



Developing new wheat varieties tolerant to biotic and abiotic stresses to improve food security under climate change in Central Asia

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CC Conference
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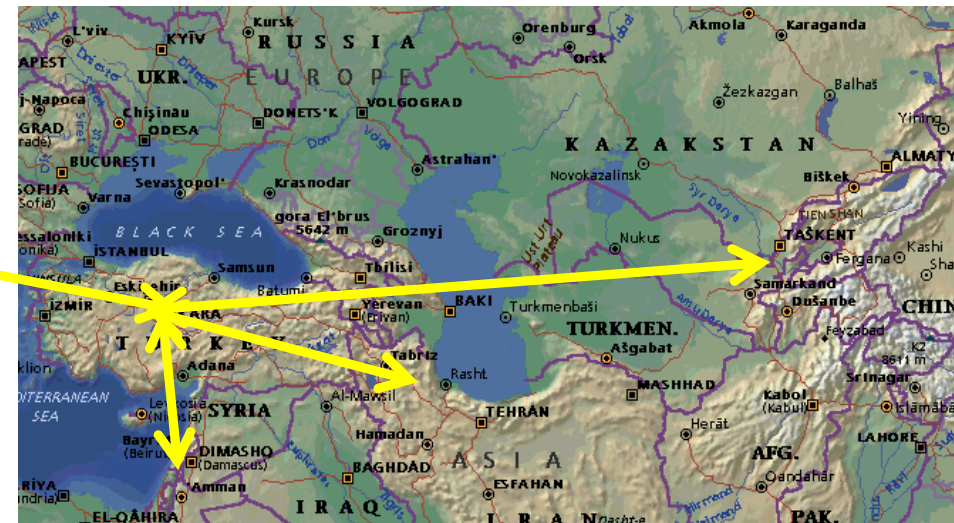
IWWIP History

- **1986 IWWIP: Turkey** and CIMMYT established joint winter wheat breeding program for the region based in Anatolian Plateau of Turkey.
- **1990 IWWIP: Turkey/CIMMYT/ICARDA**
ICARDA Highland Wheat Breeding Program joined IWWIP to establish a well integrated international breeding framework.



Current status

- Present framework
 - IWWIP-Turkey (crosses, segregating generations, trials, multiplication and international nursery distribution)
 - CIMMYT-Mexico (limited number of spring x winter crosses for spring wheat breeding)
 - ICARDA-Lebanon (crosses, segregating generations, trials, trait evaluation)
 - Iran (segregating populations exchange, trials)
 - ICARDA-Tashkent (segregating populations exchange, trials)



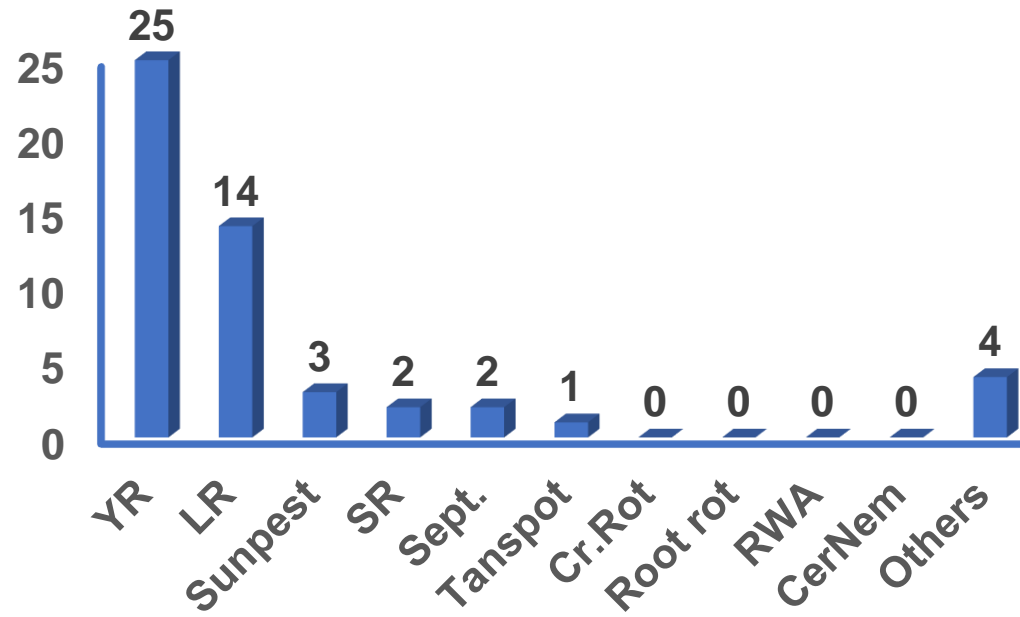
Target environments

Mega-environment	Yield, t/ha	Area, mln ha			
		Turkey	Iran	Central Asia	Total
Moderate cold full irrigation or high rainfall	>4.5	1	0.5	3	4.5
Moderate cold supplementary irrigation	2.0-4.5	3	1	1	5
Moderate cold semi-arid	<2.0	4	1	1	6
Severe cold rainfed	~3.0	0.2	0.2	0.2	0.6

