

A Quarter Century of a Tillage-Rotation-Nitrogen Rate Study in Nebraska



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ABSTRACT

A long term tillage, nitrogen rate and rotation study was analyzed using standardized precipitation indexes to determine if sub setting the data by precipitation/ET could establish specific relationships between the main effects. The study, initiated in 1986 on a silt loam, under rain-fed conditions in the western corn belt generally showed that under dry conditions No-till increased yields, and under wet conditions No-till was of no benefit. Nitrogen effects were less pronounced under dry conditions, and there were 5 years of 18 normal years where N rates applied were not sufficient to maximize yield.

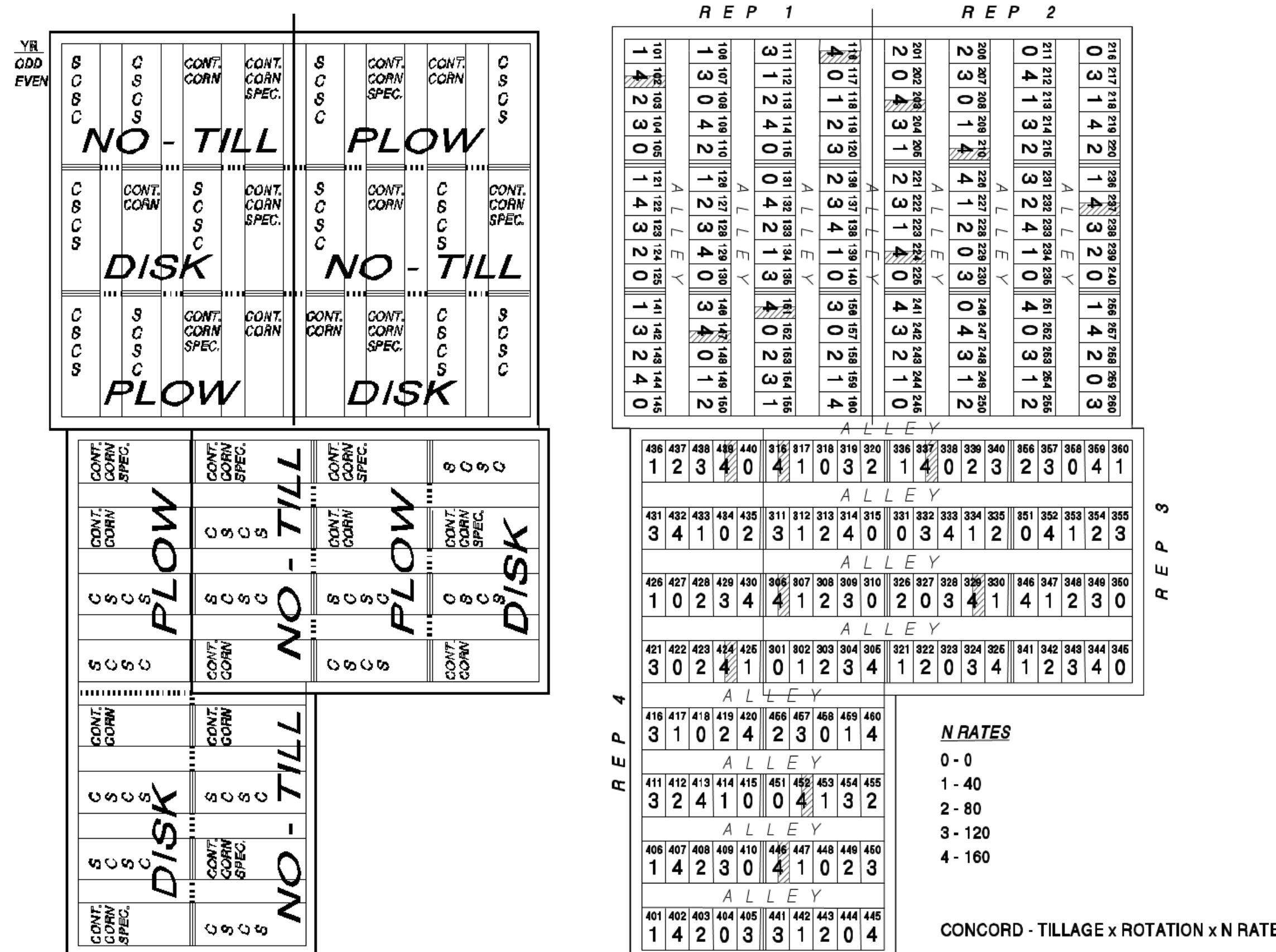
BACKGROUND

Traditional ANOVA of this experiment indicated that there were significant year x treatment interactions. In an effort to generalize how corn was responding to the tillage, N rate, and rotation treatments, we attempted to separate the years out by the precipitation/ET history for each year.

