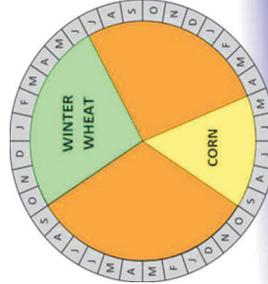
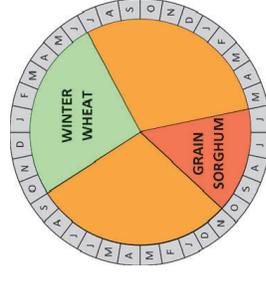


# Using Plant Available Water and Yield Environment to Adjust Nitrogen Rates

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Kansas State University

# Plant available water in drylands

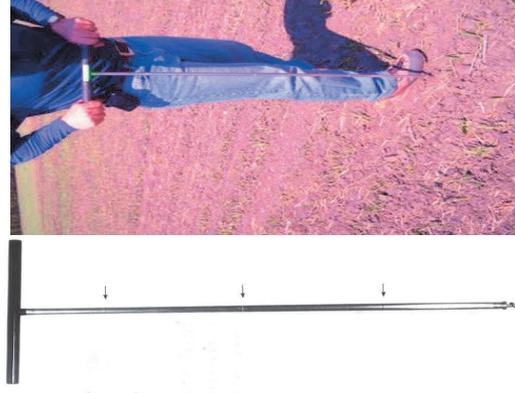


- Crop production in drylands is highly dependent on water storage during fallow and growing season precipitation
- Fallow water storage can increase the stability of crops yields year-to-year though **precipitation storage efficiency is very low (~20-40%) depending on fallow management**
- Storage of water is critical for grain crop productivity in dryland systems
- Aside water, nitrogen is next limited factor that impacts crops

# Water and nitrogen relations in drylands

- Too much fertilizer N and little water could result in excessive vegetative growth but low grain yield
- Too little fertilizer will reduce effective use of stored water
- Matching fertilizer N with available water is crucial to optimize dryland grain crop yields

# Determining plant available water



- Gravimetric water content, moisture sensors, and neutron access tubes, more accurate but expensive and time consuming
- Paul Brown Probe
  - Measures depth of moist soil
  - Amount of force required to push the probe into the soil is directly related to soil water content
  - Conversion to plant available depends on soil texture

# Paul Brown Probe soil moisture conversions

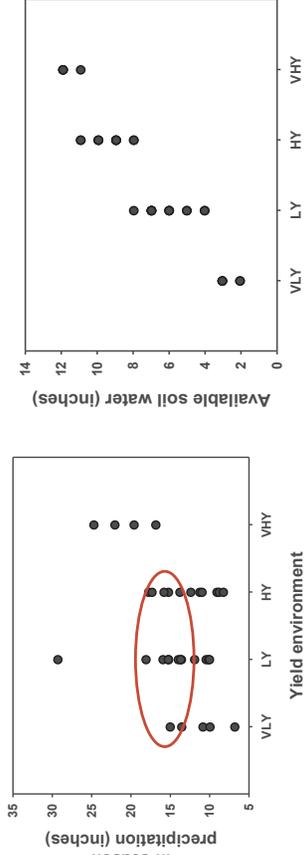
Soil texture	Plant available water per foot of moist soil
Coarse sand	0.5 inches
Coarse- loamy fine sand, fine sands	1.25 inches
Mod. Coarse- sandy loam, fine sandy loam	1.5 inches
Med.-silt, silt loam, loam, sandy loam	2.0 inches
Mod. fine- clay loam, sandy or silty clay loam	2.2 inches
Fine- sandy clay, silty clay, clay	2.0 inches

<https://envcoglobal.com/wp-content/uploads/2014/10/brown-moisture-probe-spec-2008.pdf>

