

Introduction

Grain sorghum (*Sorghum bicolor*) acres have been expanded in the semi arid regions in Oklahoma. Its natural drought tolerant nature has made it a good fit in the region over corn and soybean. The National Sorghum Growers yield contest producing yields in excess of 15 Mg ha⁻¹ has also aided in increasing acre and the interest in increasing inputs such as starter fertilizer.

Objectives

- Evaluate the impact of micronutrients application on yield.
- Evaluate the impact of specialized starter fertilizer formulations on yield.
- Demonstrating the negative consequence of poor nutrient product and rate selection on grain yield and stand.

Materials and Methods

- Studies were conducted on both producers fields and research stations.
- 2014; five locations established, four were harvested.
- 2015; four locations established, two were harvested.
- 14 treatments repeated four times, arranged in RCBD.
- Plots consisted of four rows (75 cm row spacing) 6 meters in length.
- Planted with two row John Deere Max emerge equipped with CO2 driven liquid starter system.
- Target seeding rate of 138,000 seeds ha⁻¹ (13.8 per m²)
- Nitrogen rate equalized over all treatments to reach regional yield goal
- Stand data collected after emergence.
- Center two rows harvest with plot combine

Table 1. Pre-plant soil sample results from each location.

Location	Depth cm	pH	BI	NO3	M3 P	K	SO4	Ca	Mg	Fe	Zn	B	Cu
ppm													
Billings	0-15	5.3	6.6	5	29	193	7	968	244	53	0.723	0.314	1.190
	15-45	6.1	6.9	6	13	317	9	3615	945	21	0.315	0.337	0.867
RedRock	0-15	5.8	6.7	6	10	139	7	1915	373	54	0.726	0.376	1.154
	15-45	6.5	6	2	319	13	5739	1309	24	0.300	0.500	1.100	
Enid	0-15	7.8	9	16	192	na	na	na	na	na	na	na	na
Irrigated 14	0-15	7.3	35	12	527	na	na	na	na	na	na	na	na
Irrigated 15	0-15	7	16	11	182	7	6999	156	9	3.559	0.638	0.393	
	15-30	7.8	13	17	507	10	2597	947	16	0.469	1.738	1.485	
Dryland 15	0-15	7.8	3	9	419	na	na	na	na	na	na	na	na

Table 2. Treatment Structure, products, and rates applied.

TRT	Product	Rate L ha ⁻¹	Product	Rate L ha ⁻¹	Total Amount applied in-furrow (Kg ha ⁻¹)					
					N	P2O5	K2O	S	Fe	Zn
1					0	0	0	0	0	0
2	10-34-0	23			3.25	11.1	0	0	0	0
3	10-34-0	47			6.5	22.2	0	0	0	0
4	10-34-0	94			13	44.4	0	0	0	0
5	10-34-0	187			26	88.8	0	0	0	0
6	Ultra-Fe ⁵	23			0.63	0	0	0	14.2	0
7	10-34-0	23	Thio-Sul*		4.75	11.1	0	3.2	0	0
8	10-34-0	23	K-Leaf [†]	9.4	3.25	11.1	3.7	0	0	0
9	10-34-0	23	MicroBolt Zn [‡]	23.4	3.25	11.1	0	0	0	2.5
10	18-46-0				10	25	0	0	0	0
11	9-18-9-1 [§]	23			2.78	5.55	2.78	0.309	0	0
12	9-24-3-1 ^{**}	23			2.8	7.46	0.932	0	0.311	0
13	APP Dribble	47			6.5	22.2	0	0	0	0
14	10-34-0	23	Accomplish ^{§§}	4.7	3.25	11.1	0	0	0	0

[†] Agri-Solutions-Winfield Solutions (St. Paul, MN)
^{*} Tersenderlo-Kerley (Phoenix, AZ)
[‡] HNC-Helena (Collinsville, TN)
[§] Nachurs (Marion, OH)
^{**} Agro-Culture (St. Johns, MI) Pro-Germ
^{§§} Loveland (Greeley, CO) Microorganisms <1%. Bacillus Licheniformis, Bacillus megaterium, Bacillus Pumilus

Results



Figure 1. John Deere Planter with liquid starter setup.