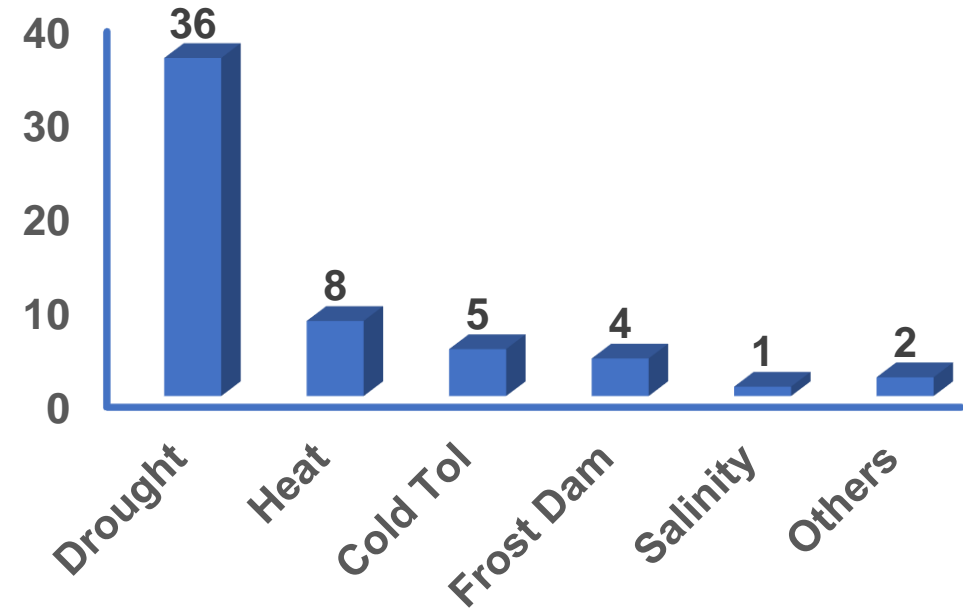
- **Spring growth habit:** no requirement for vernalization (exposure to low t.)
- **Facultative type:** weak requirement for vernalization
- **Winter growth habit:** strong vernalization requirements

The most Important Biotic and Abiotic stresses

The most Imp. Dis & Pest



The most Imp. Abiotic Stress



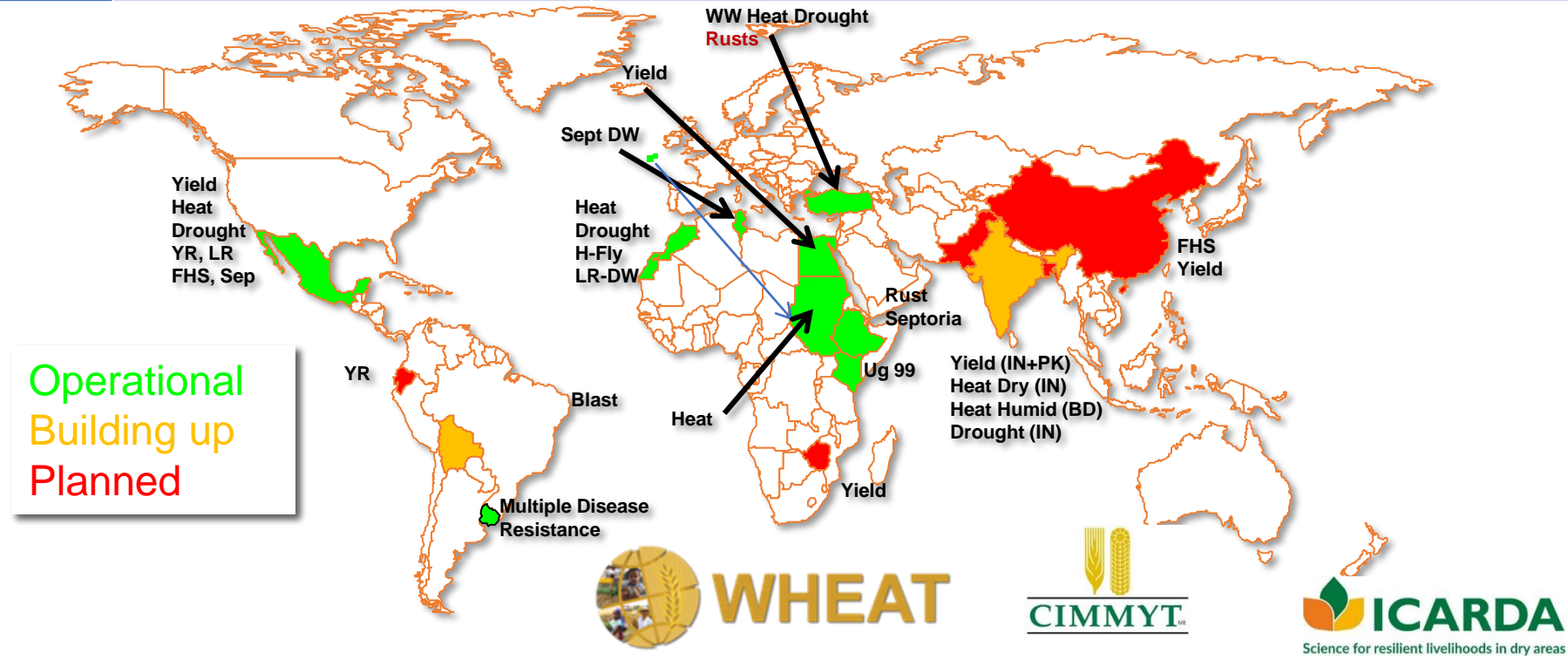
Research Institutes in Turkey contributing to the Turkey – CIMMYT – ICARDA International Winter Wheat Improvement Program



