DROPS, WATTS, AND CROPS WATER PRODUCTIVITY CHALLENGES OF THE NENA REGION

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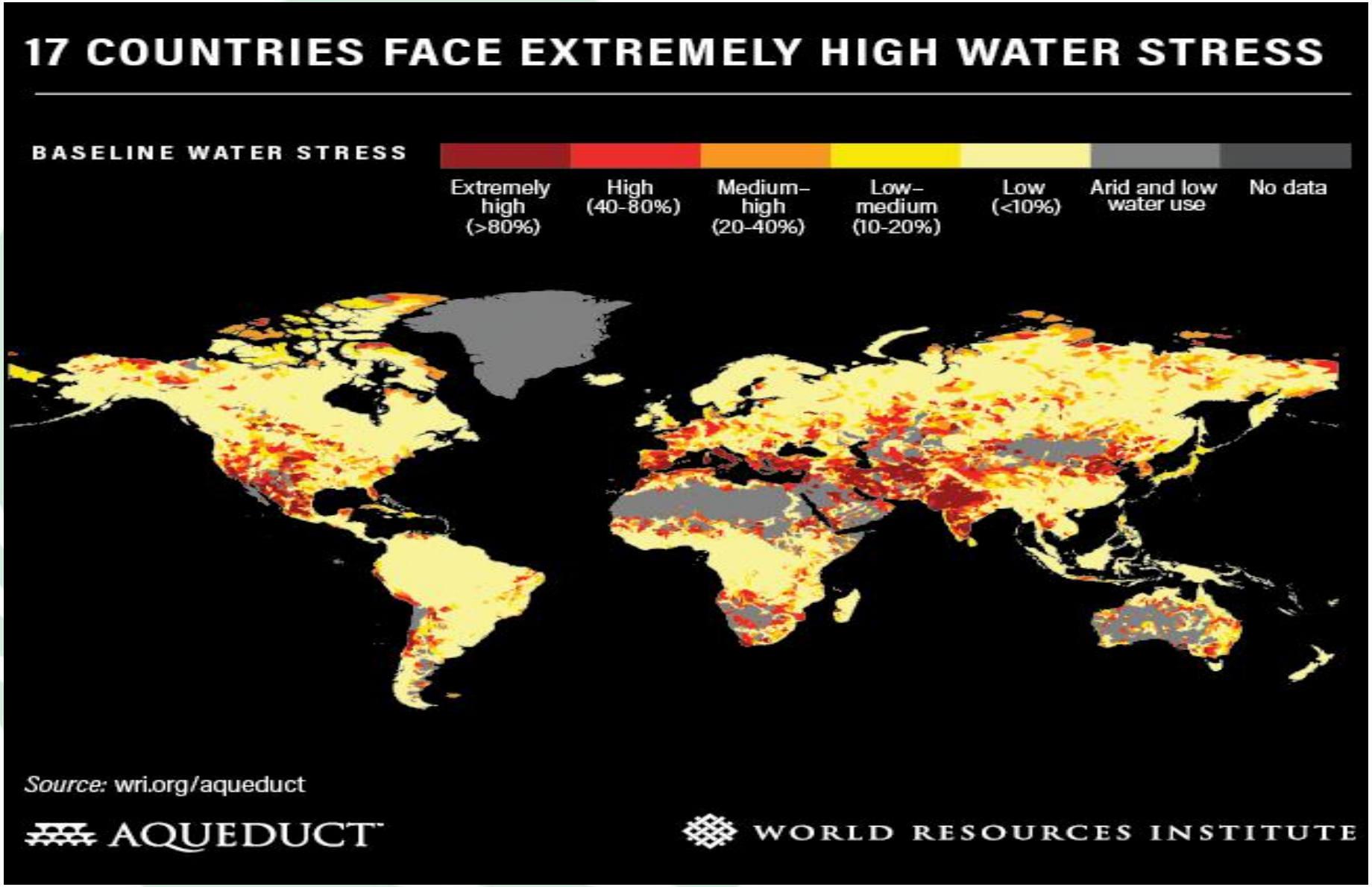