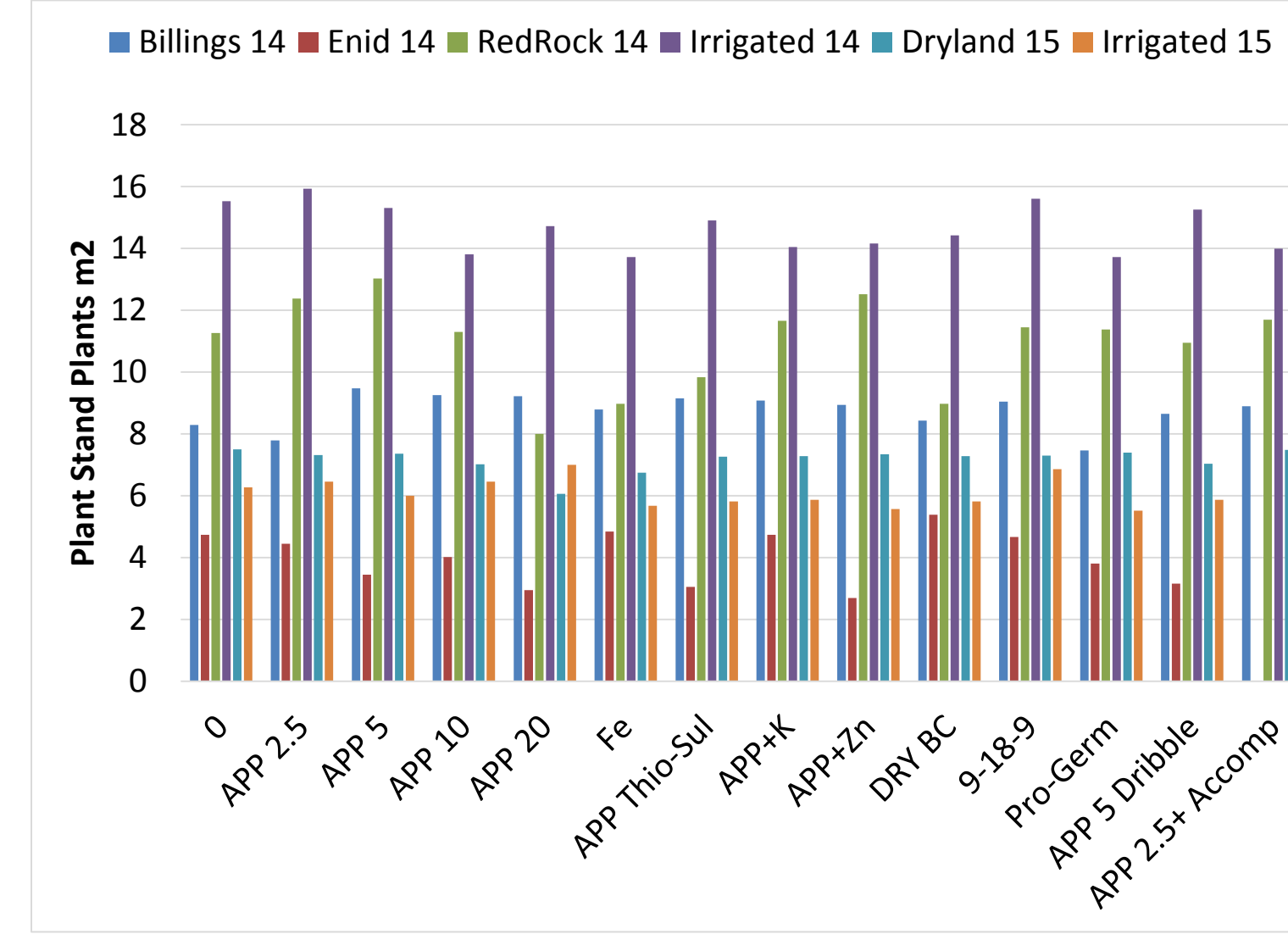
