

Yield, Water Productivity & Nutritional Value Response of Alfalfa to Irrigation Frequency & Cutting Schedules

Sultan Begna¹, Dong Wang¹, Khaled Bali², Dan Putnam³

¹USDA-ARS, Parlier, ²UC-KARE, Parlier, CA, ³UC-Davis, CA



U.S. Major Field Crops

Economic value (\$ billions). USDA. NASS

Year	Corn	Soybean	Alfalfa	Wheat
2018	52.1	36.8	10.1	9.7
2019	48.9	30.5	10.8	8.9
2020	64.3	45.7	10.2	9.4
2021	90.6	59.2	11.9	12.2
2022	91.7	61.1	13.0	14.6



True Crop Value = Economic value + Environmental value

Irrigated Alfalfa Production System in California

❖ **Flood**

❖ **28-day cutting schedule**

- **Means non-frequent irrigation (NFI) because of harvesting operations logistics challenges.**
 - **NFI practice may limit alfalfa from attaining it's yield potential.**

Objective:

Determine irrigation frequency by cutting schedule combination treatments effect on yield, crop water productivity (CWP) and forage quality of alfalfa.

Material and Methods

- Study location: USDA-ARS, Parlier CA; Planted in 03/18/2021
- Experimental design: Split-plot with 4 reps
 - Main plot: Irrigation by cutting schedule combination treatments (Frequent Irrigation: FI-28d cut, Non-frequent, NFI-28d cut, and FI-35d). NFI-28d cut received one irrigation per cut (6"=152.4mm) a week after cutting while FI treatments received irrigation weekly based on evapotranspiration (ET) value.
Irrigation treatments imposed after Cut 1
 - Sub-plot: 10 Cultivars of 8-10 Fall dormancy. HVX840RR; AFX1060, AFX960, Magna (Hi-Gest); Nexgrow6829RR, SW10, SW6330, Saltana, QA19NTC683, CUF101 (conventional).

Applied water use (irrigation + rainfall): In 2021, FI-28 & FI-35d: 1326 mm =52" (1255 + 71 mm) and NFI: 1206 mm = 47" (1135 +71 mm) in 2021. In 2022, FI-28: 1831 mm =72" (1779 + 52 mm), NFI-28d: 1637 mm = 64" (1585 +52 mm) and FI-28d : 1857 mm=73" (1804 + 53 mm).

Data: Forage yield, applied water use, water productivity, and forage quality.



