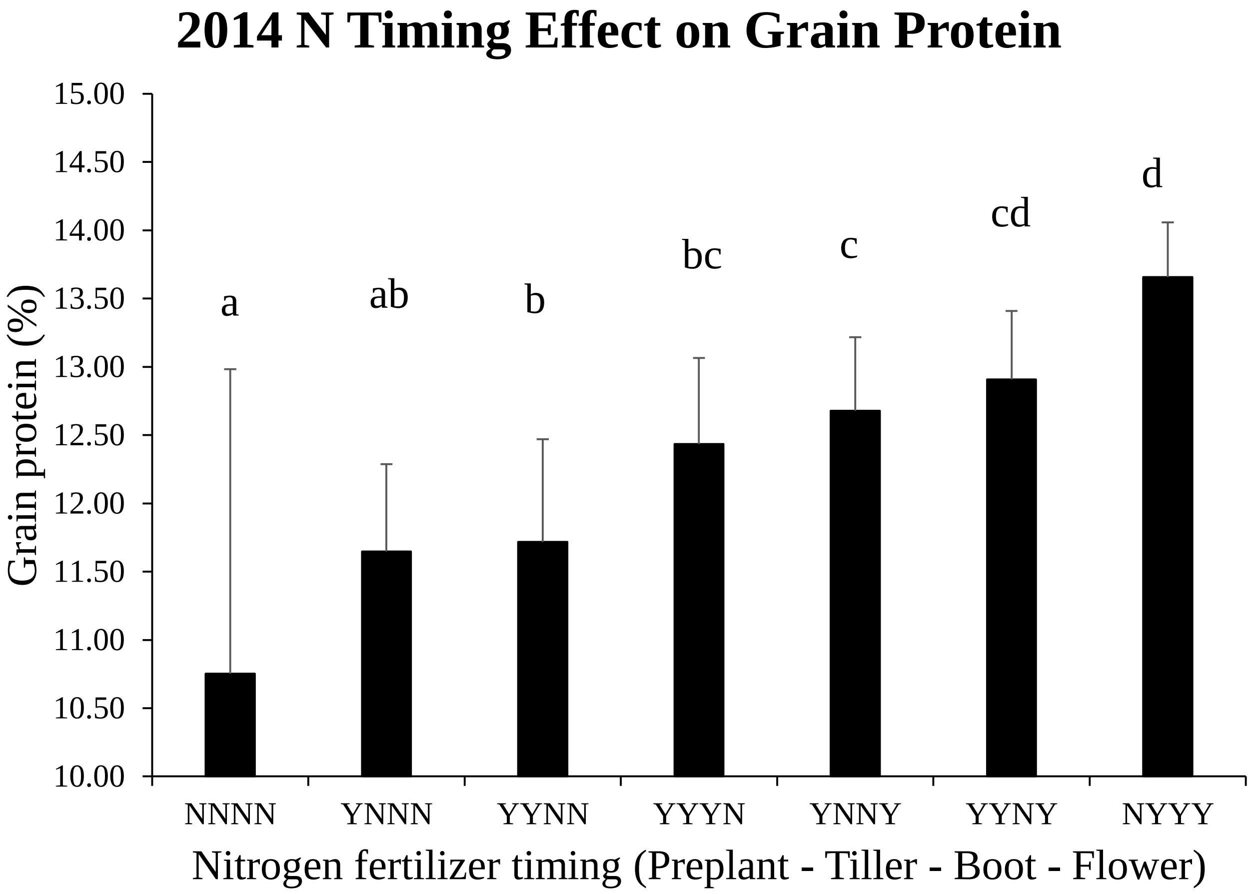
UC CE

University of California
Agriculture and Natural Resources

2014 N Timing on Grain Protein

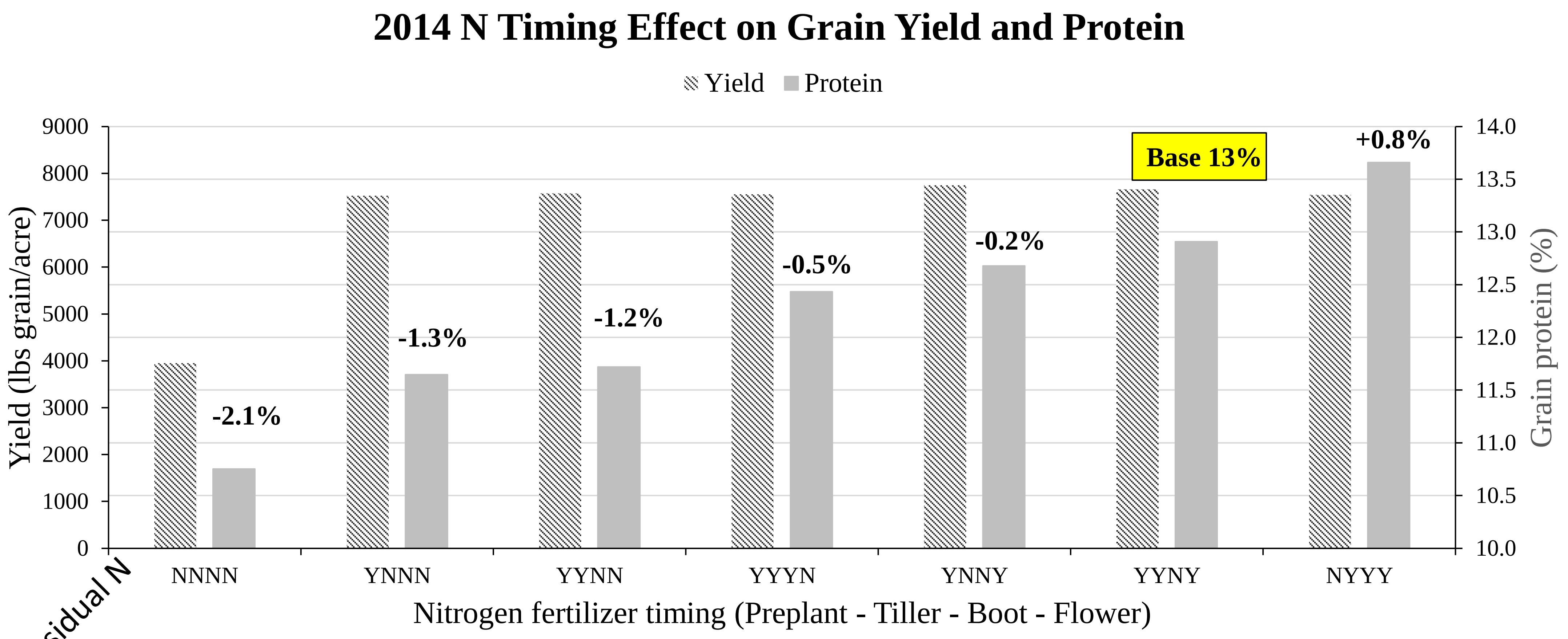
Treatment	Grain protein (%)
NNNN	10.75 a
YNNN	11.65 ab
YYNN	11.72 b
YYYN	12.43 bc
YNNY	12.68 c
YYNY	12.91 cd
NYYY	13.66 d

Values followed by the same letter are not significantly different at α = 0.05 according to Tukey's HSD



Hutmacher, Wright, Orloff, Clark, & Lundy

Interaction between Yield and Protein



40 lbs/acre residual N

Hutmacher, Wright, Orloff, Clark, & Lundy

7,600 lbs/acre avg. yield

Summary

- Understanding of small grain growth stages can be used as a means of estimating impact of management practices on yield, in particular fertilization, irrigation, and pest/disease management.
- Planting seed rate, depth, and fertility practices will depend on yield potential as well as forecasted rain/irrigation water availability.
- N fertilization rates and timing should be determined by: yield potential, desired grain protein content, or other market factors that bring a premium
- We did not find splitting applications to achieve target grain protein to be economically desirable when compared to fertilizing for yield

Thank You

Nicholas Clark – Agronomy & Nutrient Mgmt. Farm Advisor, Fresno, Kings, & Tulare Counties

(559) 852-2788

neclark@ucdavis.edu

680 N. Campus Dr., Ste. A
Hanford, CA 93230

Photo credit to the Santa Clara County Office of the Agricultural Commissioner

UC CE

University of California
Agriculture and Natural Resources