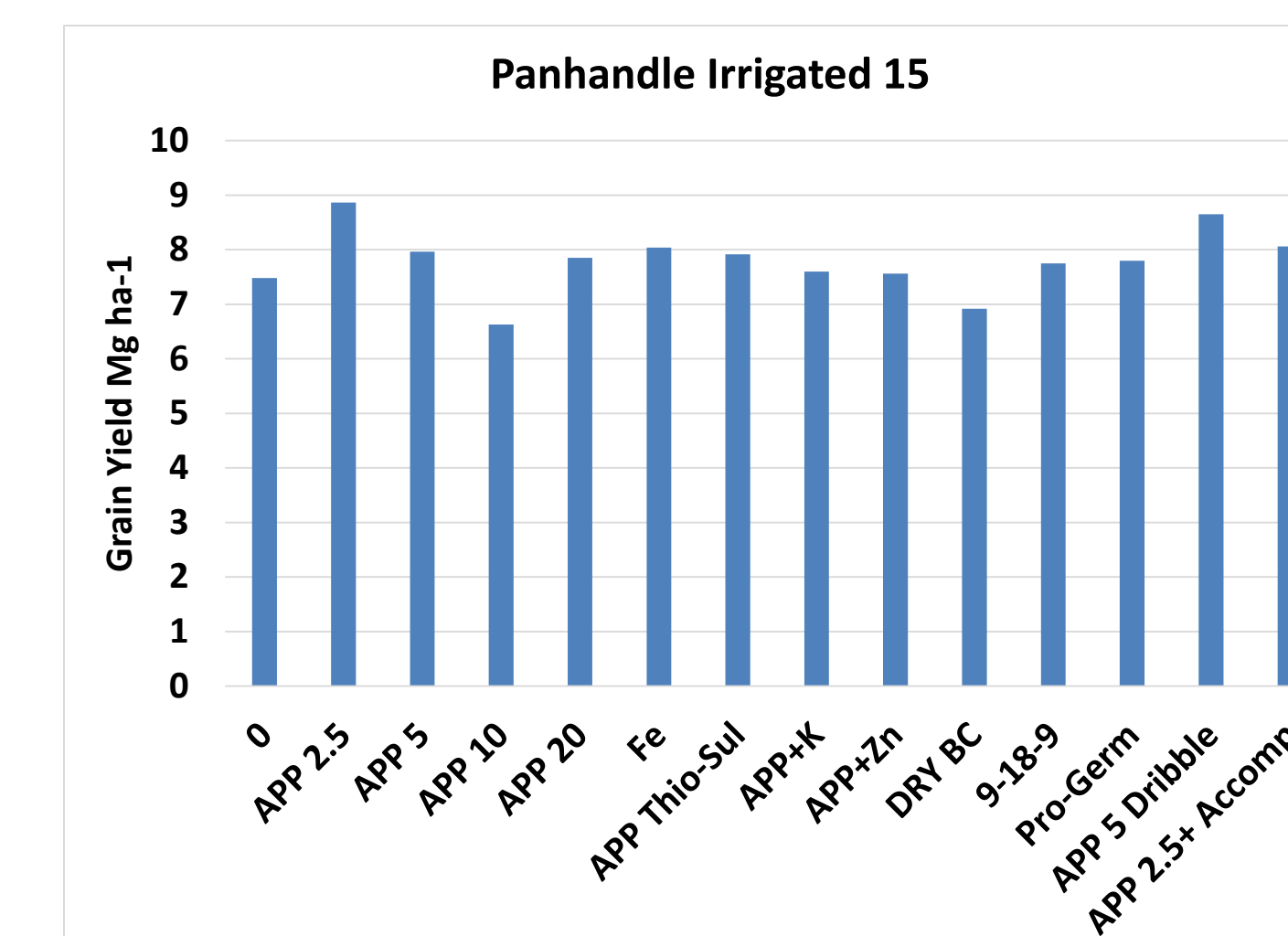