OBJECTIVES

- Determine the interaction between Tillage, Rotation and N. rate for corn production under different moisture conditions.
- Compare standard precipitation indexes and determine their usefulness.

EXPERIMENTAL SETUP

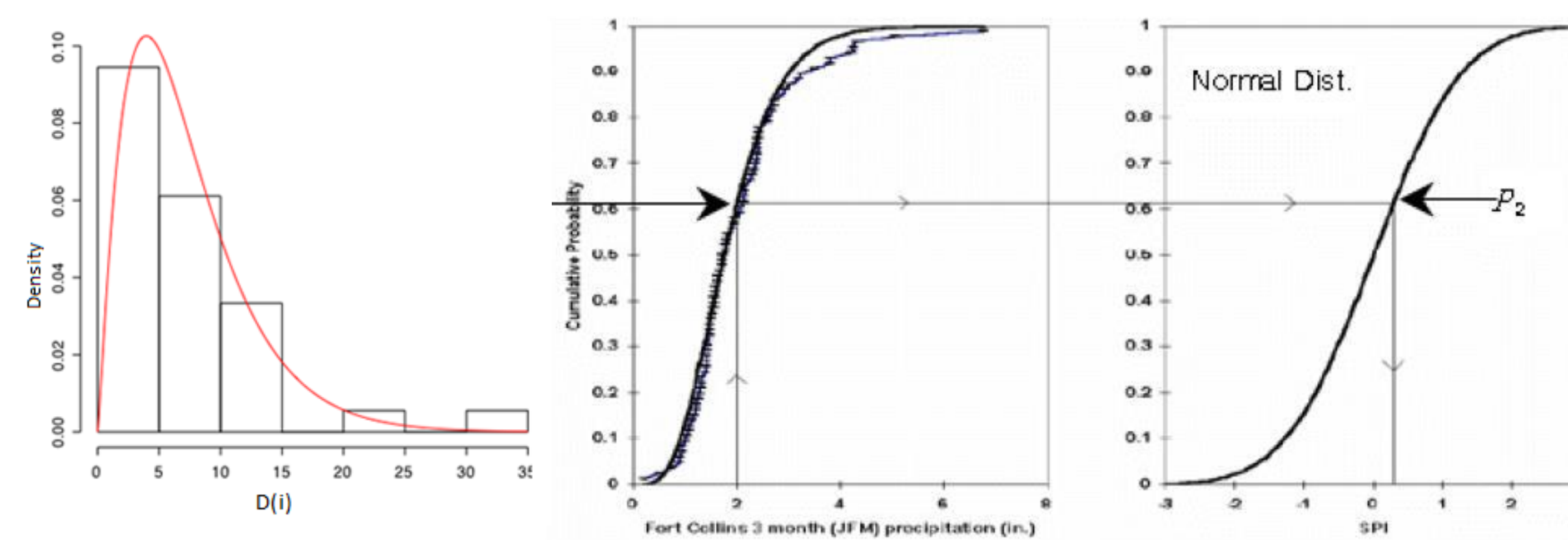


Tillage Systems:	Crop Rotation (summer):	N rates(Ammonium Nitrate):
Moldboard plow	Continuous Corn (C-C)	0 kg ha ⁻¹
Disk Tillage	Corn Soybean (C-S)	40 kg ha ⁻¹
No-till		80 kg ha ⁻¹
		120 kg ha ⁻¹
		160 kg ha ⁻¹

METHODS

SPEI & SPI

- SPEI** (Standardized precipitation evapotranspiration index) was calculated according to Vicente-Serrano et al., 2010.
$$D_i = P - ET$$
- SPI**(Standardized precipitation index) was calculated according to McKnee et al.,1993
- SPEI and SPI for five, 12 and seven months was considered for the analysis.



RESULTS

Climatic Variability

- Average yearly rainfall (1973-2014) – **702 ± 187 mm**
- 5 wet years – 1993 and 2014 were extremely wet.
- 6 dry years – 2012 and 1988 were extremely dry.
- 18 normal years.