Germplasm movement

Generation	Entry	Breeding activity	Locations
F1 & F1TOP	1000	Discard poor crosses	Izmir
F2	800	Bulk, discard poor, select resistant to leaf rust and winter types	Edirne (high rainfall, cold, Leaf Rust)
F3	700	Individual spikes selections	Diyarbakir (Irr, heat, Yr)
F4	30,000	Head Rows	Eskisehir
F5	3,500	PYT: irrigated & semi-arid (unreplicated) & diseases	Eskisehir; Adapazari (LR); Izmir (Yr)
F6 - YT	1000	Replicated YT & diseases & quality	3-4 sites YT + 4-5 sites diseases
F7 - AYT	500	Replicated YT & multiplication & mol. Markers	5-6 sites
F8 – IN	200	Distribution outside	120 sites

Increased capacity for innovations in partner research organizations	3.4 CRP commodities enhanced engagement in joint lobbying for speeding-up release of improved varieties	fully operational, integrated network of 8-10 precision phenotyping platforms, information & germplasm exchange between NARS platforms	
		Sudan (heat): supply nurseries, Izmir (rust): isolates imported, Sidi El Aidi: (heat and drought): construction completed in 1 st quarter of 2019, field planting in autumn 2018	



Global **WHEAT** Program: Field-based Phenotyping Network

Lab and Offices



BSL3 Facility



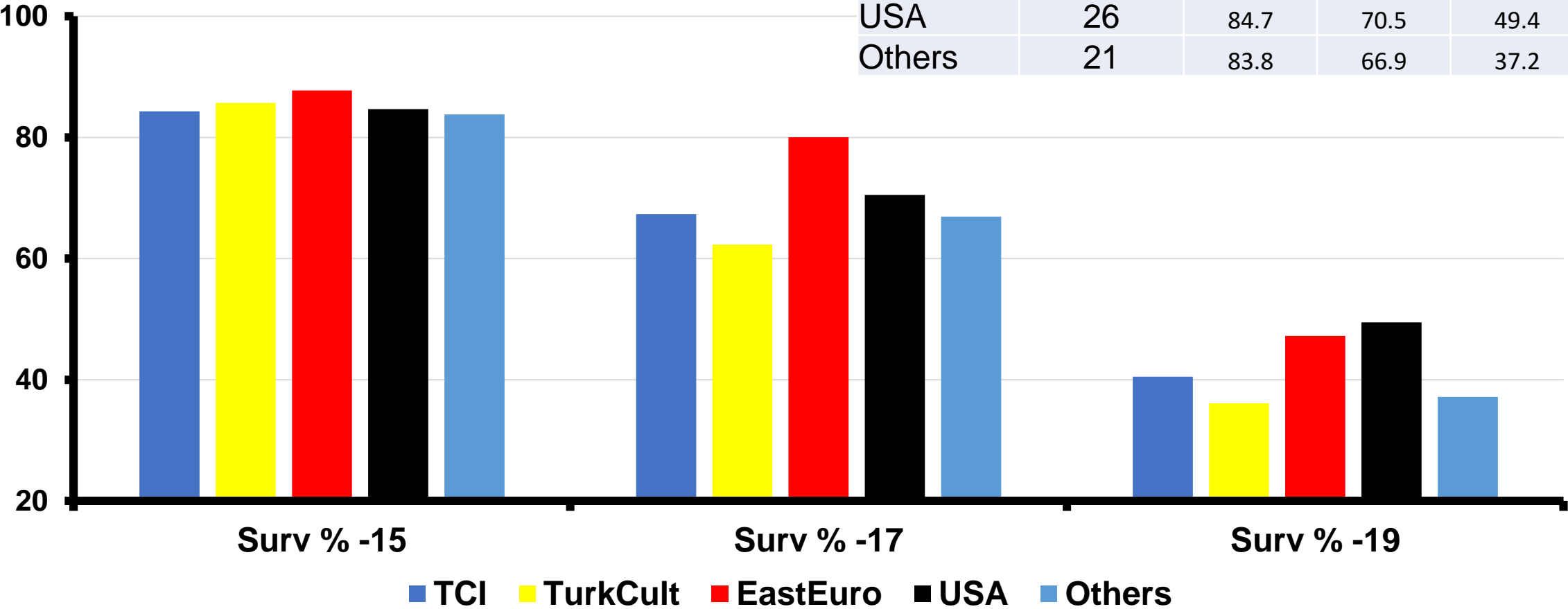
Field Work and training





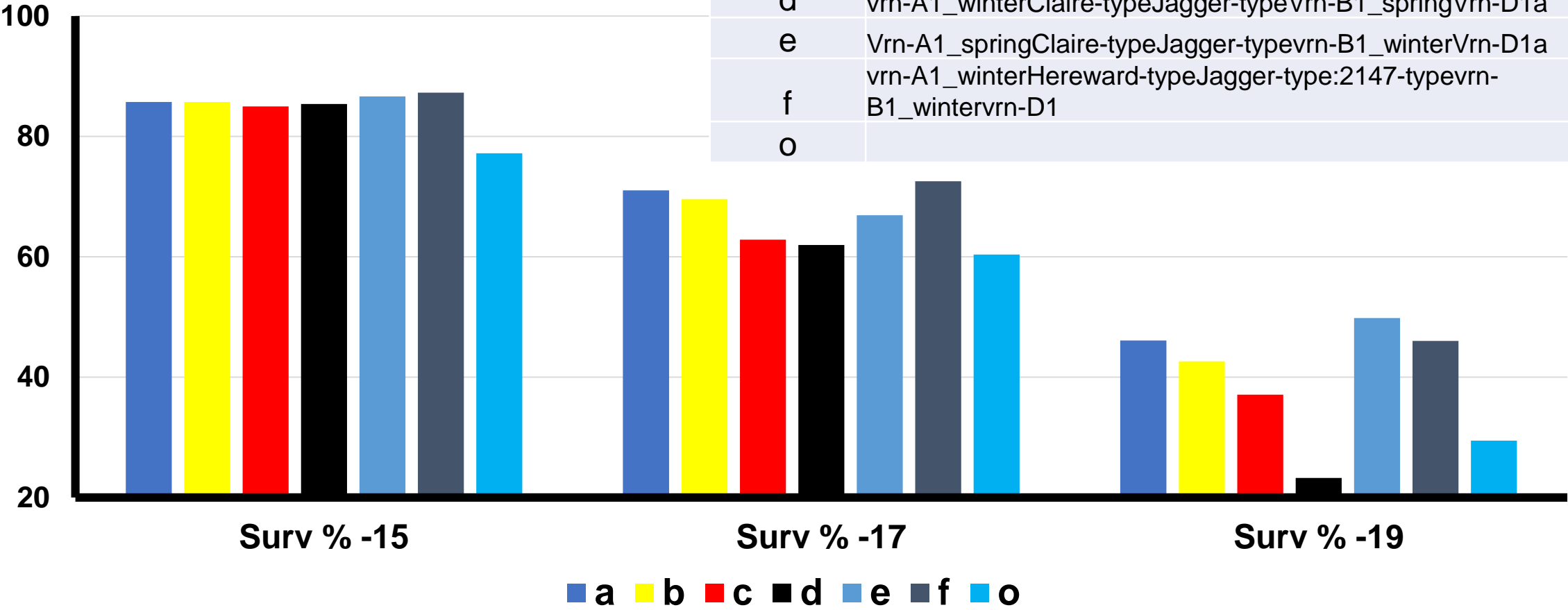
Cold Tolerance of different origins at different temperatures

GrName	no of Genotype	Surv % -15	Surv % -17	Surv % -19
TCI	127	84.3	67.3	40.5
TurkCult	18	85.7	62.3	36.1
EastEuro	9	87.7	80.0	47.2
USA	26	84.7	70.5	49.4
Others	21	83.8	66.9	37.2



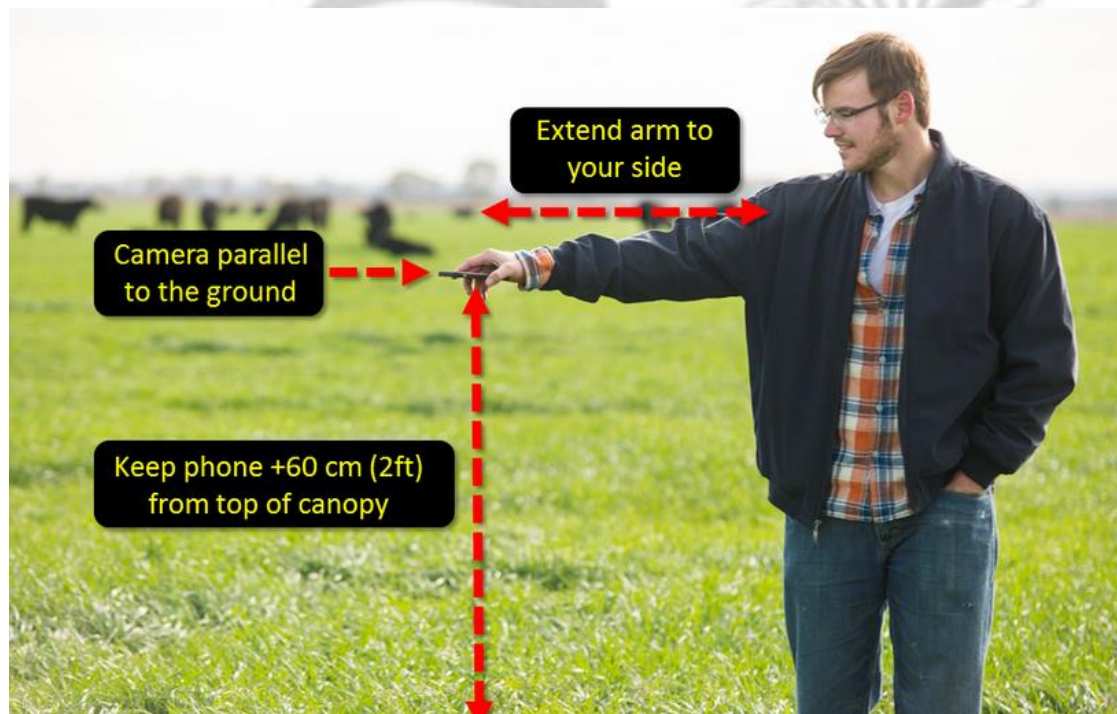
Vrn Comb vs Cold Surv

VrnGroup	Vrn Combinations	No of Ent
a	vrn-A1_winterHereward-typeJagger-type:2147-typevrn-B1_winterVrn-D1a	89
b	vrn-A1_winterHereward-typeJagger-type:2147-typeVrn-B1_springVrn-D1a	33
c	vrn-A1_winterClaire-typeJagger-typevrn-B1_winterVrn-D1a	24
d	vrn-A1_winterClaire-typeJagger-typeVrn-B1_springVrn-D1a	10
e	Vrn-A1_springClaire-typeJagger-typevrn-B1_winterVrn-D1a	9
f	vrn-A1_winterHereward-typeJagger-type:2147-typevrn-B1_wintervrn-D1	9
o		27