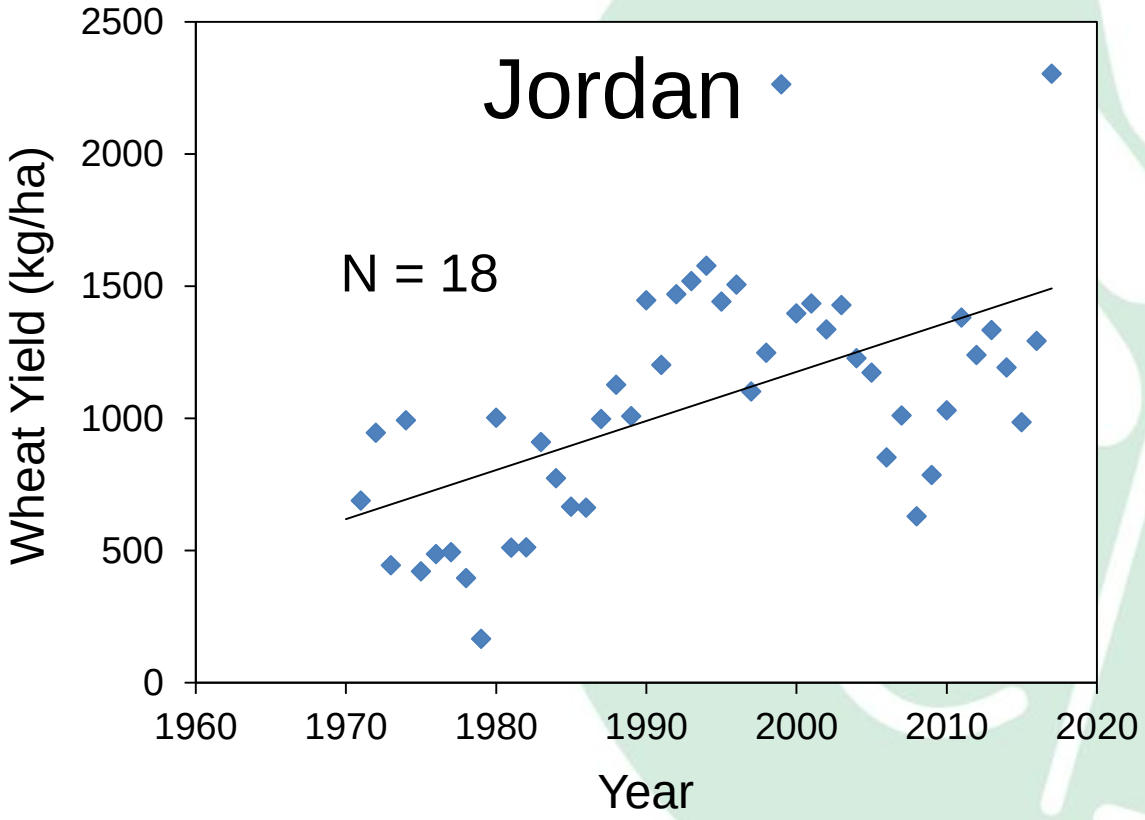
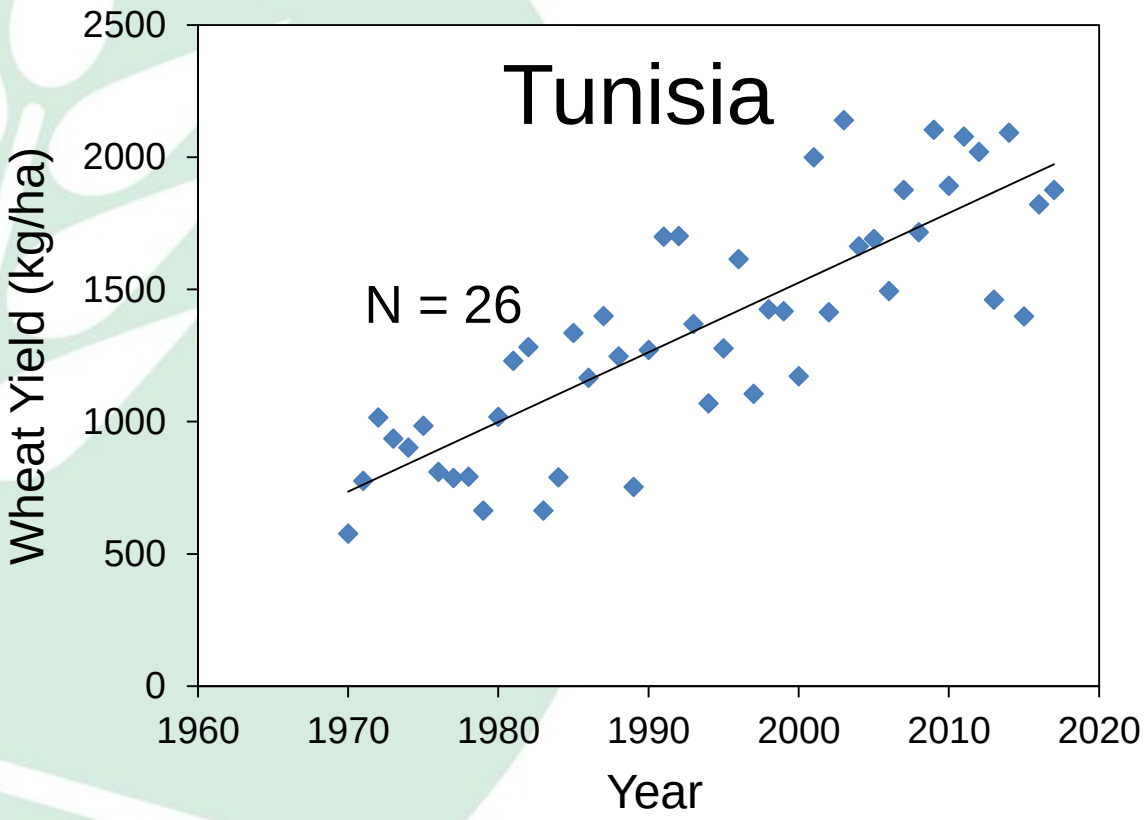
Near East and North Africa (NENA) Is the Most Water-Stressed Region on Earth (WRI, 2019)



