

Can Sidedress Nitrogen Recover Flooding-Induced Yield Loss in Maize?

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An unprecedented number of flood emergencies have ravaged the US. It's a warning of what's to come

By [Mary Gilbert](#), CNN Meteorologist

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Mississippi River crests at 19.35 feet



Research Questions



- How does flooding affect grain yield?
- When soils are saturated, how does the microbiome and its function react?
- What plant metabolic functions change under flooding stress?
 - Do these functions recover with N?

Research Questions



- How does flooding affect grain yield?

Is rescue N a
reasonable approach?

2023 and 2024 Treatments

Hybrids

Flooding Timing

Nitrogen

kg ha⁻¹

2

x

3

x

4

2023 and 2024 Treatments

Hybrids

Flooding Timing

Nitrogen

kg ha⁻¹

0

None

GH14B32

180

X

V3

X

180 + 45

GH15J91

V3 + V8

180 + 90

NIFA Flooding – Rescue N



Flooding events saturated the soil for 7 days with ponding occurring in the final 48-72 hours.



~69 cm rain in 7 days

V3 Flooding



Pre-Tassel



Influence of Flooding on Grain Yield

Flooding Treatment †

Year

None

V3

V3 + V8



Mg per ha

2023

11.7^A

11.4^A

8.8^B

2024

10.8^A

7.5^B

6.8^C

Average



11.3^A

9.5^B

7.8^C

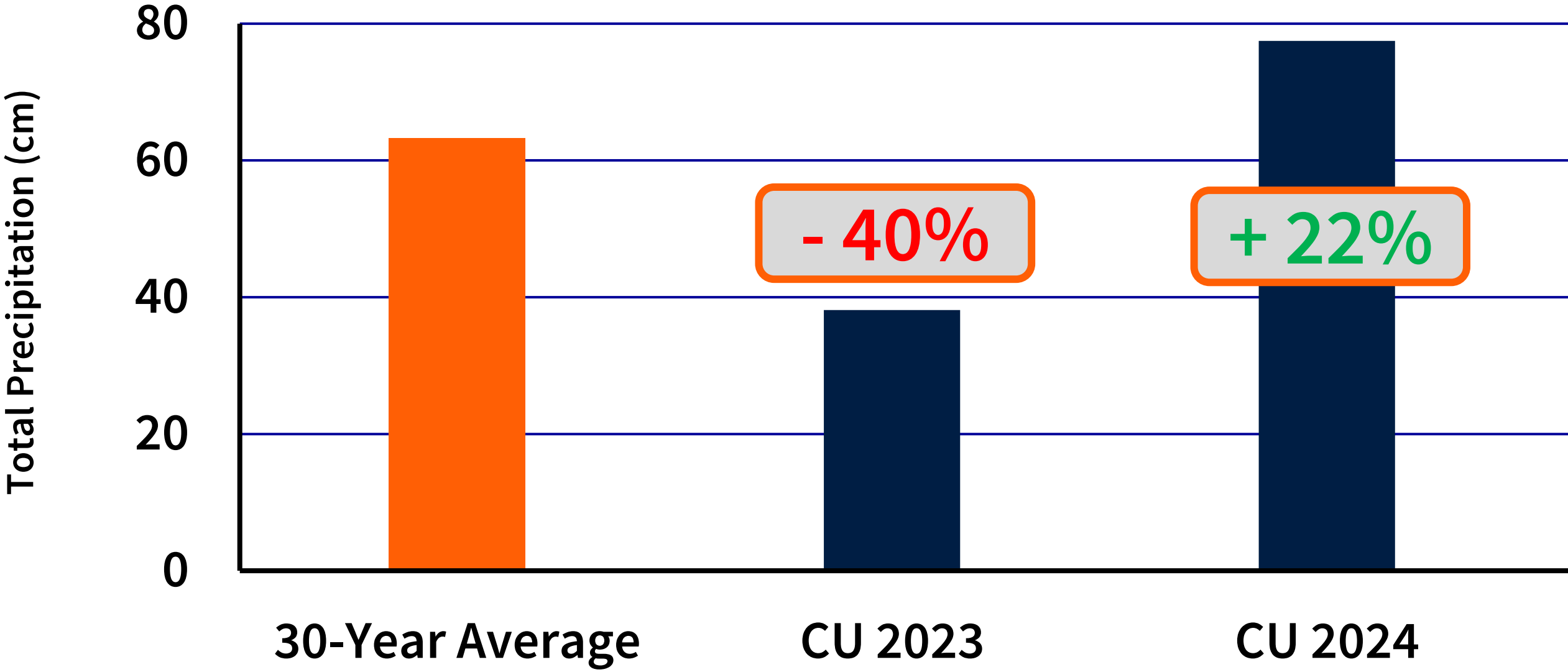
† Hybrid its interactions were non-significant ($p > 0.1000$) and therefore presented values are averaged across hybrids.
 Flooding ($p = < 0.0001$), Nitrogen ($p = < 0.0001$), Flooding x Nitrogen ($p = 0.0458$, 2023 ; $p = 0.0123$, 2024; $p = 0.0245$, both years)

