PHOSPHORUS APPLICATIONS FOR SOYBEAN PRODUCTION IN MISSOURI

2023 FRST FIELD TRIAL UPDATE

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FERTILIZER RECOMMENDATION SUPPORT TOOL

INTRODUCTION

- **Phosphorus is an important macronutrient for plant growth and development.**

- **Cereal crops have only 16% P fertilizer use efficiency globally as Dhillon et al. (2017) estimated.**

- **Using the right source, rate, placement, and timing (4Rs) is critical for managing P losses from row crops.**

- **The University of Missouri soil test program has a recommended P soil test target level of 45 lb Bray-1 P/acre for optimum row crops and small grains (Brown et al., 2004).**
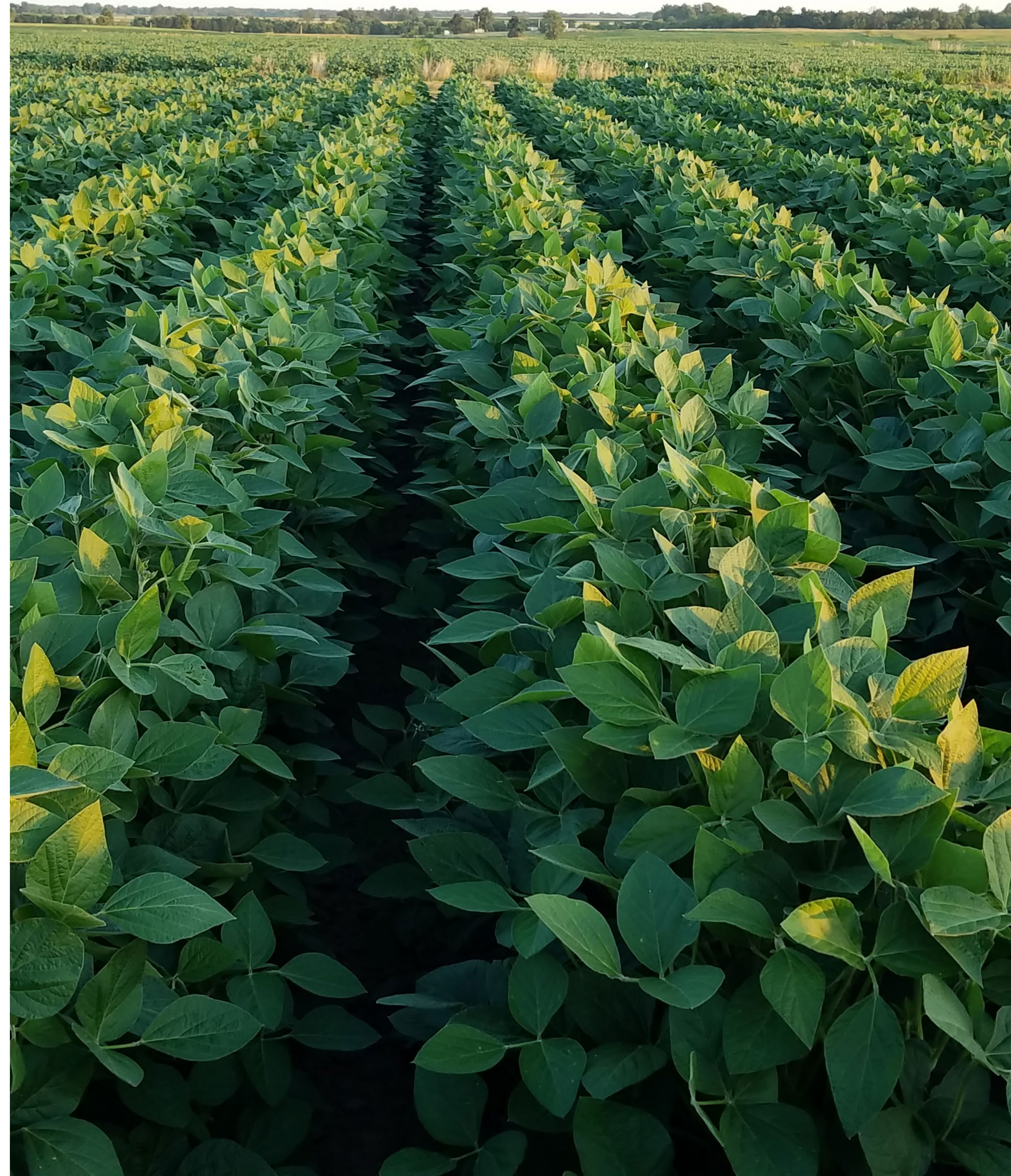
Lbs. P_2O_5/acre = Buildup P_2O_5 + Maintenance P_2O_5

