Spring Bread Wheat Breeding at ICARDA

Research highlights for 2013/14 season

W. Tadesse, M. Sanchez, Q. Sohail, A. Abdellat, A.Sherif, S. Tawkaz

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ICARDA
Science for Better Livelihoods in Dry Areas

List and highlights of major activities carried out in 2013/2014

1. Crosses:

- A total of 2000 simple and top crosses have been made at Terbol

2. Evaluation of segregating generations

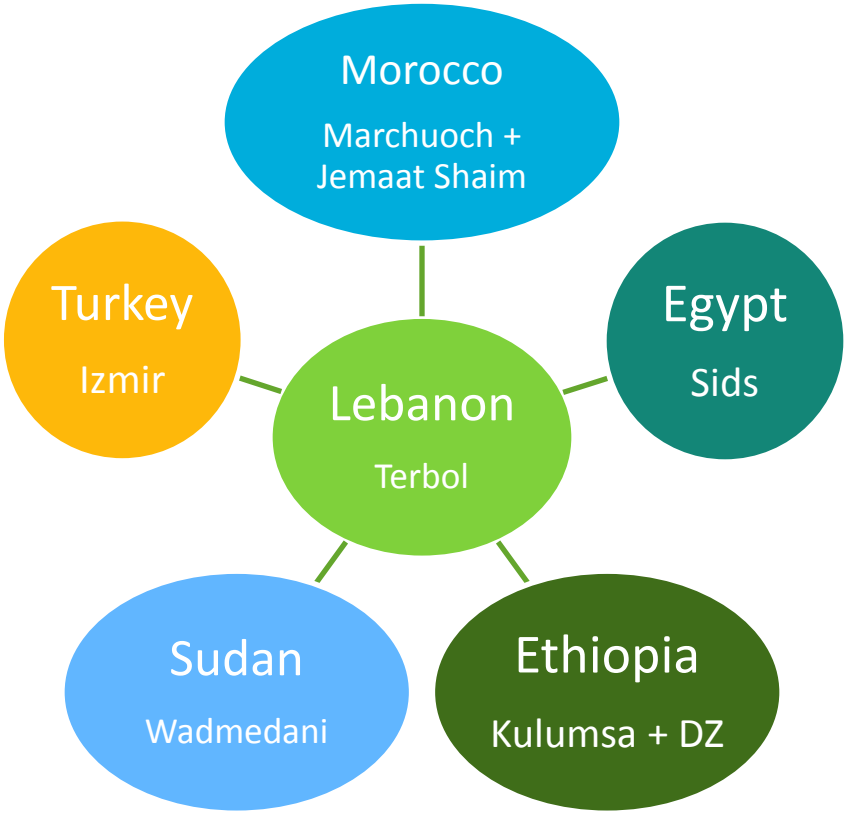
- This has been carried out using the Terbol-Kulumsa shuttle

3. Yield trials:

PYTs and AYTs have been tested at Marchuch & Jammat Shaim (Morocco); Terbol (Lebanon), Sids (Egypt); Wadmedani (Sudan)

4. Genotyping:

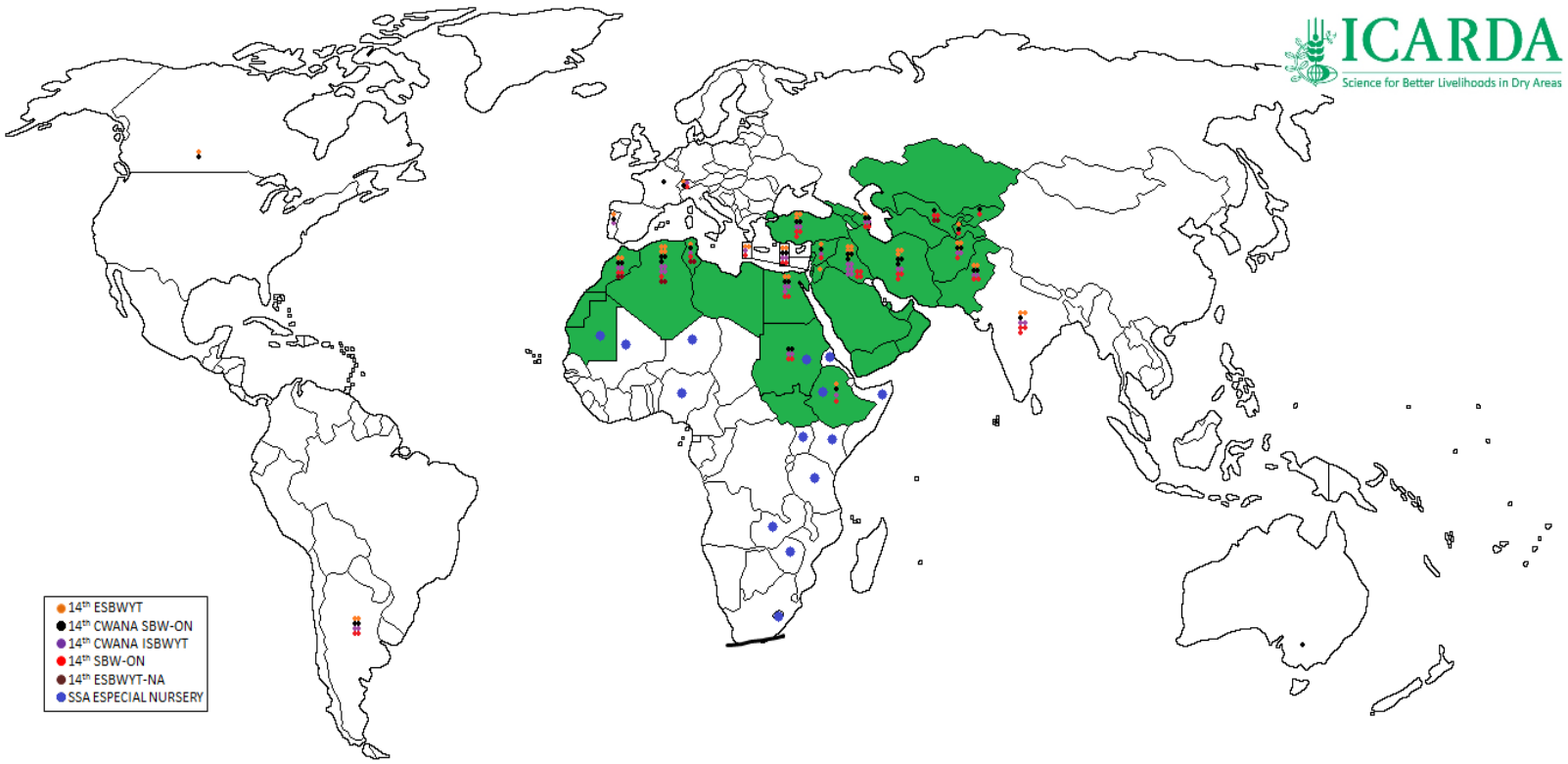
All the AYTs have been genotyped using 15 K SNP