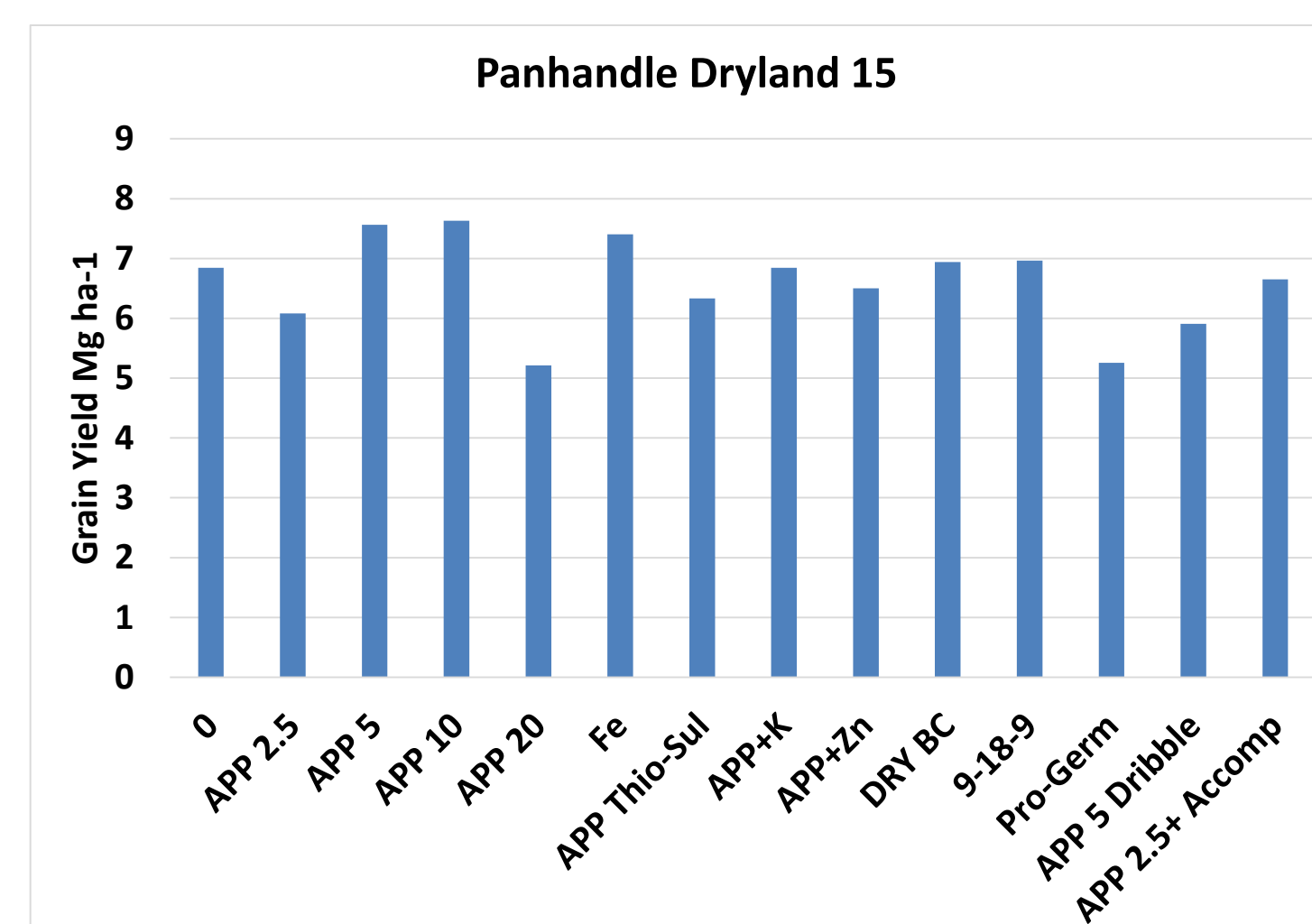
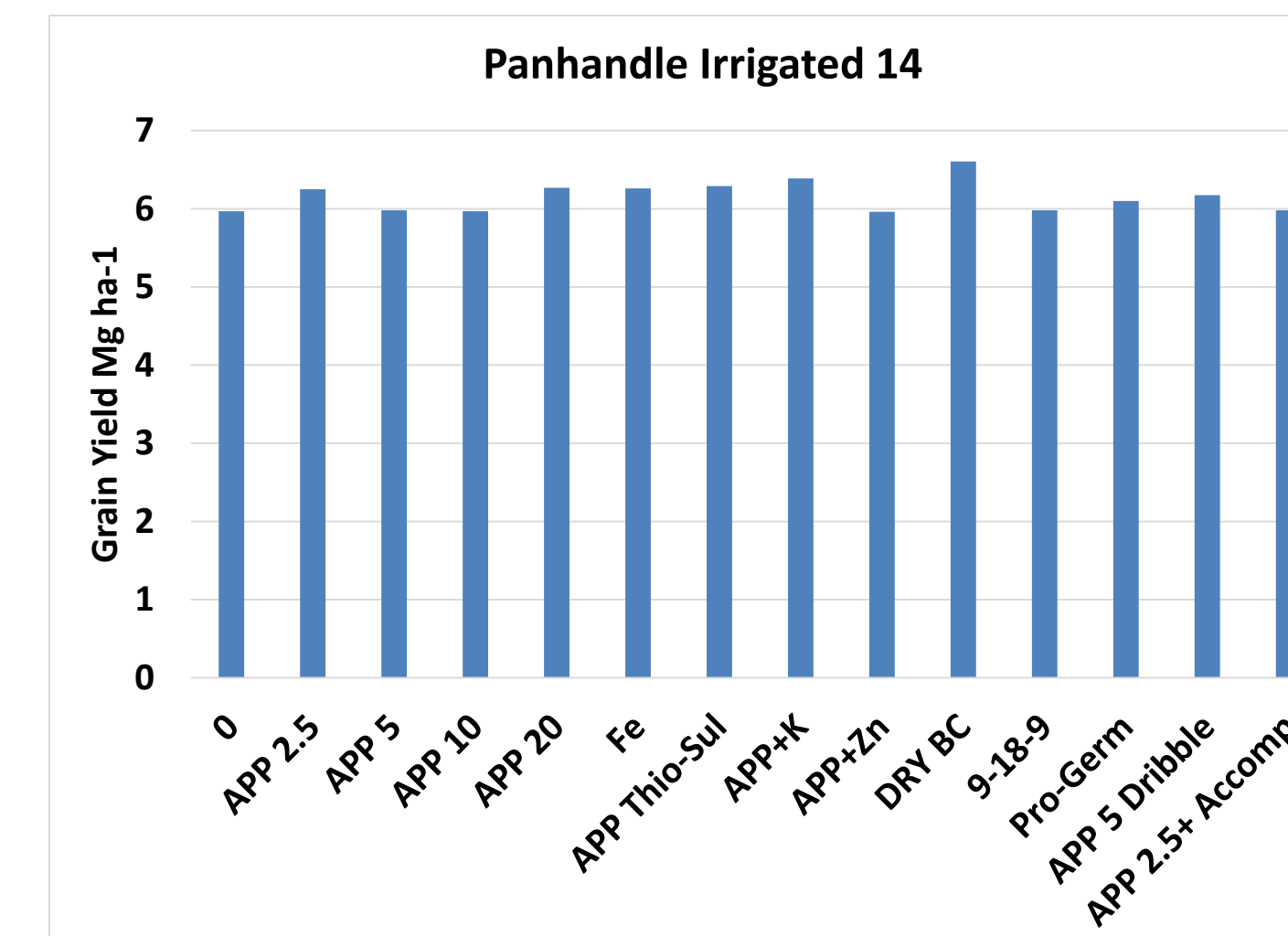