Maintenance P_2O_5 = (Yield goal) x (P_2O_5 removal/unit yield)

Buildup P_2O_5 = 110 x ($STP_d 0.5$ - $STP_o 0.5$)/Years

INTRODUCTION

- **Northern Missouri contributes over 60% of soybean production.**

- **Objective: To evaluate the impact of phosphorus application rates on soybean growth, yield, quality, and P uptake.**

MATERIALS AND METHODS

- **Year: 2023**

- **2 locations:**
  - ✓ **Ross Jones Farm near Bethel, MO (Shelby County)**
  - ✓ **Growers Farm, Millard, MO (Adair County)**

- **RCBD with 4 replications**

- **Treatments: 0, 56, 112, 168, 224 kg P$_2$O$_5$ ha^{-1}**

- **Fertilizer source: TSP (46% P$_2$O$_5$)**

- **Application timing: After seeding before emergence**

- **Application Method: Broadcast**

- **Plot size: 3 m X 12 m**
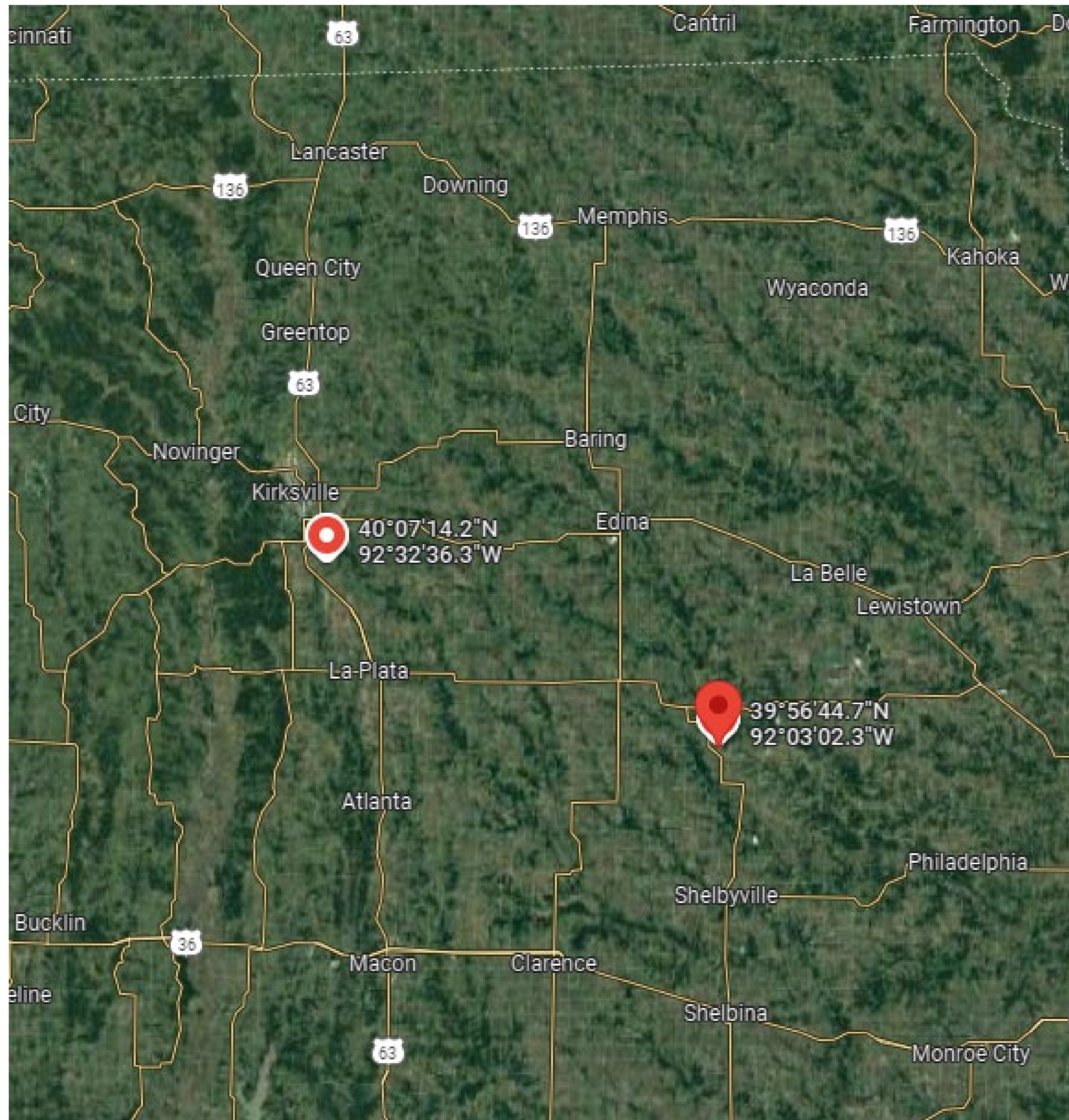
MATERIALS AND METHODS