INCREASE SELECTION ACCURACY FOR THE DRYLANDS

PhenoApps: EARLY GROUND COVERAGE



CANOPEO

<http://canopeoapp.com/>

Early Ground Coverage in WFW (NDVI vs Yield)

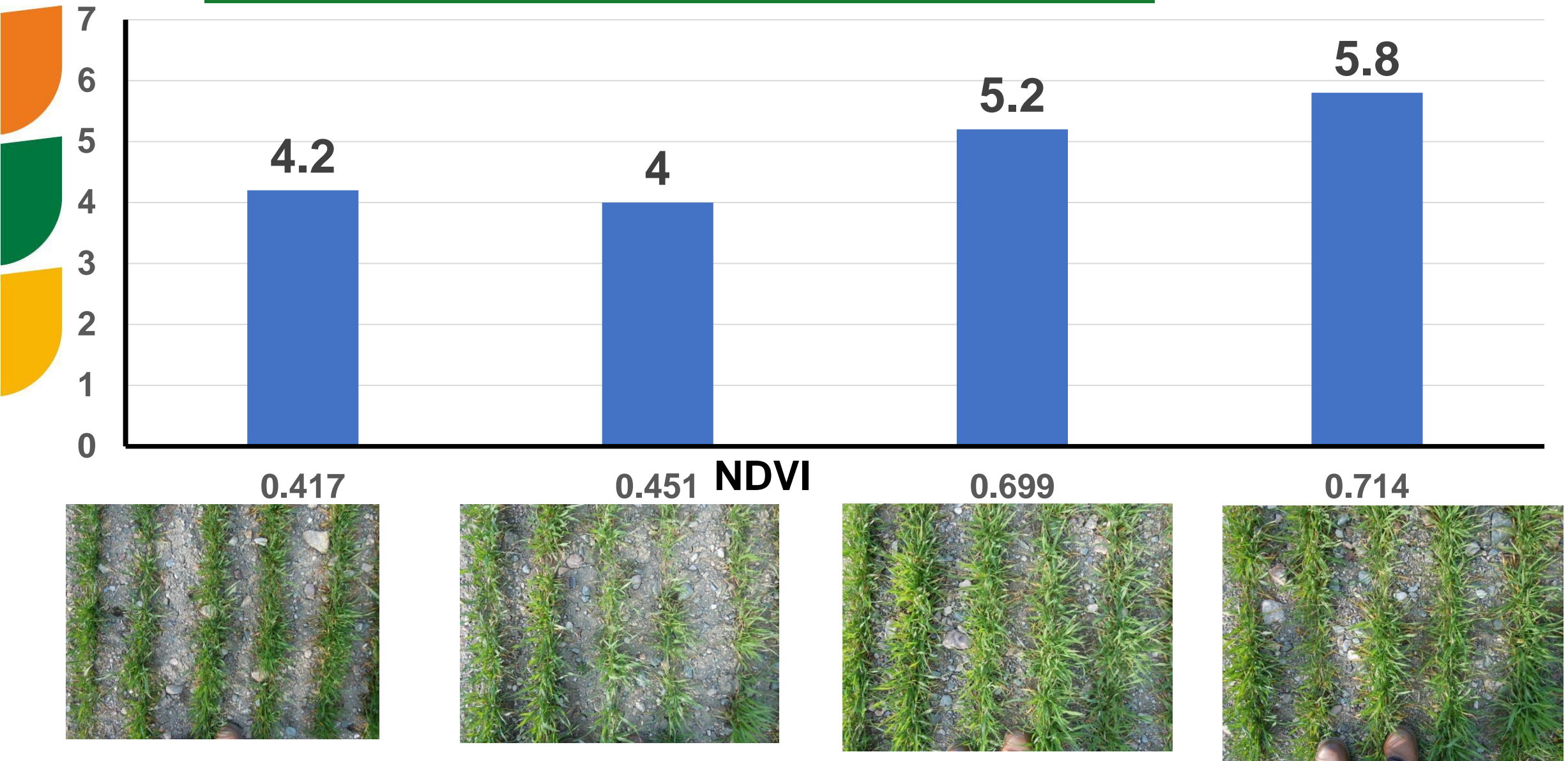
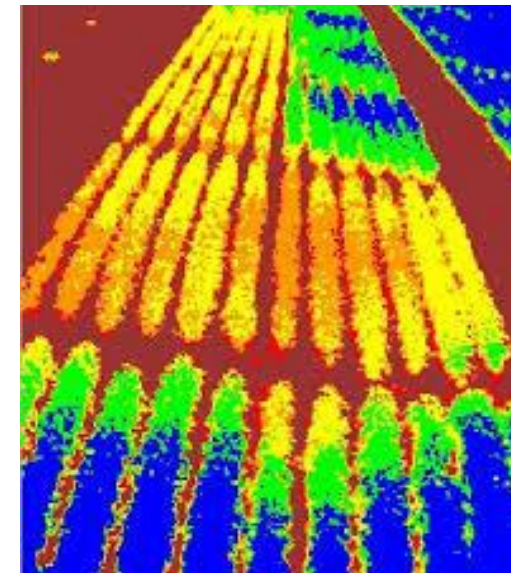
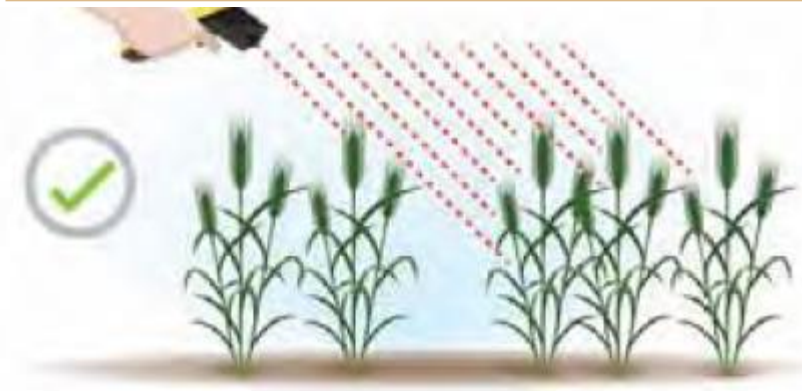