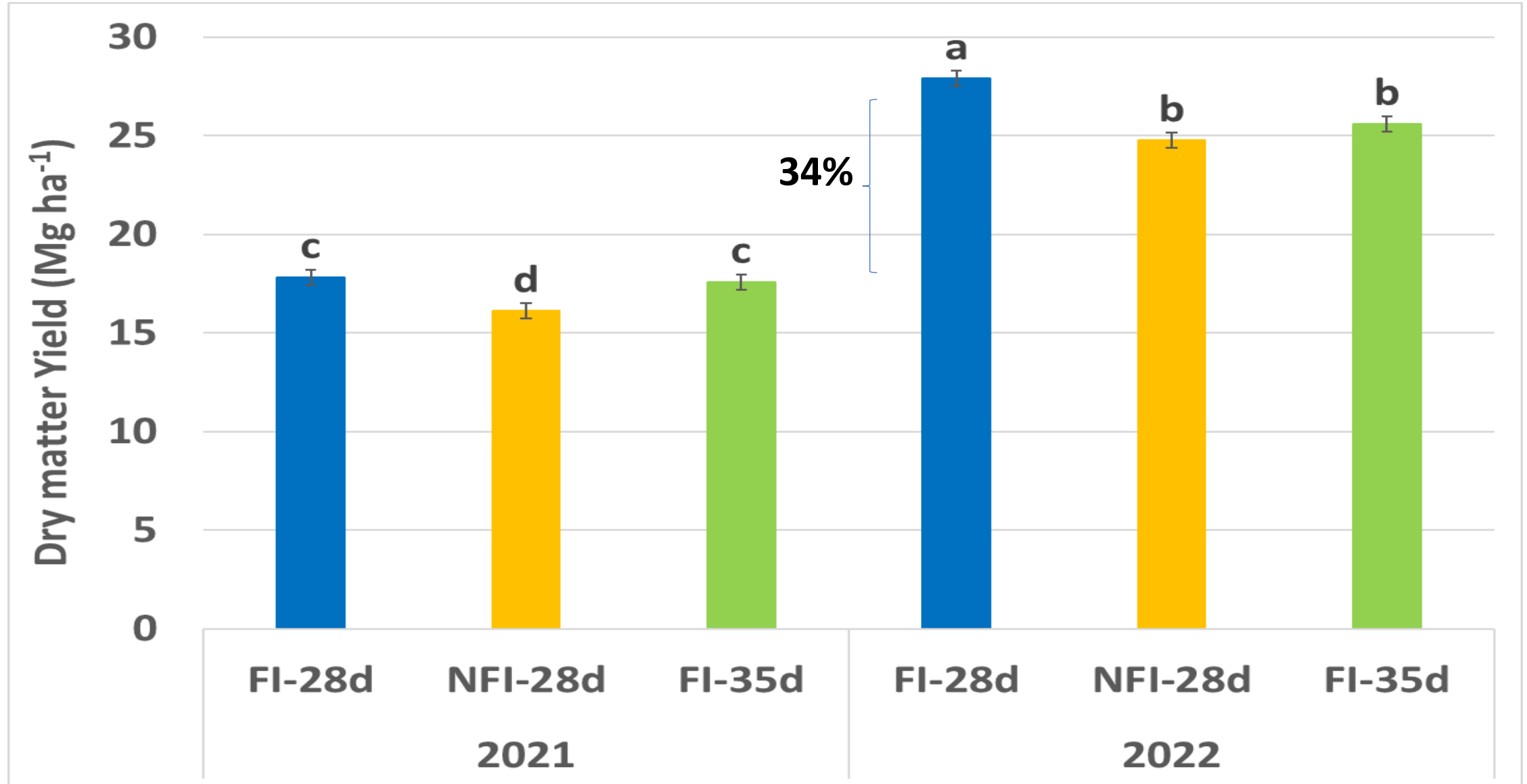
NFI-28d, FI-28d, FI-35d



RESULTS