- Soils:
  - ✓ Bethel, MO: Putnam silt loam
  - ✓ Millard, MO: Armstrong loam
- Tillage: No-till
- Row spacing: 38 cm
- Soybean variety & planting date
  - ✓ Bethel, MO: GH3922E (28 April)
  - ✓ Millard, MO: AG38XF1 (18 April)
- Plant Population: 444,789 seeds ha^{-1}
- Previous crop: Corn
- No irrigation
- No artificial drainage
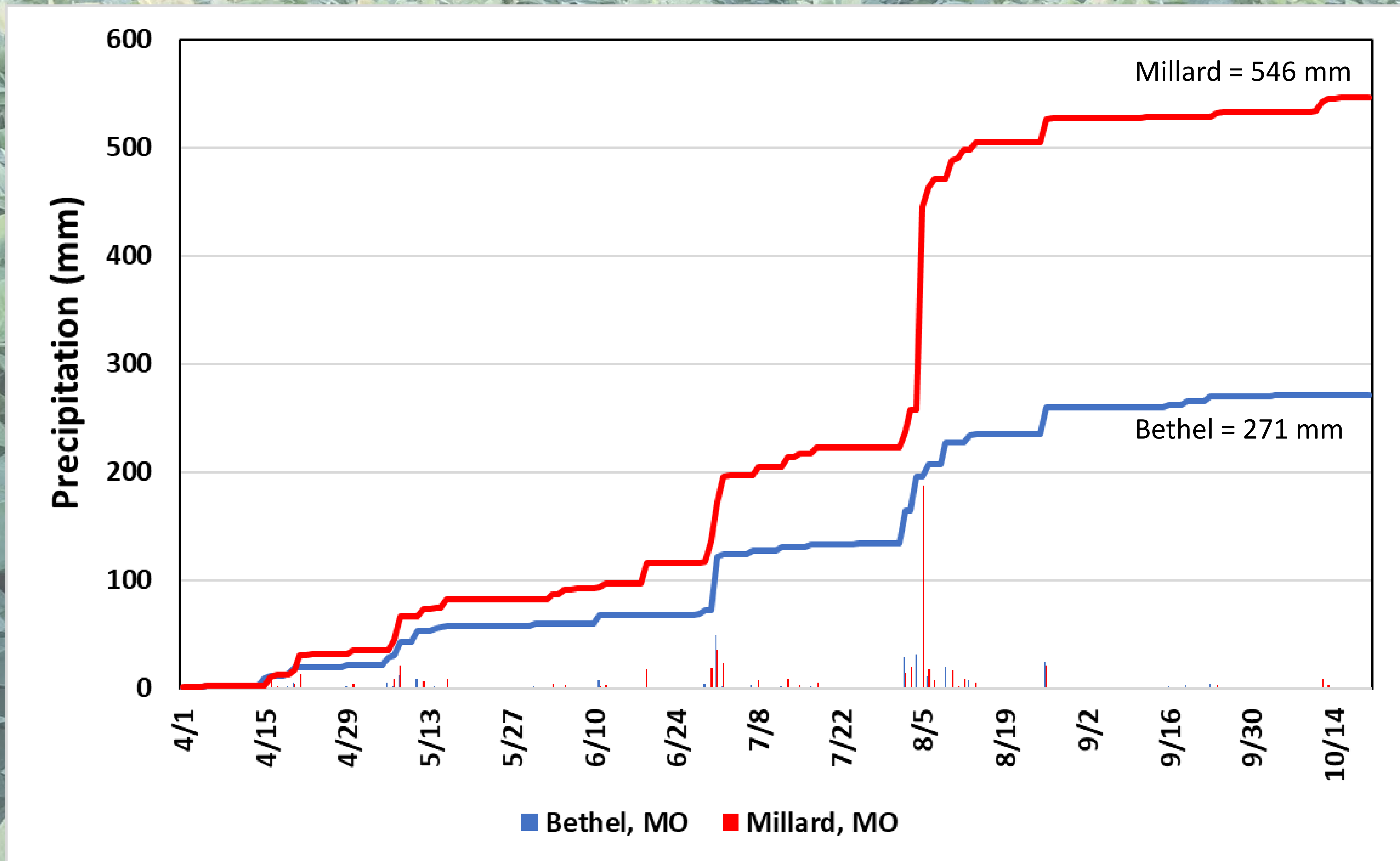
MATERIALS AND METHODS