Time course of annual wheat yields since 1970

(N is the slope of the regression line in kg/ha/year)





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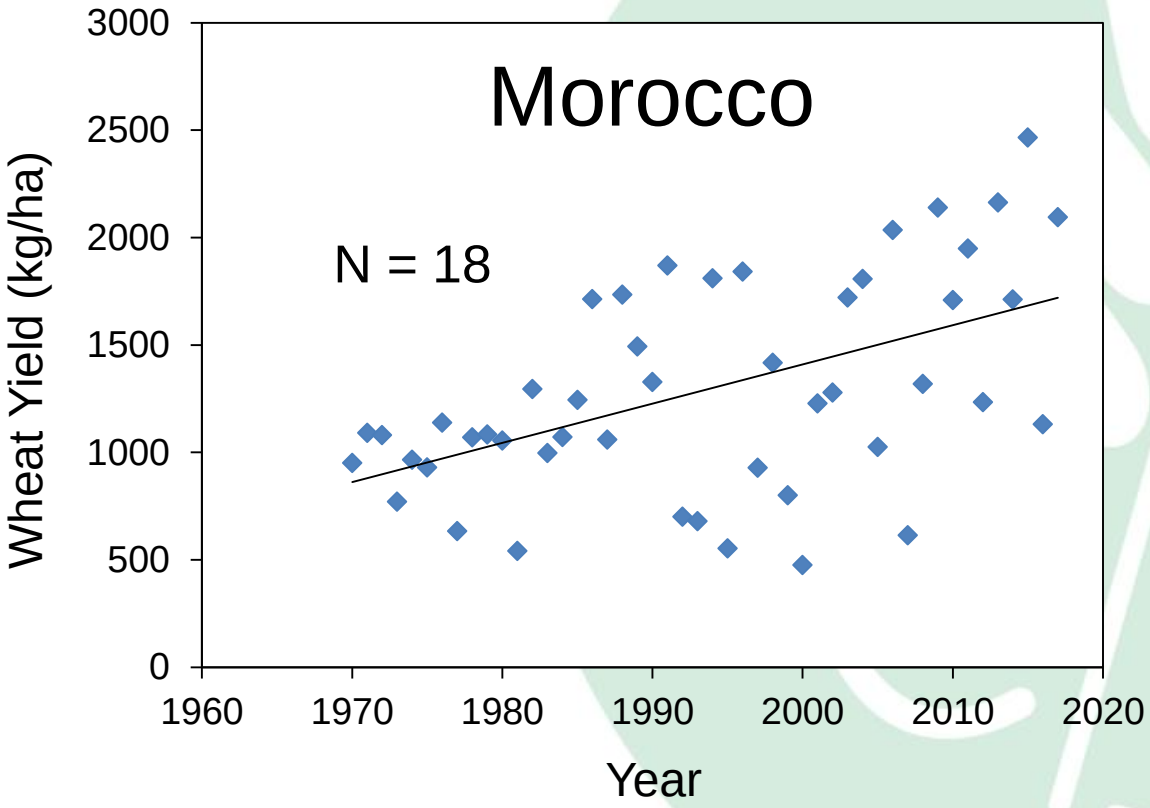