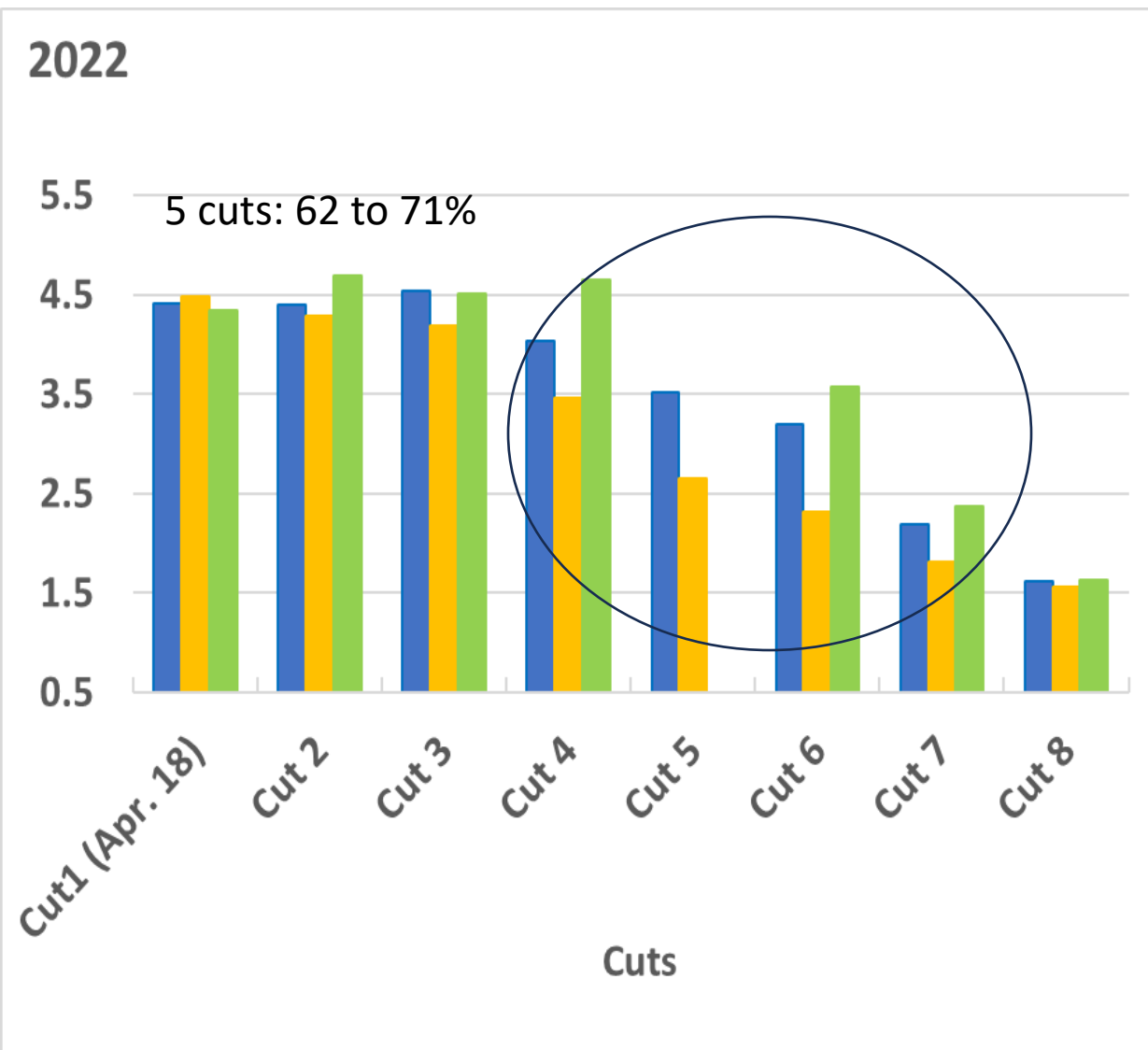
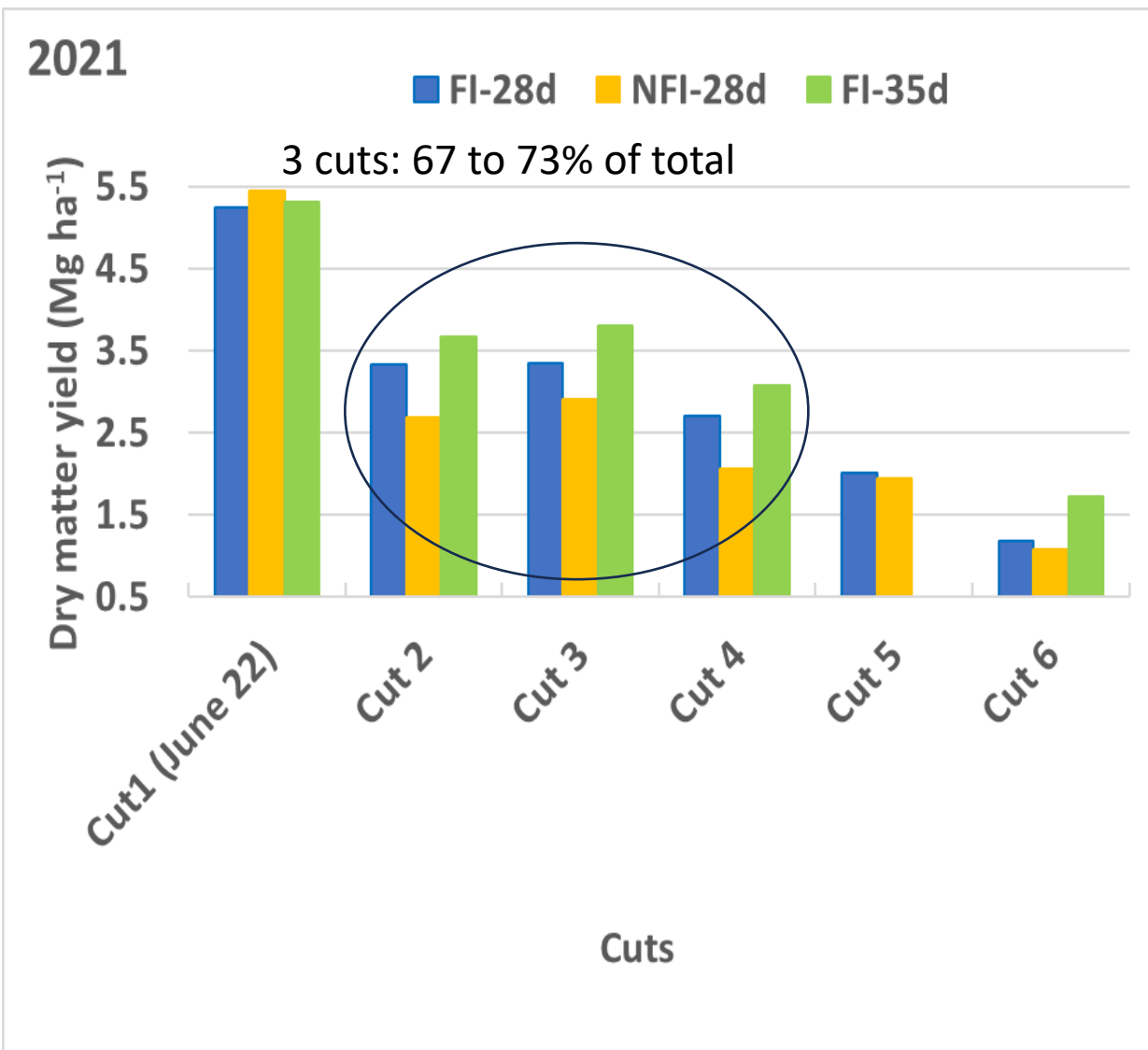
Irrigation frequency & cutting schedule effect on dry matter yield.