# Experiments at K-State to evaluate N rate and soil water at planting in sorghum

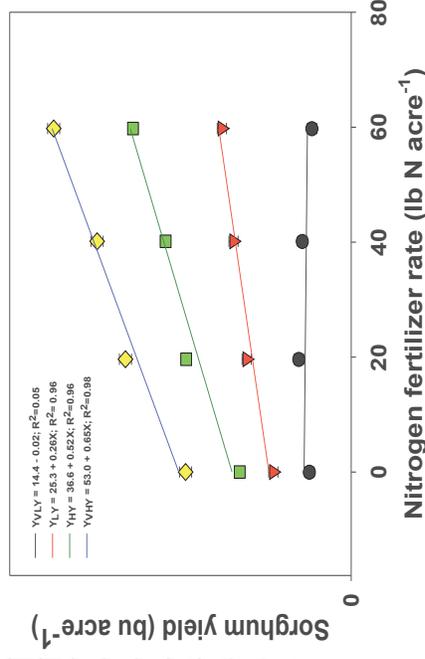
- Long-term study at Hays from 1970 to 2002
- The objective was to determine if the soil water at planting could be used to make N application decisions
- Treatments
  - Four N rates (0, 20, 40 and 60 lb N/acre)
  - Soil water at sorghum planting determined with Paul Brown probe at 6 random locations within each plot
  - depth of moist soil were converted to plant available water at planting (ASW) using conversion tables based on soil texture
  - Growing season precipitation was recorded over the 32-years

# Available water and yield environments

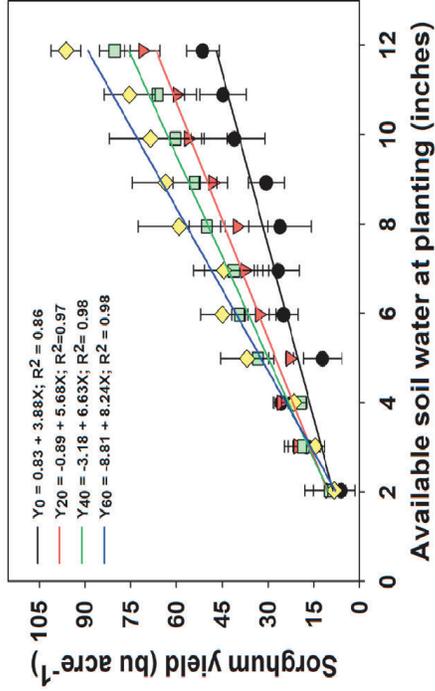


Very low yielding (VLY), low yielding (LY), high yielding (HY), and very high yielding (VHY) a

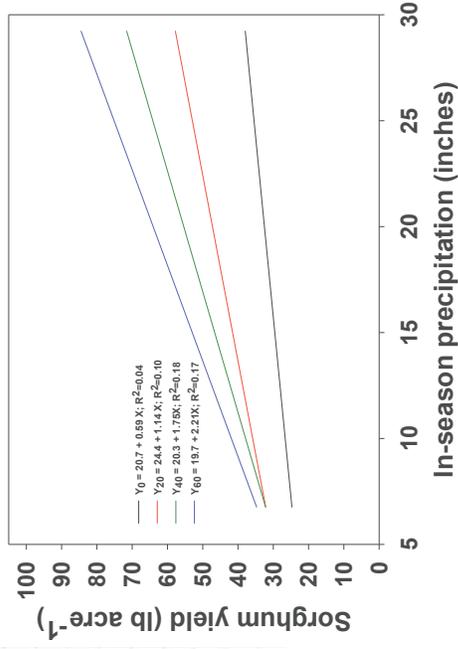
# Yield environment impacts N response



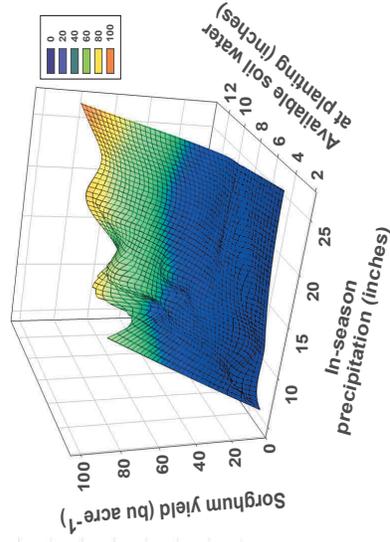
# N response in sorghum depends on available water at planting