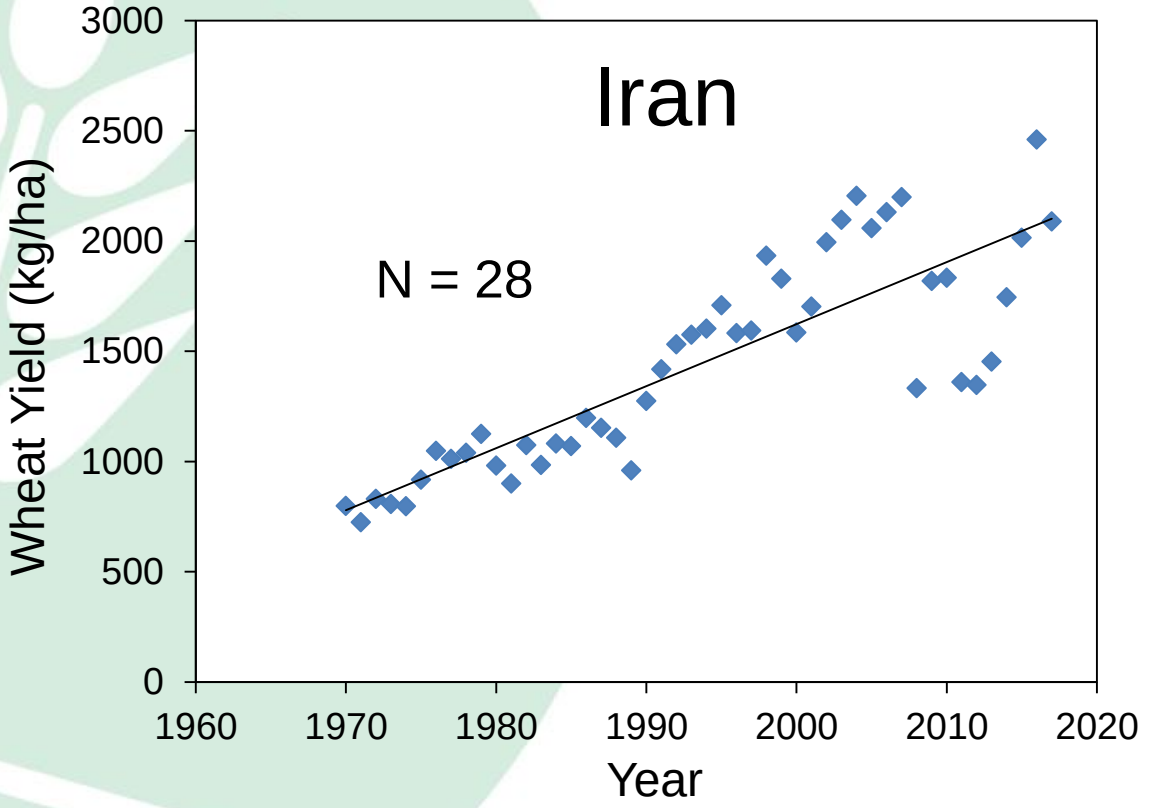

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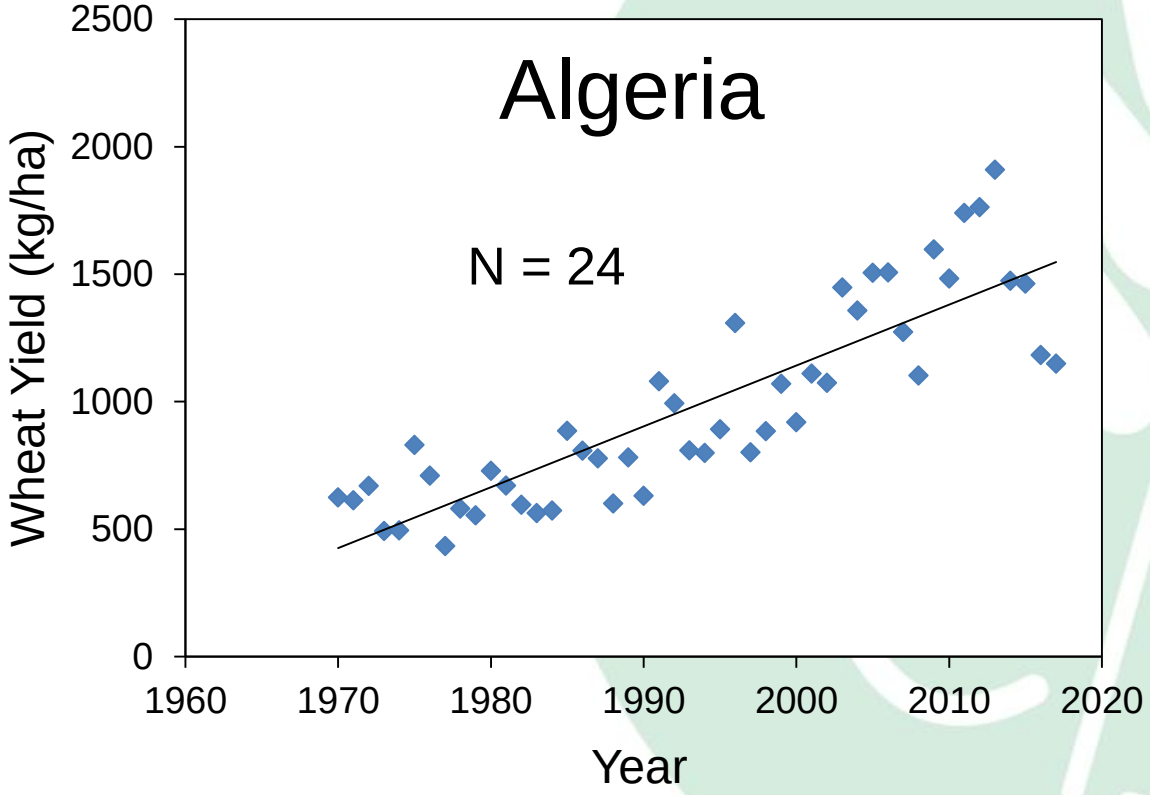