Frequent (F) and non-frequent (NF)



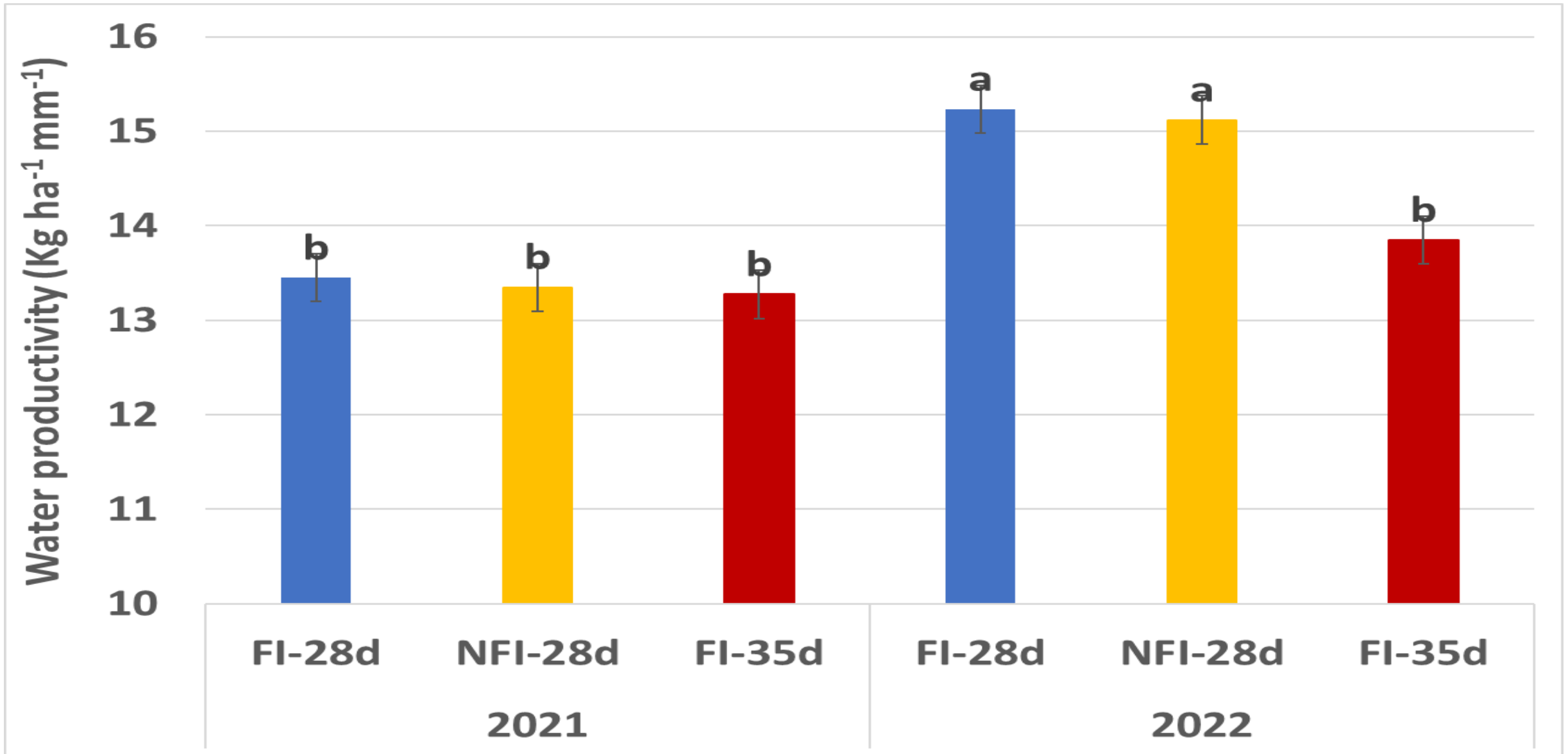
Irrigation frequency & cutting schedule effect on dry matter yield of each cut.

Frequent (F) and non-frequent (NF)