Table 1: An overview of wheat phenotyping techniques.

Canopy Temperature (°C)

Measurement	Physiological trait/s	Reason to measure trait	Advantages of tool	Disadvantages of tool
1. Canopy temperature	Evaporative cooling from the canopy surface.	Linked to many physiological factors: stomatal conductance, plant water status, roots and yield performance under a range of environments.	Integrative; quick, easy and cheap to measure; non-destructive; remote.	Sensitive to environmental fluxes; interaction with time of day and phenology.



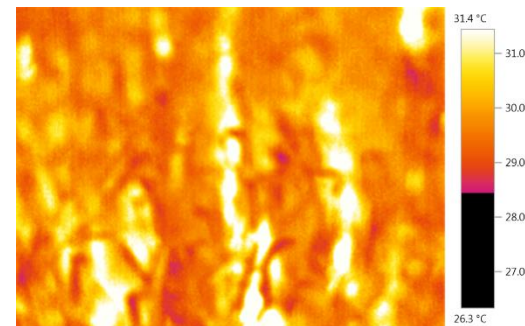
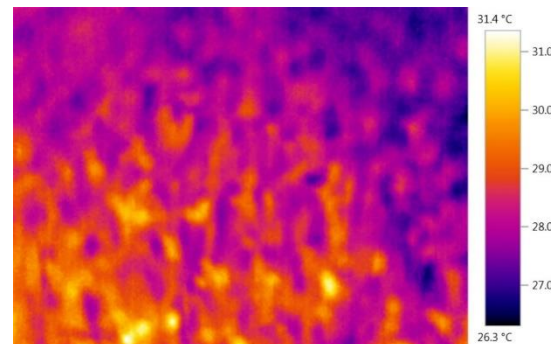
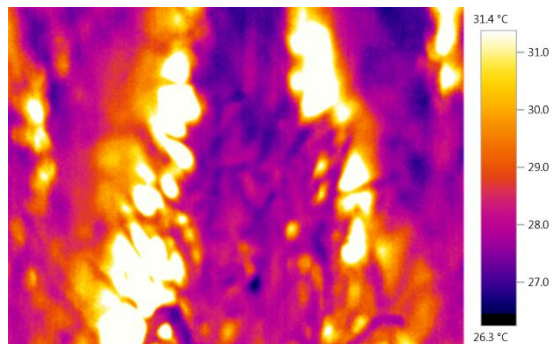
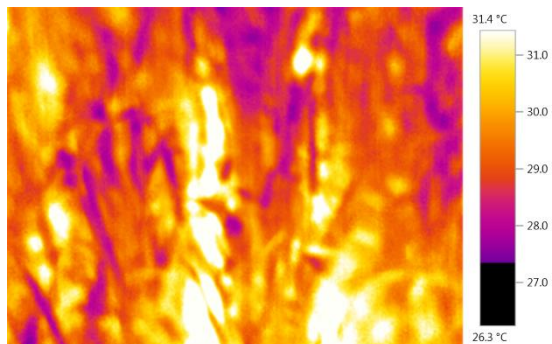
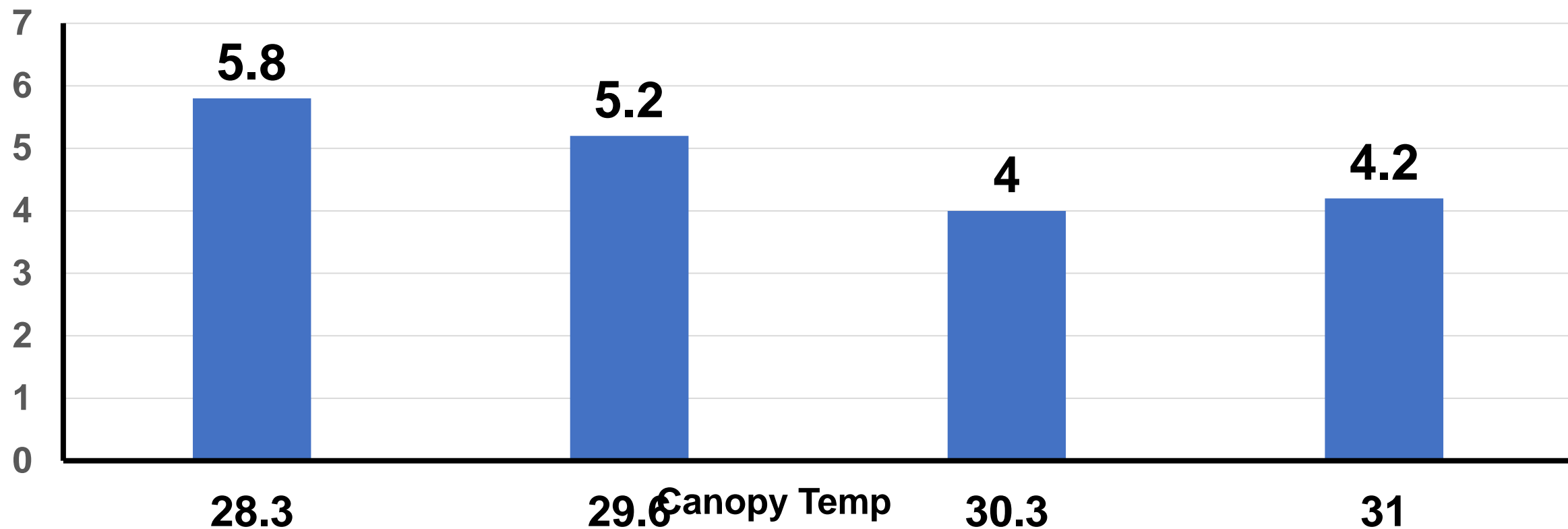
Stage: Flag leaf and next to anthesis