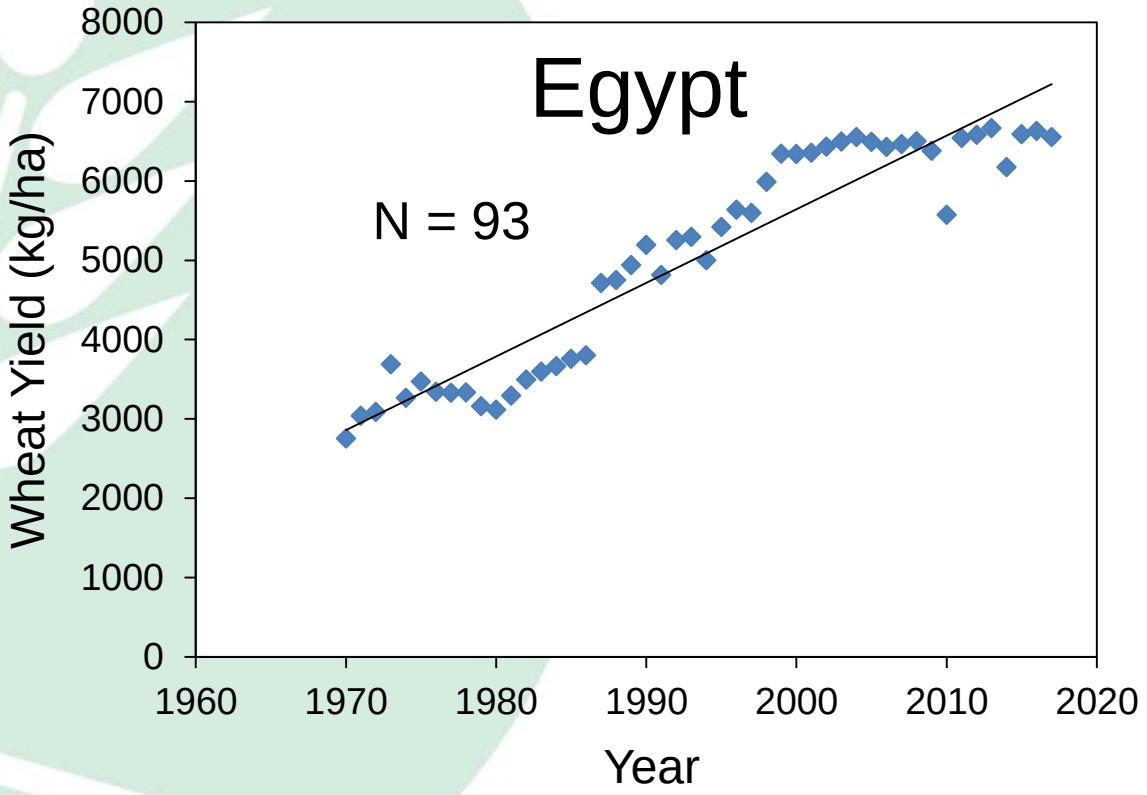

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