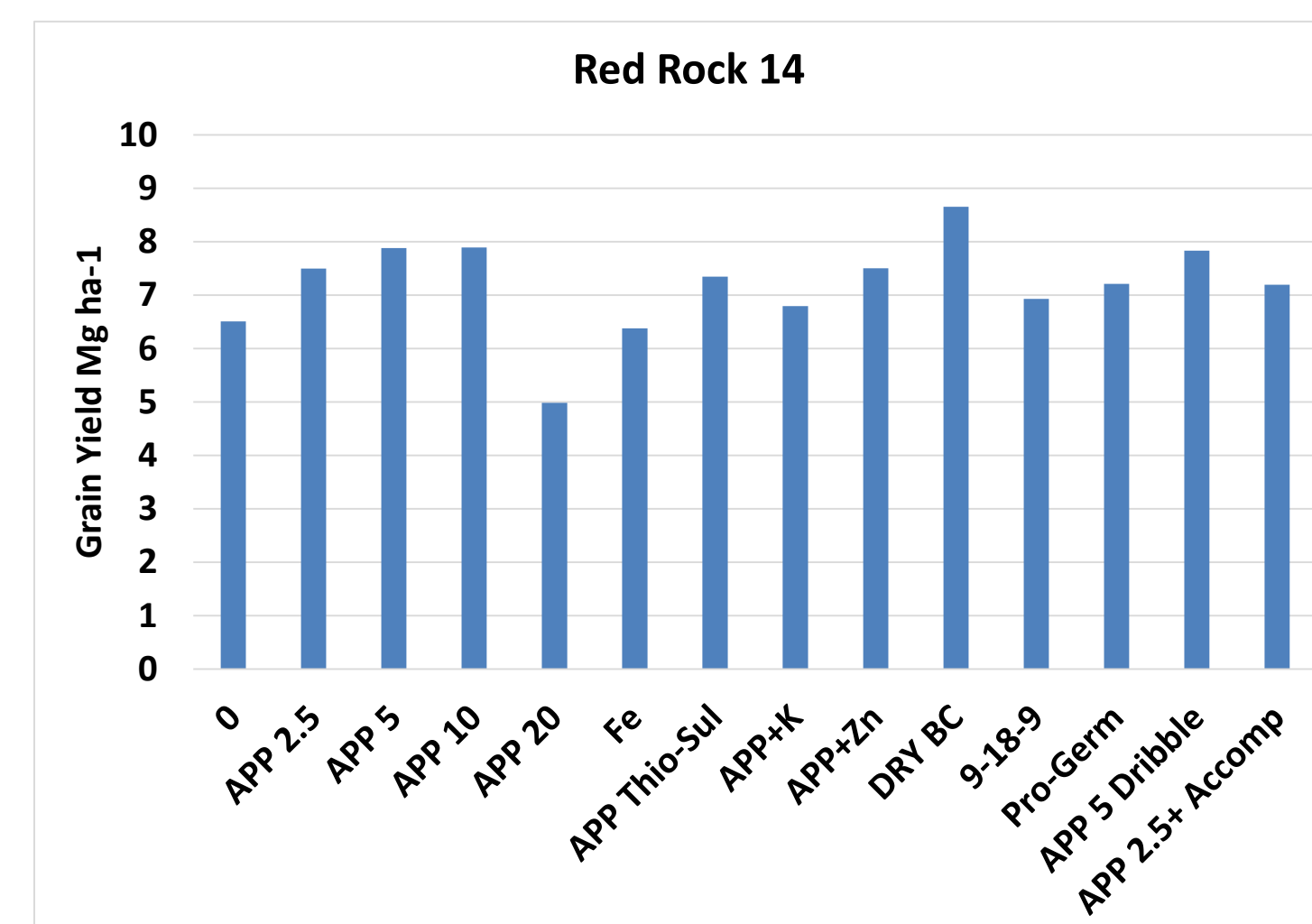