Distribution of International Nurseries and Yield Trials

The following International nurseries and yield trials have been distributed from Terbol station, Lebanon to more than 40 countries in the CWANA region and beyond up on request from the NARS .

1. Spring bread wheat observation nursery for CWANA (15th CWANA SBWON)
2. Spring bread wheat observation nursery for heat tolerance (15th SBWON HT)
3. Spring bread wheat yield trial for irrigated environments (15th CWANA ISBWYT)
4. Spring bread wheat yield trial for dry-land environments (15th CWANA DSBWYT)
5. Elite spring bread wheat yield trial (15th ESBWYT)
6. Especial nursery for 12 countries in Sub Saharan Africa (AfDB project)
7. CAIGE nursery for 2015



Geographic distribution of ICARDA s' spring bread wheat international nurseries, 2014/15

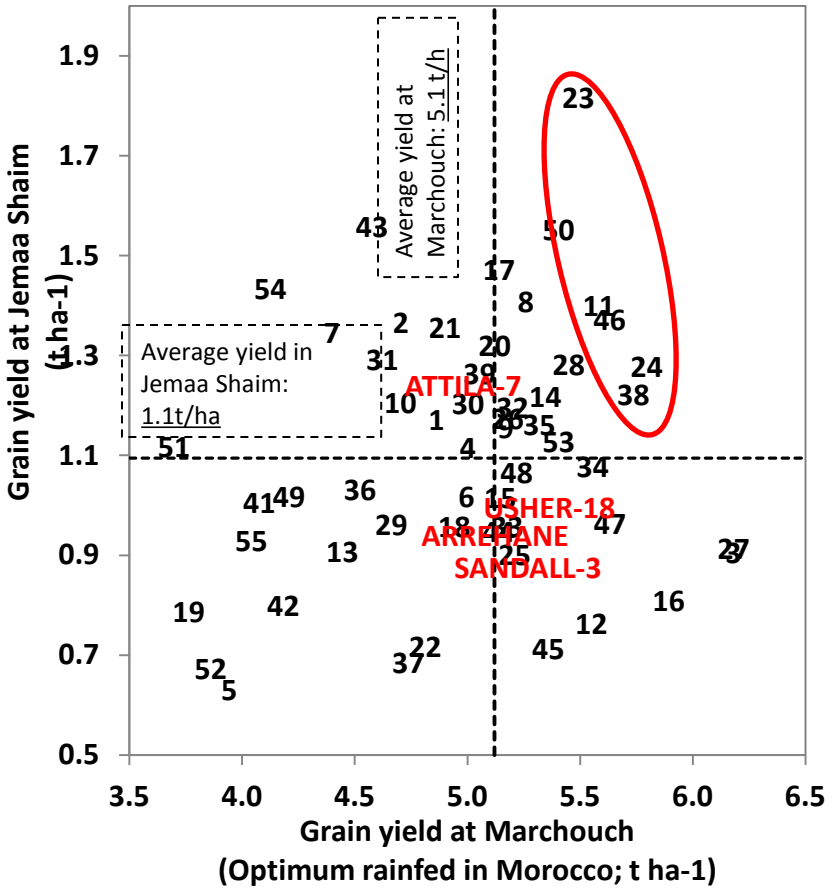
Germplasm Performance

Agronomic performance of the top 20 high yielding synthetic derived wheat genotypes at Merchouch, Morocco, 2013/14