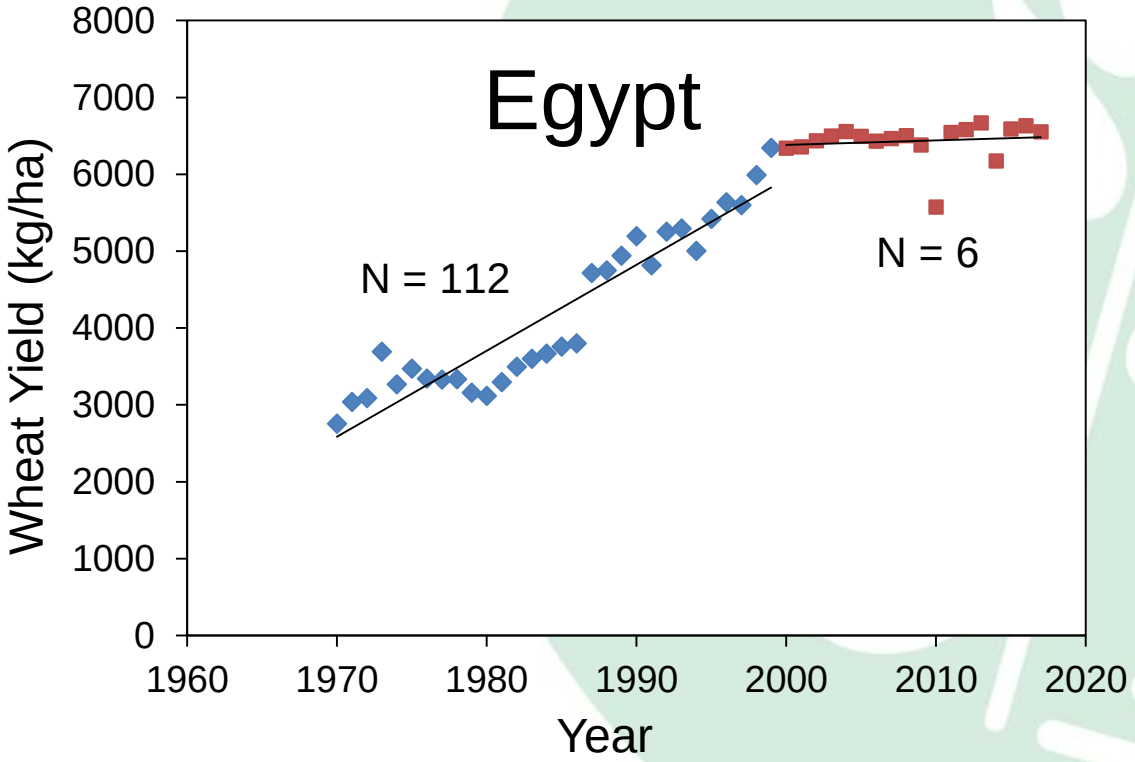
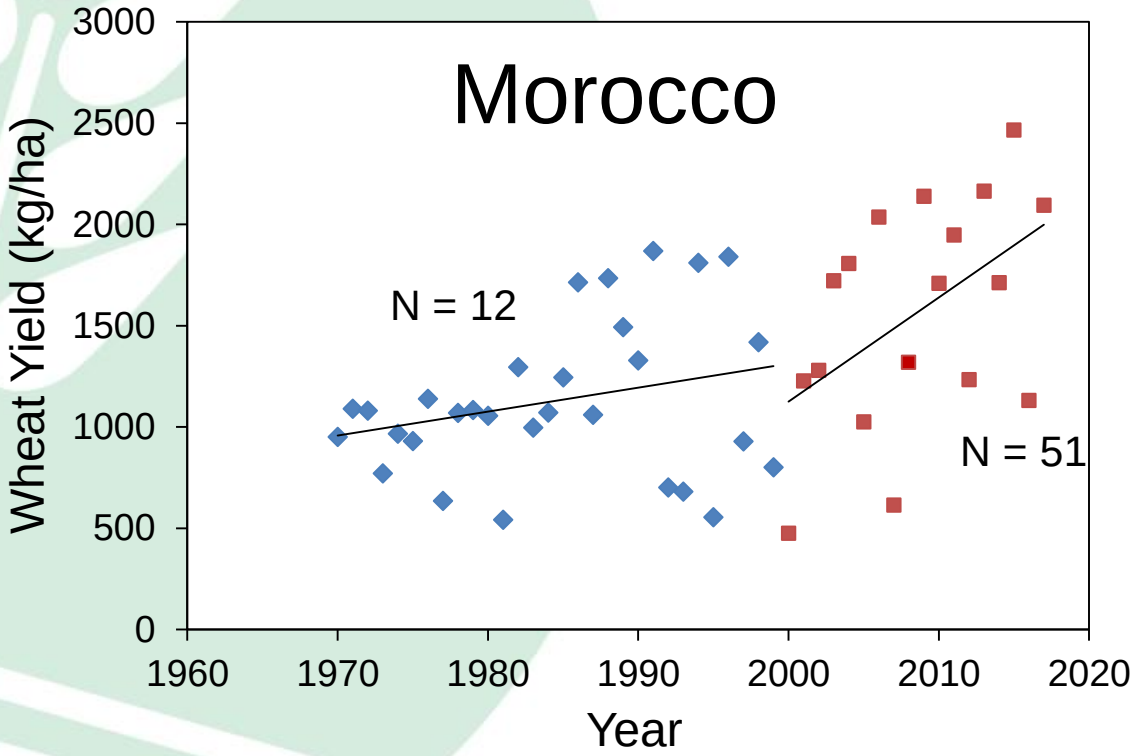