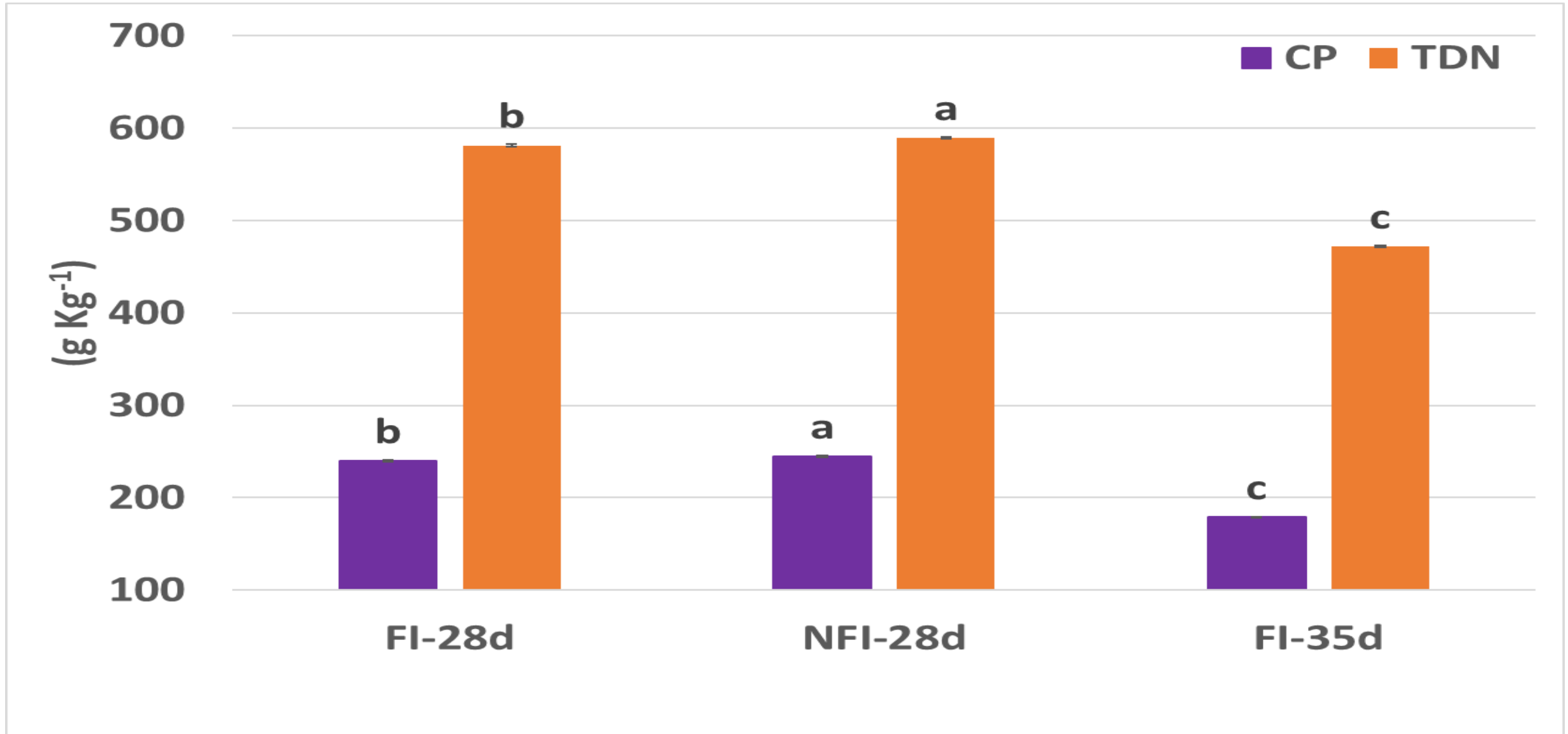


Irrigation frequency & cutting schedule effect on water productivity.

Frequent (F) and non-frequent (NF)



Irrigation frequency & cutting schedule effect on crude protein (CP) and total digestible nutrients (TDN). Frequent (F) and non-frequent (NF)



Summary

- ❖ **Frequent irrigation (FI) with 28d and 35d cutting schedules improved yields compared with non-frequent irrigation (NFI) harvested at 28d schedule.**
- ❖ **NFI-28d cutting schedule produced a slightly lower seasonal yield but similar in crop water productivity as FI-28d and FI-35d schedules with applied water use saving by about 10%.**
- ❖ **Regardless of irrigation frequency and cutting schedules, the first three in 2021 and five cuts in 2022 contributed the most to total seasonal yields (67 to 73 % and 62 to 71%).**
- ❖ **Most of the reduction in seasonal yield occurred during the hot summer growth periods of July, August and September which can be linked to high temperatures impact.**
- ❖ **NFI-28d cutting schedule produced the greatest CP and TDN, and the least by FI-35d schedule.**

Acknowledgments

Private seed companies: (NAFA-Affiliated Associations)