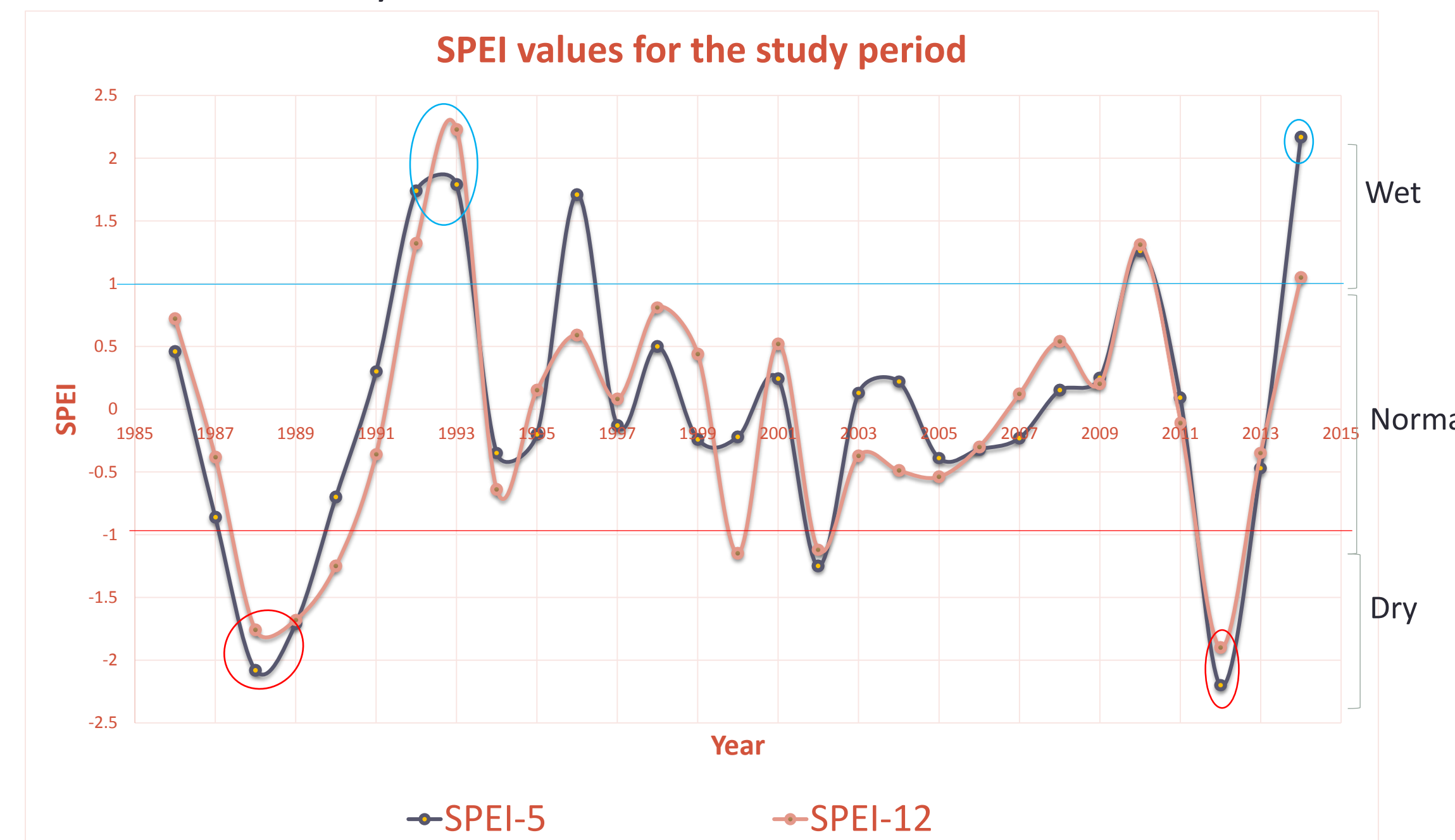
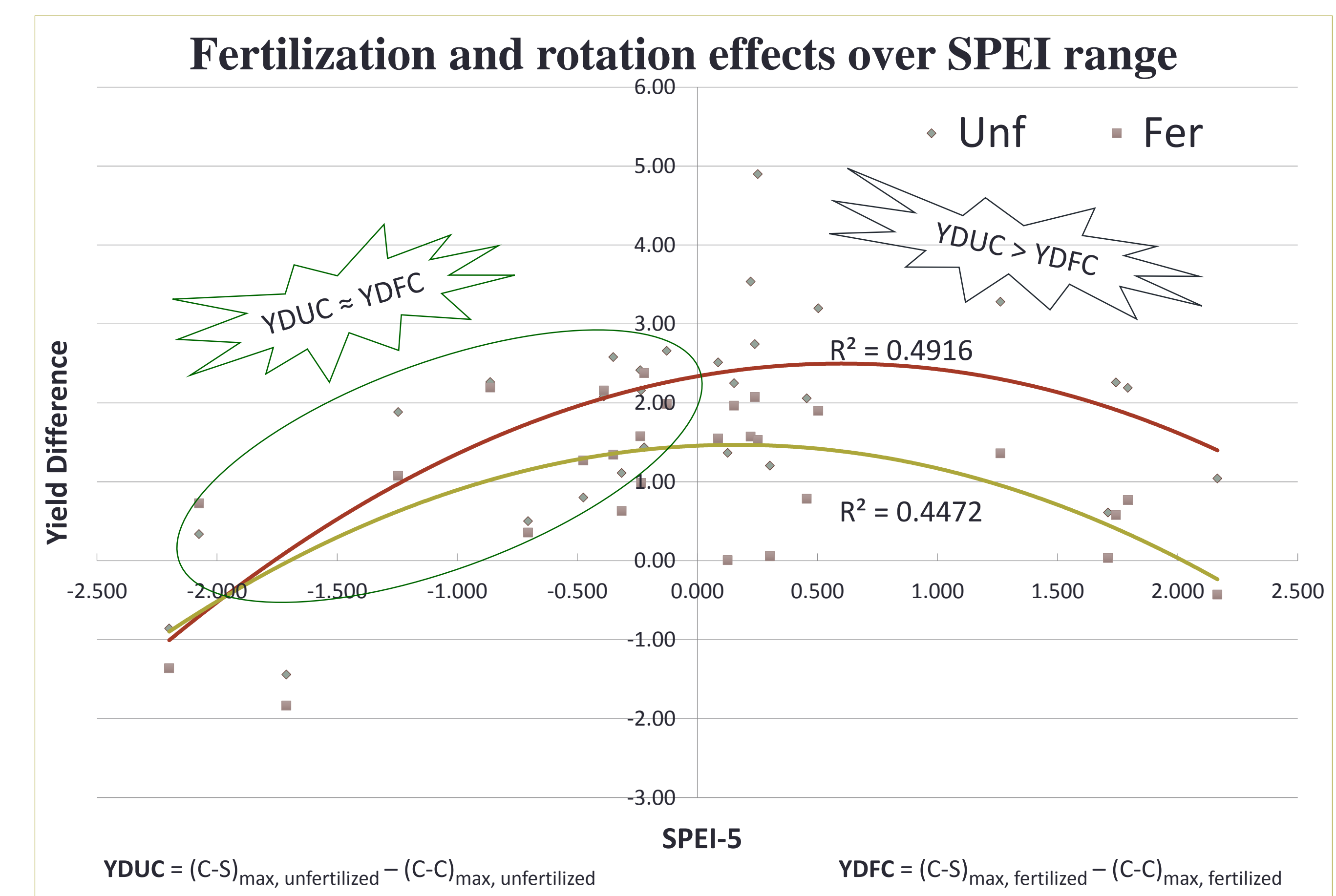
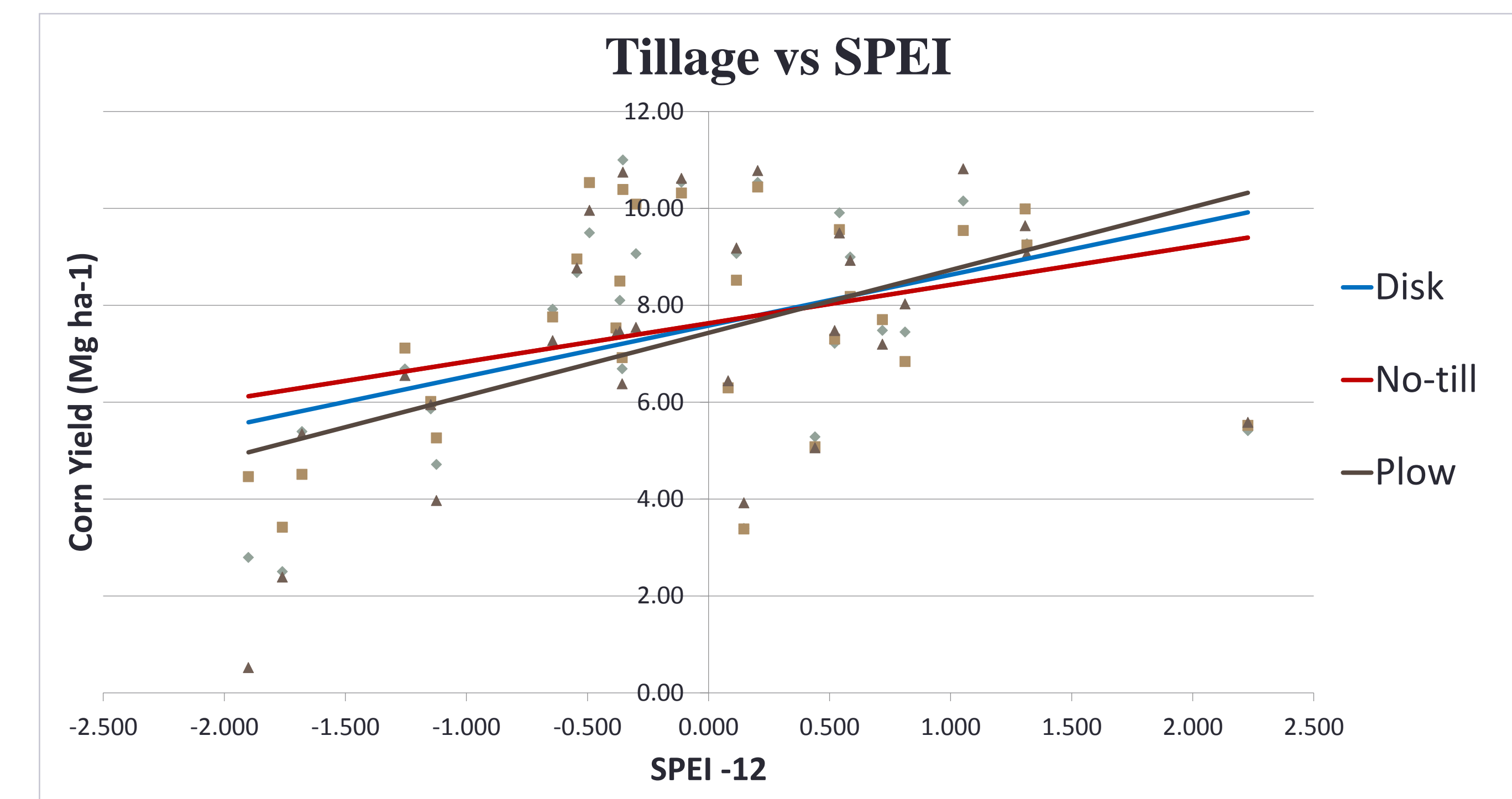


Table. Effect of tillage and rotation over years and by wet, normal, and dry years using the SPEI.

Tillage	Rotation	29 year average	Wet	Normal	Dry
Mg ha ⁻¹					
Plow	CC	6.6	8.2	6.9	4.2
	Corn-soy	8.1	9.4	9.1	4.1
Disk	CC	6.8	8.1	7.1	4.7
	Corn-soy	8.2	9.5	9.1	4.6
No-till	CC	6.8	7.7	7.2	4.8
	Corn-soy	8.4	9.3	9.1	5.5
ANOVA					
Tillage x Rotation		NS	*	*	***
Average rainfall(mm)		730	1016	747	511

RESULTS



CONCLUSIONS

- For 6 Dry Years:**
 - N response was minimal
 - Year x Tillage x Rotation was significant since in severe drought corn following soybeans were not increased:
 - Moderate drought increase from C-S, 21%
 - Severe drought increase from C-C, 17%
 - Normal years:**
 - C-S consistent, 28% increase
 - Year x N rate effect was significant:
 - Linear response (5 years) and quadratic (12 years) .
 - Wet years:**
 - Tillage was significant.
 - Plow 4.1% and Disk 0.7% > yield than No-till.
- SPEI is a better tool than SPI for moisture prediction.**