- **Data Collection:**
  - ✓ **Weather conditions**
  - ✓ **Soil samples**
    - ▪ **Pre-plant & post-harvest**
    - ▪ **2 depths (0-15 & 15-30 cm)**
  - ✓ **Soybean yield**
  - ✓ **Grain P concentration**
  - ✓ **Grain oil and protein concentration**

Statistical Analysis:

- ✓ **Glimmix procedure, SAS software**
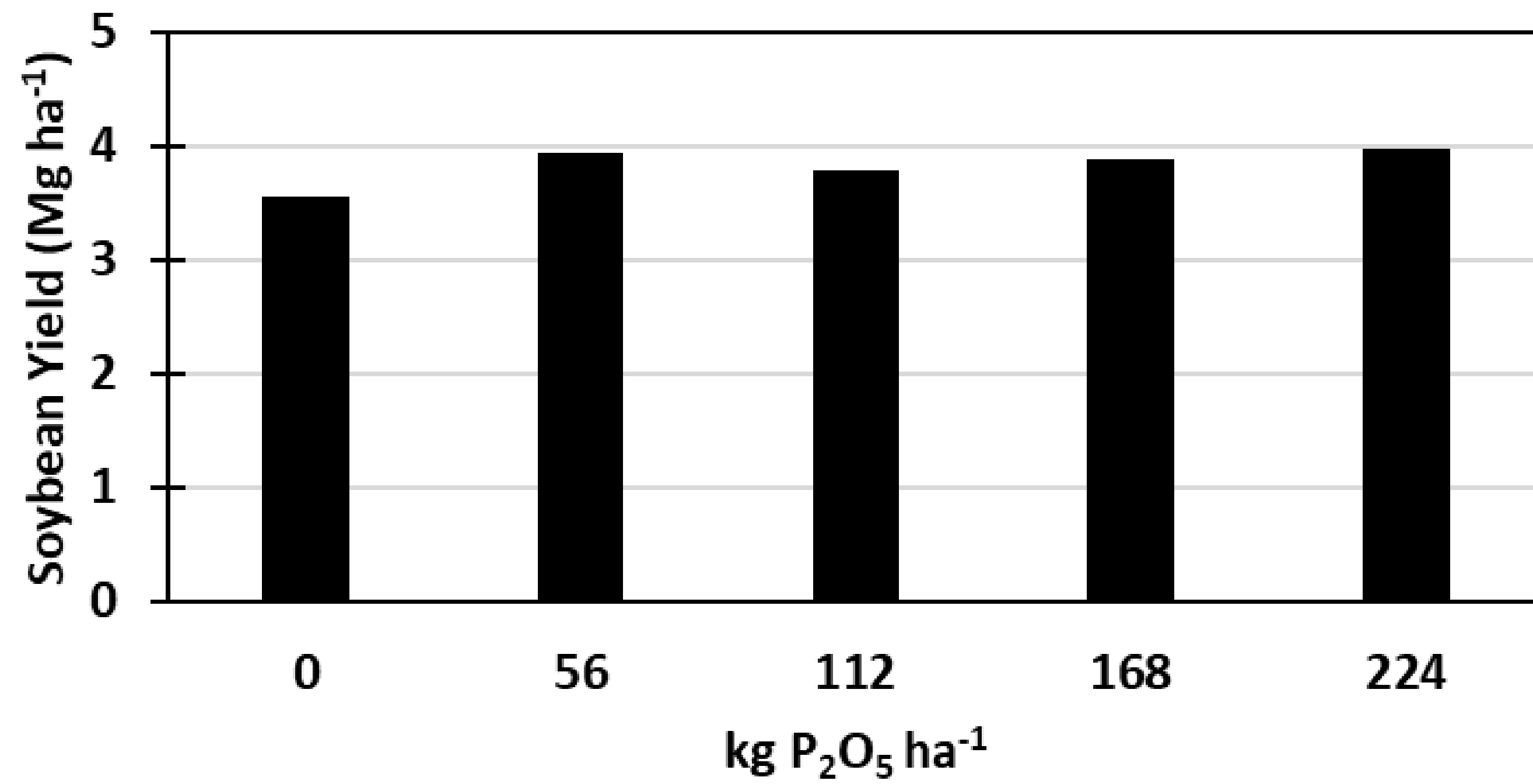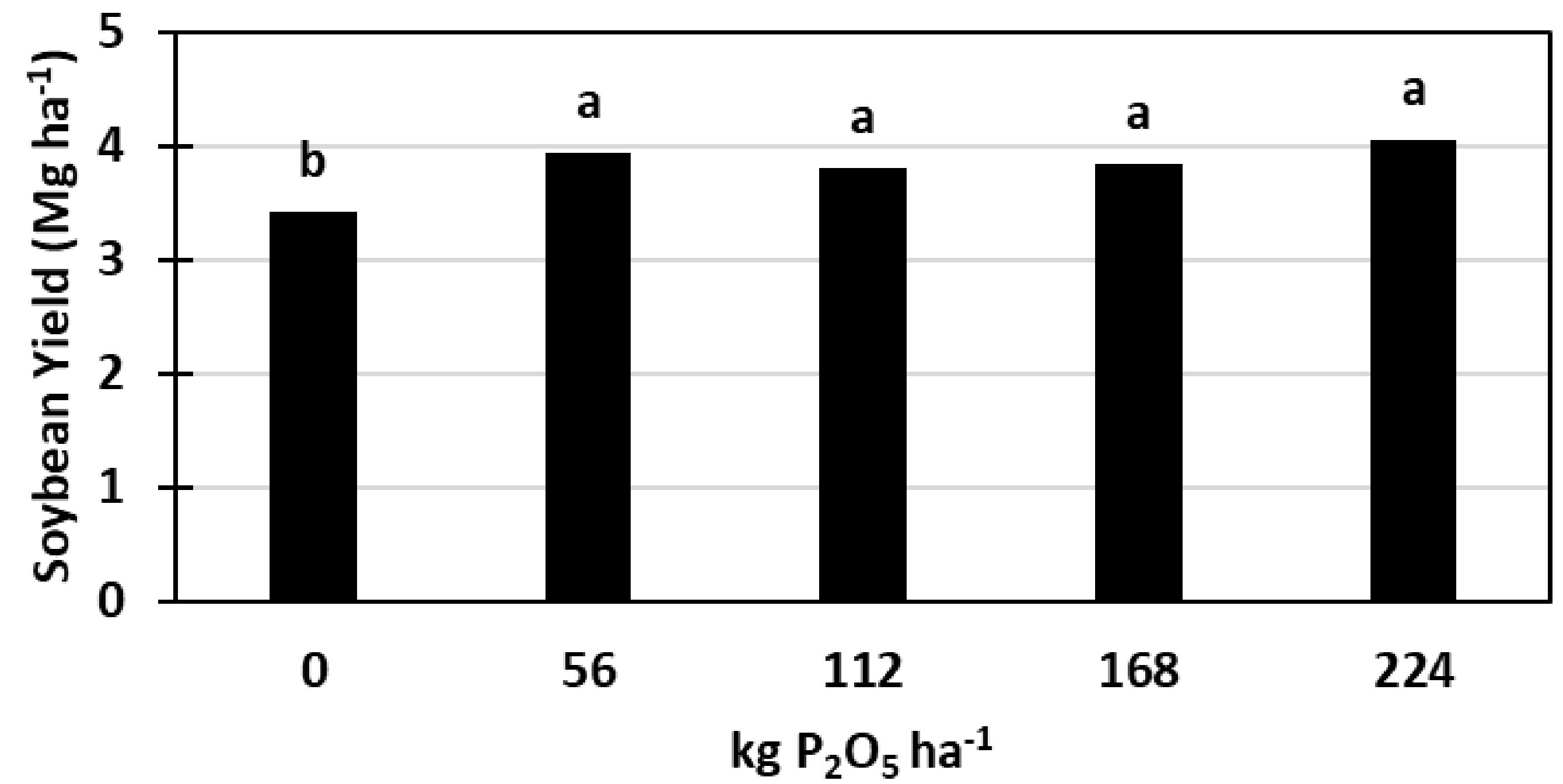
RESULTS