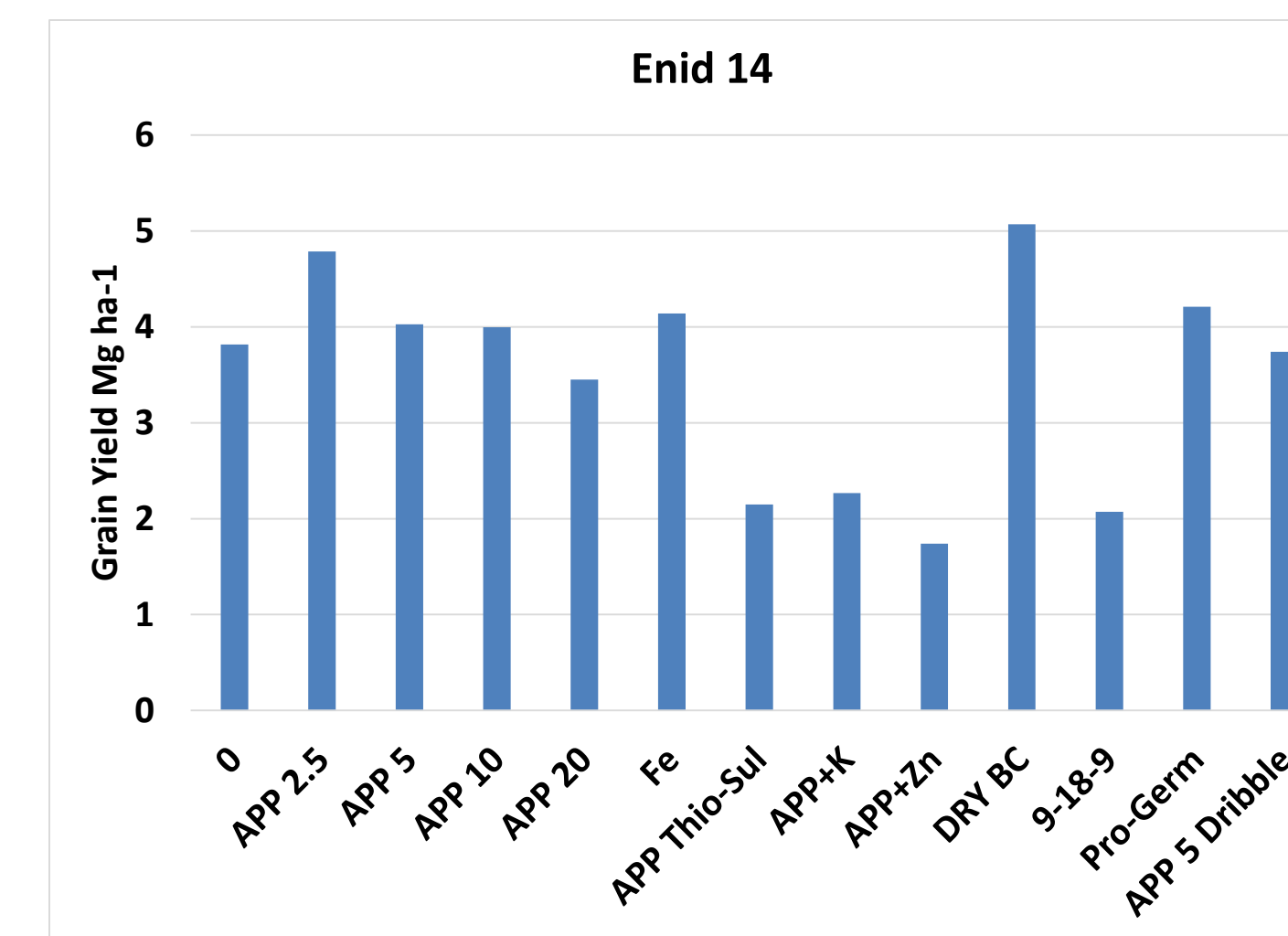