# In-season precipitation effects on yield were minimal

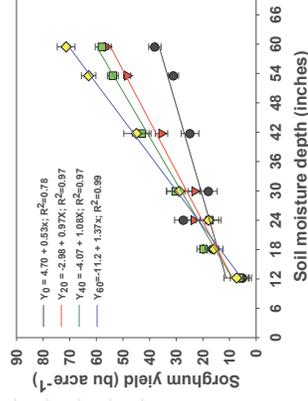


# Sorghum yields more impacted by available water at planting than in-season precipitation

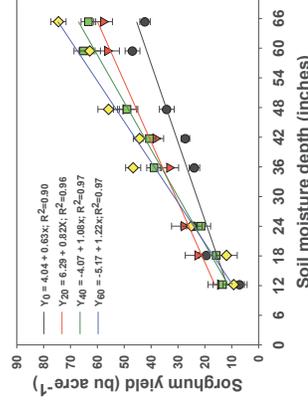


# Depth of moist soil effects on sorghum yield

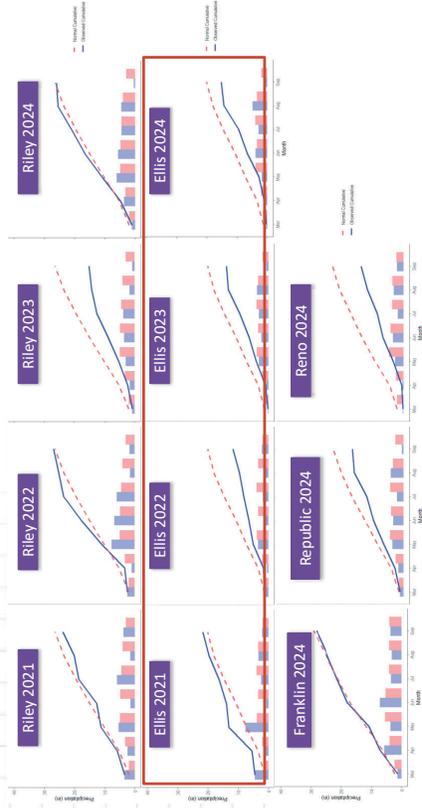
7 to 12 inches of in-season precipitation



12-16 inch in-season precipitation

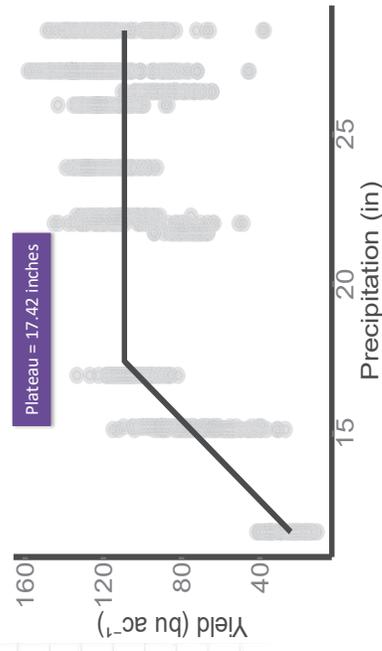


# Fallow and in-season precipitation impacts yield environment



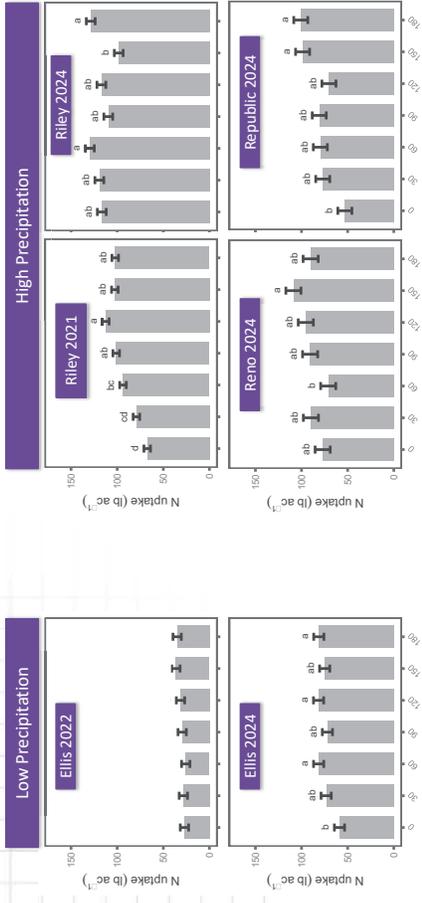
Mauro and Dorivar et al. New Sorghum N rate study across Kansas

# Grain sorghum yields impacted by environment



Mauro and Dorivar et al. New Sorghum N rate study across Kansas

# Yield environment affects nitrogen uptake



Mauro and Dorivar et al. New Sorghum N rate study across Kansas

# Summary

- Crop response to N depends on soil water at planting and growing season precipitation in dryland environments
- Precipitation distribution has a significant influence on N uptake and removal in grain crops
  - Increased precipitation during fallow increase plant available water at planting
- Little N removal in low yield environments
- Fertilizer-N can be adjusted based on
  - Yield goal
  - Residual N
  - Soil water content at planting
  - Fallow and in-season precipitation

# Funding and Contact Info



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