When: the hottest time of day (noon time)

Testo thermal cam

Canopy Temperature : Well irrigated plants have lower temperatures than ambient air because of evaporative cooling. Low canopy temperature indicates more stomatal conductance and generally good adaptation (Reynolds *et al.*, 2001). Canopy temperature is measured with an infrared thermometer. Measure when the plant surfaces are dry (i.e. without dew) and when the sky is clear and wind low, at an angle of 30°, 30 cm above canopy.

Canopy Temperature vs Yield in WFW



International Nursery Dist. 2018-2019



No	Nursery	# of Entry	Gr	Distributed
1	26FAWWON-Irr	208	20	89
2	26FAWWON-SA	105	20	66
3	22IWWYT-IR	40*2	140	48
4	21IWWYT-SA	40*2	150	43
Total				246

32 Countries
74 Programs



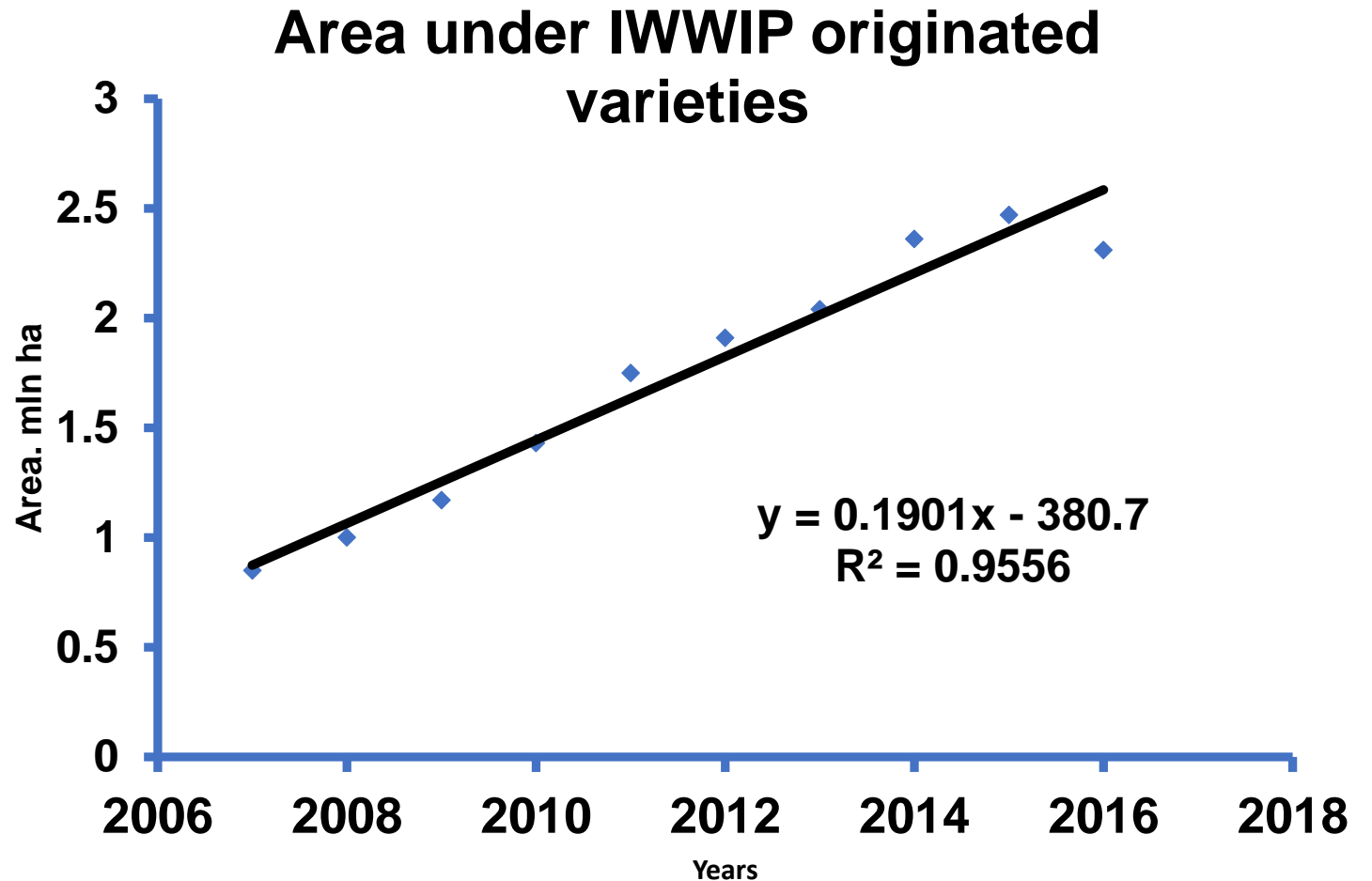
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**246
boxes**