RESULTS

➤ Pre-plant Soil Samples	Bethel, MO		Millard, MO	
Soil properties	Soil Depth (cm)			
	0-15	15-30	0-15	15-30
pHs	6.0	5.9	6.0	5.6
OM (%)	2.6	1.9	2.3	1.7
Bray I P (lbs acre^{-1})	15.4	6.8	32.8	12.05
Mehlich III P (mg kg^{-1})	8.7	5.2	19.0	9.4
Bray I P (mg kg^{-1})	7.70	3.38	16.40	6.03
Ca (mg kg^{-1})	1989	2055	2386	2188
Mg (mg kg^{-1})	178	247	223	282
K (mg kg^{-1})	86	83	104	85
Zn (mg kg^{-1})	0.5	0.2	0.9	0.3

RESULTS

RESULTS

Bethel, MO

Grain P (g kg^{-1}) vs kg P$_2$O$_5$ ha^{-1}

kg P$_2$O$_5$ ha^{-1}	Grain P	Group
0	~5.3	d
56	~5.5	c
112	~5.8	b
168	~5.9	ab
224	~6.0	a

Millard, MO

Grain P (g kg^{-1}) vs kg P$_2$O$_5$ ha^{-1}

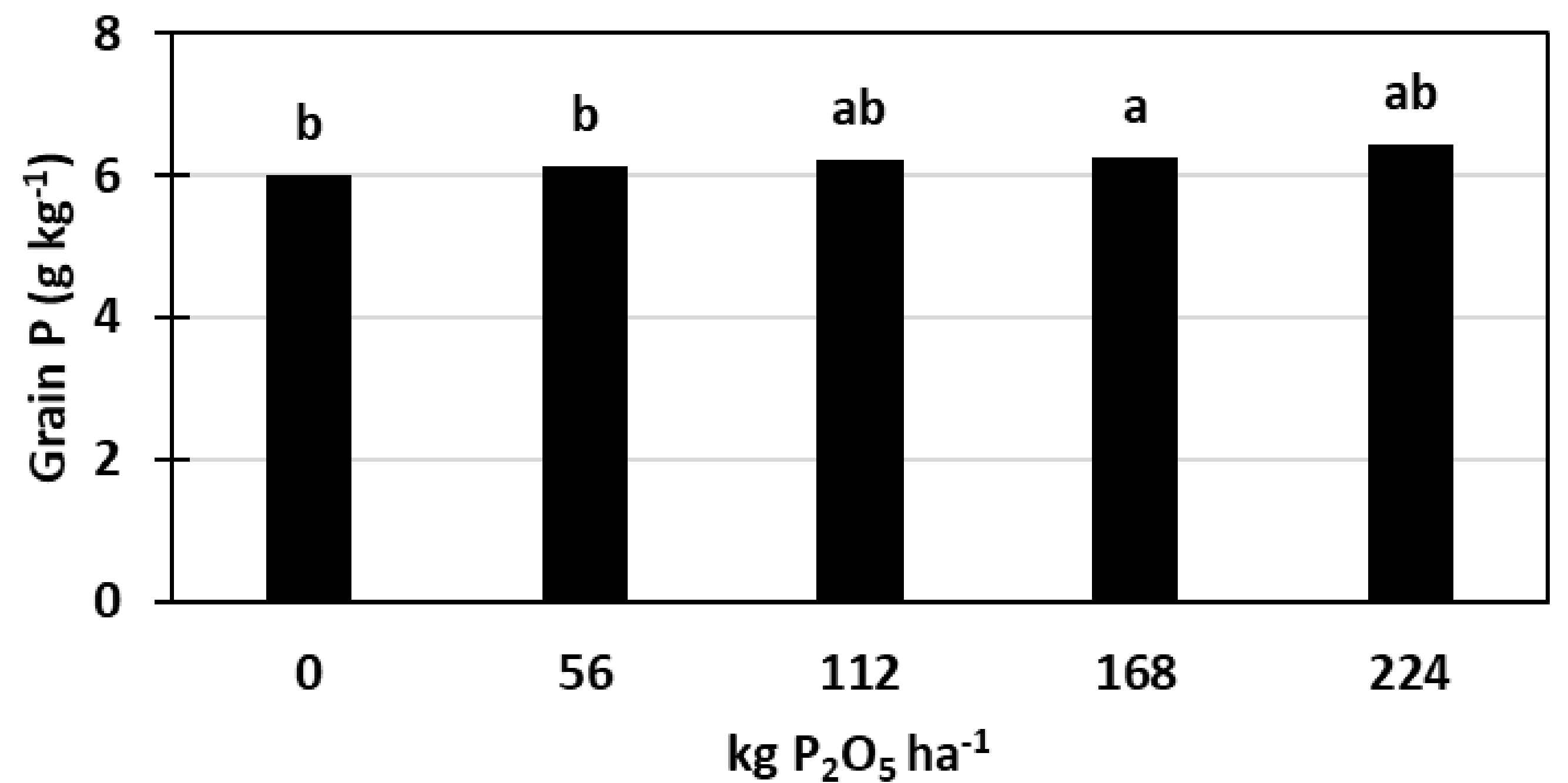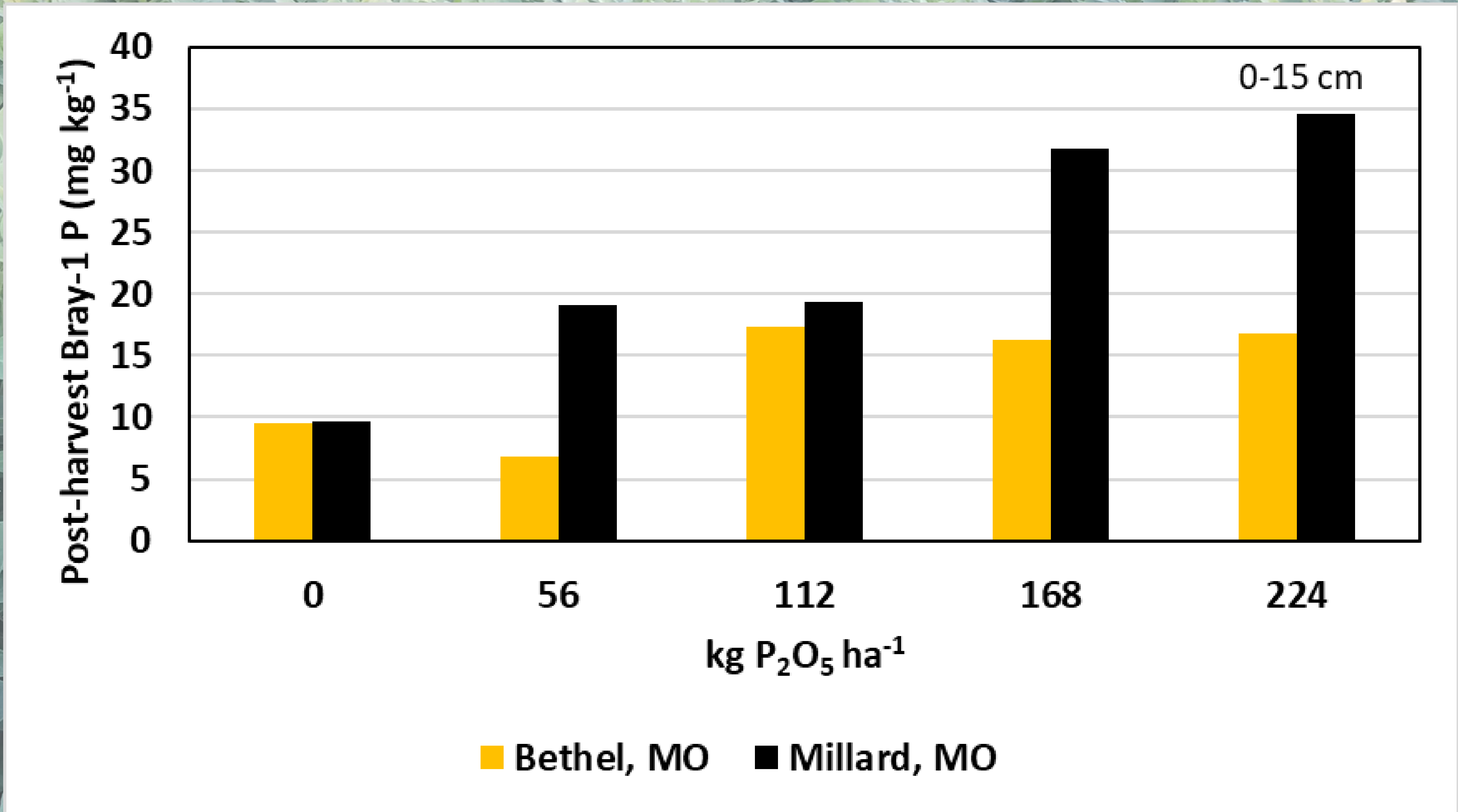| kg P$_2$O$_5$ ha^{-1}	Grain P	Group
0	~6.0	b
56	~6.1	b
112	~6.2	ab
168	~6.2	a
224	~6.4	ab