Yield-Rainfall Ratio (Kg/ha/mm)

yield (decadal average, kg/ha) divided by the long-term, country average annual precipitation (mm/year)

Years	Algeria	Iran	Jordan	Lebanon	Morocco	Tunisia
1970-79	6.8	4.0	5.0	1.6	2.8	4.0
1980-89	7.9	4.6	7.4	2.3	3.5	5.3
1990-99	10.4	7.0	13.3	3.3	3.4	6.7
2000-09	14.5	8.4	10.2	4.2	3.9	8.3
2010-17	17.1	7.8	12.1	4.9	5.2	8.8

Sadras and Angus (2006) proposed a maximum, attainable WP of wheat of **20 kg/ha/mm**

Using the last decade yield average , we calculated the minimum ET, compatible with achieving that yield as:

$$\mathrm{ET} = E + \frac{Y}{WP}$$

E from soil was estimated from Sadras and Angus as 60 mm (for zero yield), then we corrected the E for previous decades using the simulation model AquaCrop (less yield meant higher E due to less crop cover)

Estimated attainable Evapotranspiration (ET, mm) and water productivity (WP, kg/ha/mm)

Decade	Algeria		Egypt		Iran	
	ET	WP	ET	WP	ET	WP
1970-79	114.6	5.2	355.2	9.1	142.8	6.4
1980-89	114.6	6.1	366.1	10.7	142.2	7.4
1990-99	122.4	7.6	427.1	12.8	168.1	9.6
2000-09	134.8	9.6	433.9	14.9	171.0	11.2
2010-17	136.1	11.2	380.7	16.8	149.4	12.0

Irrigation Techniques VS Water Productivity

- The water shortage and inefficiency of traditional irrigation methods increased the amount of wasted water in addition to the non-harmonized production of vegetables

Adaptation

Balanced Pressure Drip Irrigation systems

Indicator	Traditional Drip Irrigation System	Balance Drip Irrigation System
Water Flow	Stream flow volume should be large	Stream flow volume is small
Flow Direction	Water Flow depends on gravity and the water flow at different inclination varies the amount of the flow	Water flow depends on the balanced pressure and the quantity is equal with different slopes
Areas and Quantities	Huge water quantity for small areas	Small water quantity for large areas