W/F Wheat varieties from IWWIP released in the region

Country	Varieties released
Afghanistan	6
Armenia	4
Azerbaijan	4
Georgia	6
Iran	9
Kazakhstan	2
Kyrgyzstan	9
Tajikistan	5
Turkey	35
Turkmenistan	3
Uzbekistan	3
Total	86



Highest yield lines of winter wheat in Karshi-Uzbekistan: 2018

Entry	Name	Seed color	YR, rep-1	YR, rep-2	YR, rep-3	GY, t/ha	TKW (g)
35	UZ23FAWIR-37	White	30 MR	30 MR	40 MR	10.14	48.91
31	UZ15PC-295	White	10 MR	10 MR	10 MR	9.881	44.29
20	UZ15PC-58	Red	30 MR	35 MR	40 MR	9.729	46.28
49	KRBW17-12	White	10 MR	5 MR	5MR	9.696	40.25
47	KRBW17-10 (New Variety)	Red	10 MR	10 MR	0 MR	9.62	44.31
43	KRBW17-6	Red	25 MR	20 MR	25 MR	9.563	48.71
5	KR15-9808 (New Variety)	Red	10 MR	10 MR	10 MR	9.523	42.05
3	Gozgon (CK)	Red	R	5R	R	9.362	42.08
4	Yaksart (CK)	Red	10 MR	5 MR	10 MR	9.063	40.75
2	Buniyodkor (CK)	White	10 MR	20 MR	10 MR	8.885	45.2
1	Krasnodar-99 (CK)	Red	100 S	95 S	90 S	8.087	39.55
LSD _{0.05}						0.5295	2.664
CV(%)						2.57	2.65



Adoption and Impact studies in Tajikistan and Kyrgyzstan

Preliminary study description and findings
January 2019

Study team (Aziz Karimov et al)



Tajikistan

- Survey in three provinces (**Khatlon, Sugd** and Districts of Republican Subordination (DRS)) of Tajikistan in the 2016/17.
- Chosen **6 districts**, **115** wheat growing **farm** households in each district; **5-9 villages** in each district
- The **top-10** varieties cultivated about **92%**, Most of them **3-16 years old**, released before 2002 and 2014
- The **top 3** varieties are **Basribey, Alex** and **Krasnodar** which accounts **60.3%** of all Tajik farmers.
- Five varieties (**Alex, Ormon, Norman, Chumon and Shokiri**) originated from the **IWWIP** and cultivated **27.1 %**.
- Alex was released in 2007, Chumon released in 2011 and Shokiri released in 2015
- The achievement by the IWWIP varieties is encouraging. Expected higher adoption in the future especially for the most recent varieties

- 
- In 2017, The **survey** with 700 households from **Osh, Chuy and Issyk-Kul** provinces; account about **80% of the cultivated area** of wheat.
 - In the 2017/2018 season, many farmers **began to grow barley**. Like in; Chuy oblast, in the Zhayilsky and Sokuluk districts.
 - The most widely grown varieties are;
 - **Osh**; Intensiv (32%), Kayrak (17%), Zubkov (8%), Krasnovodopodskaya210 (6%), Aidar Manyz (6%)
 - **Chuy**; Intensiv (56%), Bezostaya1 (12%), Krasnodarsky (7%)
 - **Issyk-Kul**; Kazakhstan10 (53%), Bezostaya 1 (20%), Intensiv (12%)
 - Many farmers first **learned** new varieties from **relatives, friends** and other **farmers** (78%), **market** (8%), **farmer groups** (6%).
 - Most varieties are grown mainly from 2008 until now. **Cultivation** years of a variety is **4-7 years**.
 - Farmers mainly use their own seeds. In all three oblasts in 2017/2018 compared to 2016/2017, **own seed usage increased**.

Human Resource Development

Year	# of Trainee from CAC	Place	# of Partic. Trav. Sem.	Place
2007	3	Turkey	50	Turkey
2008	5			
2009			45	Ukraine
2010	3	Turkey		
2011	3	Turkey	46	Bulg.-Rom.
2012	5	Turkey		
2013	2	Turkey	45	Uzbekistan
2014	2	Turkey		
2015	2		48	Az.-Georgia
2017	2	Russia	74	Russia
2018	3	Turkey	54	Turkey
Total	30		372	



Turkish Juniouir Scientists
Training (2007-2018)

Place	# of trainee
CIMMYT HQ	9
ICARDA HQ	5
Turkey-ICARDA Rust Center	20
Kenya, BGRI	6
Total	43
Eng. Course (2007-19)	873

Winter Wheat Traveling Seminar 11-12 May 2012, Uzbekistan

Thank you...

Questions???