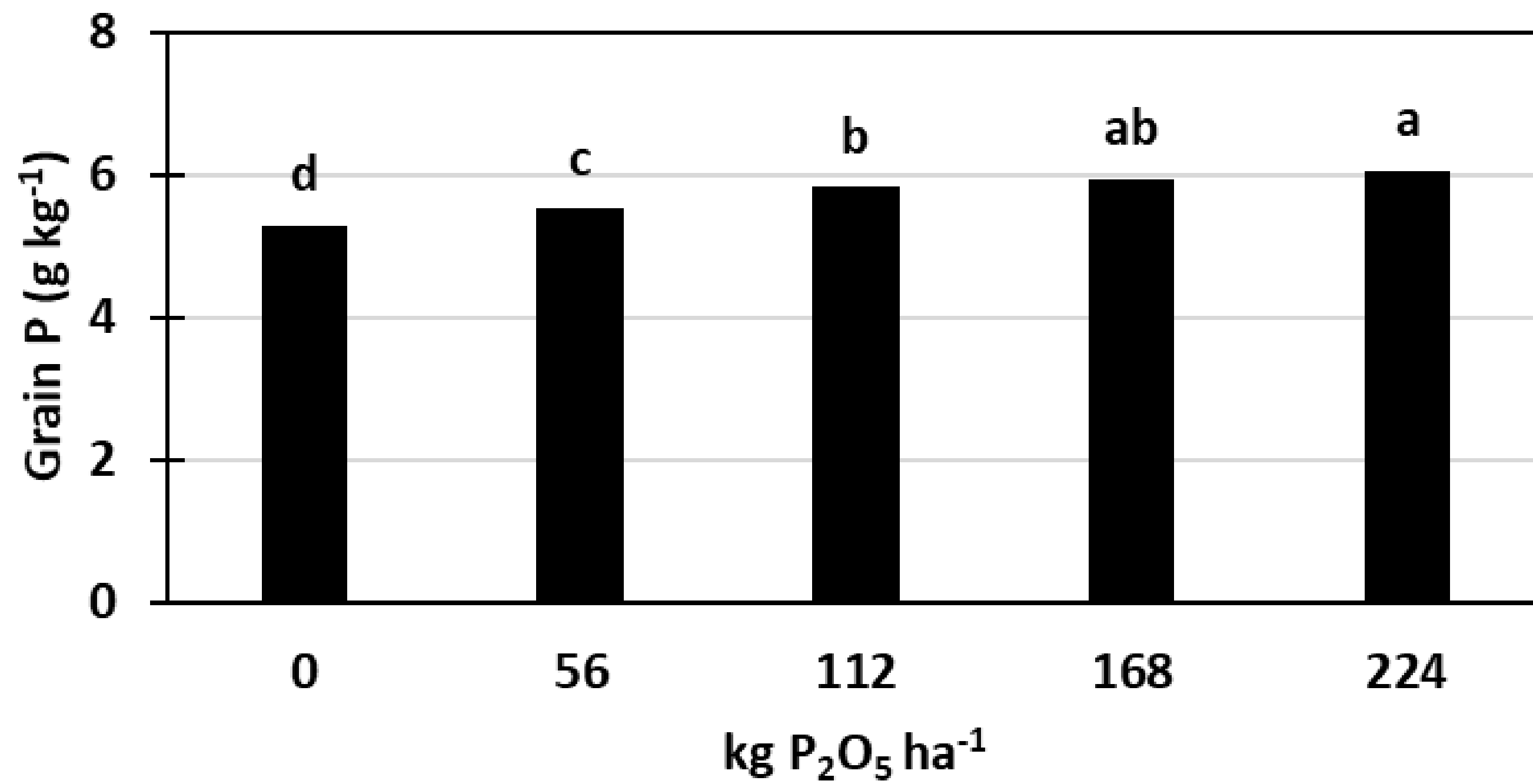
➢ **No impact on soybean grain oil and protein content**

RESULTS

CONCLUSIONS

- Soybean responded to P applications at only one site.

- Study is repeated in 2024.

- P application needs further evaluation (more site years) to update recommendations.

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Thank you

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