Influence of Rescue N on Grain Yield

Year	Nitrogen Treatment (kg per ha) †			
	0	180	180 + 45	180 + 90
				
				
2023	6.1 ^C	11.0 ^B	12.5 ^A	13.0 ^A
2024	4.3 ^D	8.0 ^C	9.7 ^B	11.4 ^A
Average	5.2 ^D	9.5 ^C	11.1 ^B	12.2 ^A

† Hybrid x treatment interactions were non-significant ($p > 0.10$) and therefore presented values are averaged across hybrids.
 Nitrogen ($p = < 0.0001$; all years)

Total Precipitation During the Growing Season



Influence of Flooding and N Application on Grain Yield (2023)

Nitrogen Management	Flooding Treatment †			N Mgmt. Average
	None	V3	V3 + V8	
	Mg per ha			
0	7.1	6.6	4.6	6.1 ^C
180	12.7	11.5	8.9	11.0 ^B
180 + 45	13.3	13.5	10.6	12.5 ^A
180 + 90	13.9	13.8	11.3	13.0 ^A
Flooding Average	11.7 ^A	11.4 ^A	8.8 ^B	

Influence of Flooding and N Application on Grain Yield (2023)

In a drier year, rescue N can recover all flooding-induced yield loss!

0	7.1	6.6	4.6	6.1 ^C
180	12.7	11.5	8.9	11.0 ^B
180 + 45	13.3	13.5	10.6	12.5 ^A
180 + 90	13.9	13.8	11.3	13.0 ^A
Flooding Average	11.7 ^A	11.4 ^A	8.8 ^B	

Influence of Flooding and N Application on Grain Yield (2024)

Nitrogen Management	Flooding Treatment †			N Mgmt. Average
	None	V3	V3 + V8	
	Mg per ha			
0	5.9	3.4	3.7	4.3 ^D
180	11.5	6.9	5.7	8.0 ^C
180 + 45	12.6	8.6	8.0	9.7 ^B
180 + 90	13.3	11.0	9.8	11.4 ^A
Flooding Average	10.8 ^A	7.5 ^B	6.8 ^C	

Influence of Flooding and N Application on Grain Yield (2024)

In a wetter year, rescue N can recover some flooding-induced yield loss...

0	5.9	3.4	3.7	4.3 ^D
180	11.5	6.9	5.7	8.0 ^C
180 + 45	12.6	8.6	8.0	9.7 ^B
180 + 90	13.3	11.0	9.8	11.4 ^A
Flooding Average	10.8 ^A	7.5 ^B	6.8 ^C	



Bring it back to Extension:

Does it pay?

What about water quality?

Crunching the Numbers...

Year	Flooding x Nitrogen	Δ Yield Mg per ha	\$ grain	\$ N	Δ Profit	Tot. Profit
			—————\$USD per ha—————			
2023	0 to 180 kg (no flooding)	5.6	1,049	-217	827	827
	+ V3 flood	-1.2	-226	0	-226	601
	+ V3 flood & 45 kg N	2.0	368	-54	314	<u>915</u>
	+ V3 flood & 90 kg N	0.3	52	-54	-2	913

In a drier year, only 25% of N needed to recover lost yield and profit

Crunching the Numbers...

Year	Flooding x Nitrogen	Δ Yield Mg per ha	\$ grain	\$ N	Δ Profit	Tot. Profit
			—————\$USD per ha—————			

In a wetter year, 50% of N needed to recover SOME yield and profit

2024	0 to 180 kg (no flooding)	5.6	1,049	-217	832	832
	+ V3 flood	-4.6	-854	0	-854	-22
	+ V3 flood & 45 kg N	1.7	321	-54	267	245
	+ V3 flood & 90 kg N	2.4	433	-54	379	624

† Calculations based on \$USD 0.55 per 0.46 kg N as urea and \$USD 4 per 21.5kg of maize 

Key Takeaways

- In a drier year, a 25% rate of rescue N regained yield and improved profit
- In a wetter year, 25% or 50% rates of rescue N regained profit, but not yield
- When faced with rescue N decisions, forecasting is key to determine if one should call the local coop, or their insurance adjuster

More info at:

Crop Physiology Laboratory

University of Illinois

<http://cropphysiology.cropsci.illinois.edu>



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