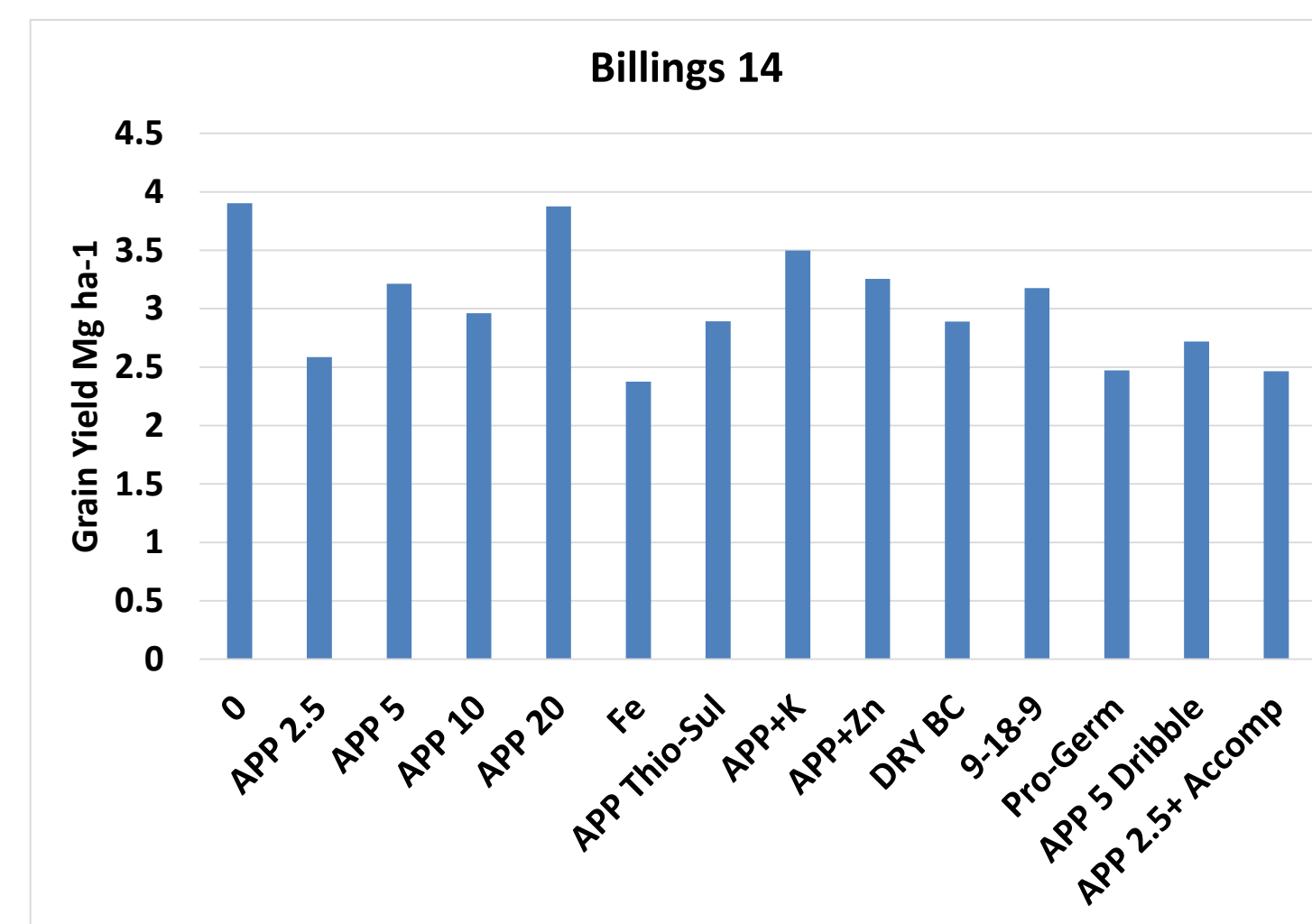