Signs of Success

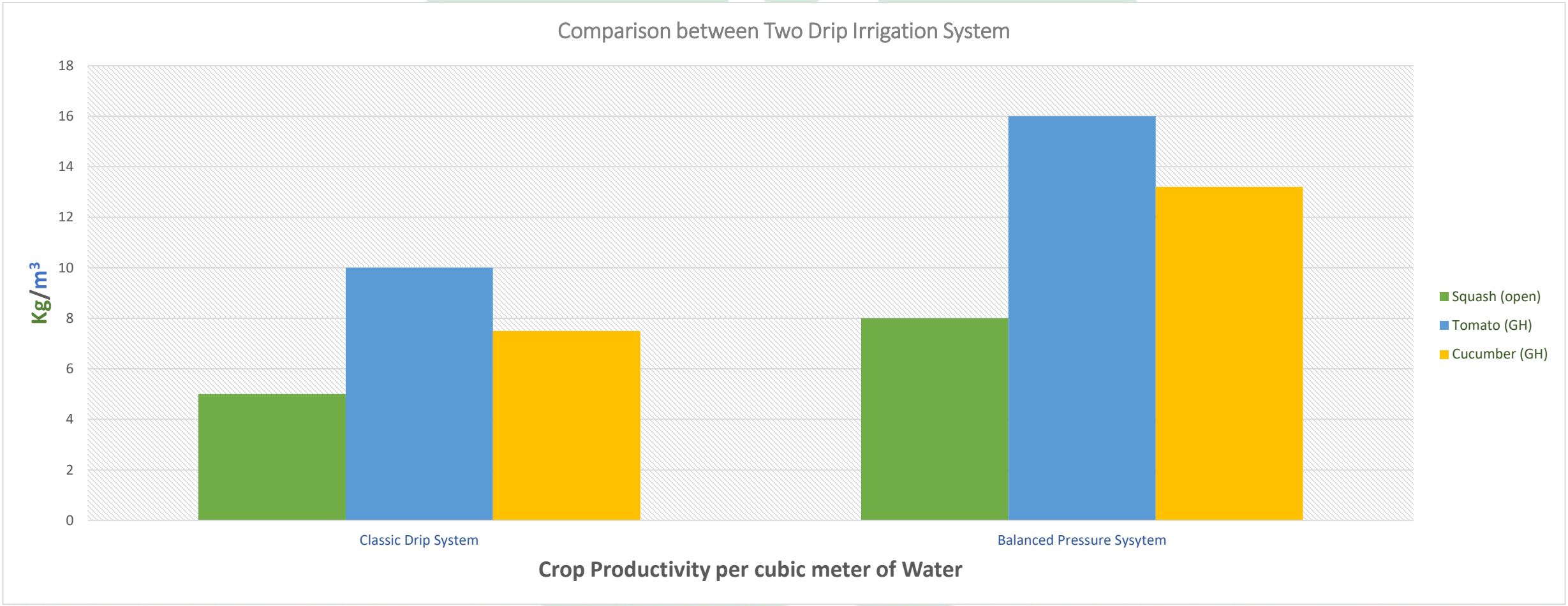
The total planted area with all crops (Open and Protected) are **690 Dunum** (50% under the classic drip irrigation system and 50% under the balanced pressure drip irrigation system) for one season. The results showed that crops grown under the classic drip irrigation system produced **2,634.3 tons/season**. While the crops produced under the new balanced pressure irrigation system were **3,140 tons/season**. So that productivity increased by **16.1 %** using the new irrigation system.
At the level of water consumption per crops under the classic drip irrigation system, was **247,015 m^3**; While the crops under balanced pressure irrigation system consumed **208,298 m^3**. Which means that the new system reduced water consumption by **15.67 %**.

	Old System	New System	Differences	Estimation Price (USD)	Saving (USD)
Water consumption (m3)	247,015	208,298	38,716 (m3)	0.5 USD/m3	19,358
Production (Ton)	2,634.3	3,140	505.7 (Ton)	1 USD/Kg	505,700
Total value of saved water/generated income per a planting season in USD=					525,058

Comparison between classic drip irrigation and balanced pressure drip irritation system

Item	Classic system	Balanced pressure system	Differences
Cost /dunum (open field)	165 USD	220 USD	+55 USD
Cost/dunum (greenhouse)	330 USD	440 USD	+ 110 USD
Operational life	3-5 years	5-7 years	+ 2 years
Production under open irrigated system /season (Squash)	2.5 tons	3.3 tons	+ 0.8 tons
Water consumption (Squash - open field)	500 m^3	415 m^3	- 85 m^3
Production under greenhouses /season (cucumber-JV)	4.5 tons	6.5 tons	+ 2 tons
Water consumption (cucumber - Greenhouse)	600 m^3	490 m^3	- 110 m^3
Production under greenhouses /season (Tomato-JV)	12 tons	16 tons	+ 4 tons
Water consumption (Tomato - Greenhouse)	1200 m^3	1000 m^3	- 200 m^3

Comparison between classic drip irrigation and balanced pressure drip irritation system/Palestine



WATER PRODUCTIVITY AT FIELD SCALE

- Difficult to measure WP accurately, ETa determinations still inaccurate (Sida/FAO project objective)
- Maximum wheat WP in the field in NENA countries has been found to be 14-15 kg/ha/mm, below the 20 kg/ha/mm
- There is a significant WP gap in wheat production (average values less than 50% of maximum potential)
- Increasing WP *per se*, is not enough. Must result in higher net income , higher employment, other societal benefits.
- Modification of modern system is a new gate for higher WP.