Figure 2. Stand counts from all locations (Plant m²). Target population of 13.8.



Figures 3-8 above, show the grain yield from each location (Mg ha⁻¹). ANOVA analysis showed no significant treatment difference at any site year (Alpha = 0.05).



Discussion

- At only one location, Panhandle Dryland 15, ANOVA analysis (Alpha = 0.05) documented significant treatment impact on stand (APP 10, APP 20, Fe, APP Dribble Band).
- LSD T-Test did find significant stand differences
 Enid 14: Broadcast > APP20, APP+ThioSul
 RedRock 14: APP2.5, APP5, APP+ThioSul, APP+Zn > APP20 and Fe
 Irrigated 14: APP2.5 > APP10, Fe, APP+K, ProGerm, APP+Accomp
- Negative impact on stand by trts APP20 and APP+Thiosul not always documented as expected.
- ANOVA did not find significant treatment impact on yield at any site year.
- LSD T-Test did find significant stand differences
 Billings 14: Check, APP20 > APP2.5, Fe, ProGerm, APP+Accomp
 Enid 14: Broadcast > APP+ThioSul, APP+K, APP+Zn
 Fe, APP2.5 > APP+ThioSul, APP+K
 RedRock 14: Broadcast > APP20
 Irrigated 14: Broadcast > trts 1,3,4,9,11,12,13,14
 APP+K > Check, APP20, APP+Zn
 Dryland 15: APP10 > APP20, ProGerm, APP Dribble
 APP5, Fe, Broadcast, 9-18-9 > APP20, ProGerm
 Irrigated 15: NS



Conclusions

- OSU's traditional recommendation of APP5, 10-34-0 at 47 L ha⁻¹, with addition of other nutrients based upon soil test shown to be valid. In no location was APP5 significantly less than other treatments.
- The dryland, nor-irrigated, production of sorghum in this semi-arid environment does not seem conducive to additional input cost of specialty starter formulations.
- If producers do not have starter capabilities the broadcast application of a fertilizer showed to be just as effective. In some circumstances out preforming in-furrow applications.

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