Name	Days to heading	Plant height (cm)	Yelow rust severity	1000 seed weight (gm0	Yield (t/ha)
NEJMAH-11	108	90	10MR	44	8.2
NEJMAH-8	108	85	10MR	43	7.4
NEJMAH-12	108	85	15MR	45	7.1
TAJ-1	107	100	40S	42	7.1
SHIHAB-8	109	95	5R	50	7.1
NEJMAH-19	109	85	10MR	45	6.9
MUNIA//CHEN/ALTAR 84/3/CHEN/AEGILOPS SQUARROSA (TAUS)//BCN	103	100	5R	46	6.7
SHIHAB-4	109	100	5R	55	6.7
SHIHAB-20	109	90	10MR	43	6.7
NEJMAH-17	108	90	5R	42	6.6
NEJMAH-20	108	90	10MR	44	6.6
NEJMAH-21	107	100	10MR	42	6.6
BEDER-5	107	90	10MR	39	6.6
SHIHAB-13	108	100	20MS	48	6.4
SHIHAB-19	108	100	5R	46	6.3
NEJMAH-6	108	85	5R	44	6.3
CROC-1/AE.SQUARROSA (205)//KAUZ/3/SASIA	107	85	5R	41	6.1
SHAMIEKH-1	110	95	5R	44	6.1
NEJMAH-26	108	90	5R	45	6.1
NEJMAH-18	114	90	5R	47	6.1
QAMAR-4	107	95	5R	39	6.0
Attila-7 (check)	108	95	5R	38	4.8

Selected high yielding genotypes combining yield potential and drought tolerance at Merchouch and Jemaa Shaim stations in Morocco, 2013/14

Var	Pedigree
23	JAWAHIR-1/3/PASTOR/SERI//PFAU
24	JAWAHIR-1/3/PASTOR/SERI//PFAU
46	JAWAHIR-1/3/PASTOR/SERI//PFAU
11	SHUHA-4//NS732/HER/3/QAFZAH-33
38	JAWAHIR-1/3/PASTOR/SERI//PFAU
50	JAWAHIR-1/3/PASTOR/SERI//PFAU
28	JAWAHIR-1/3/PASTOR/SERI//PFAU
16	SHUHA-4//NS732/HER/3/MILAN/DUCULA
	USHER-18
	ATTILA-7
	SANDALL-3
	ARREHANE

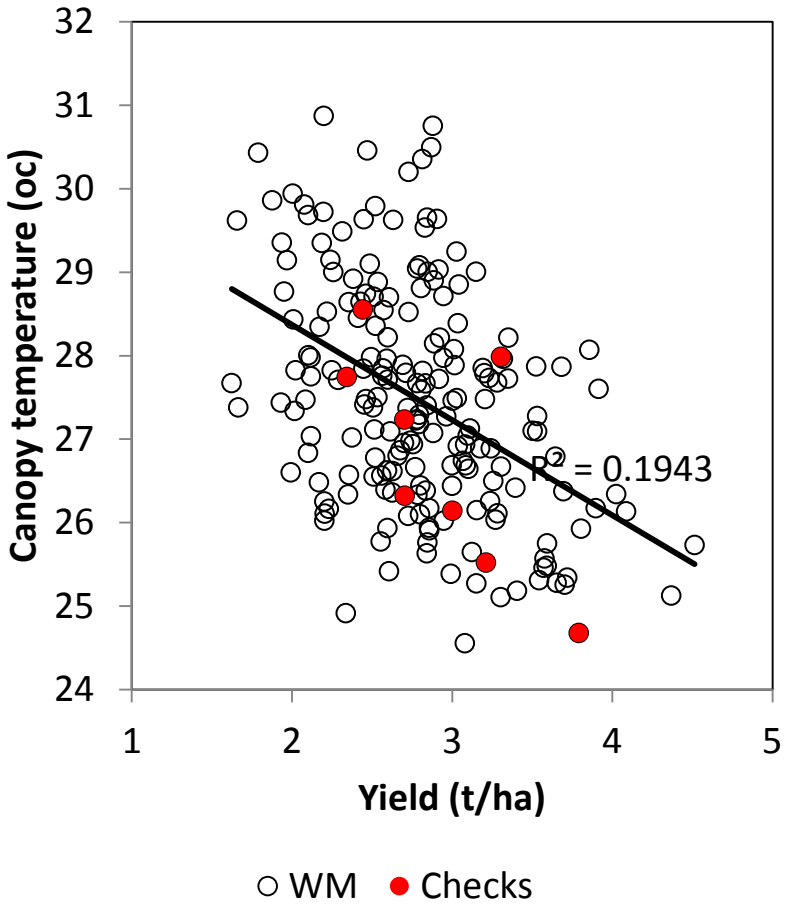


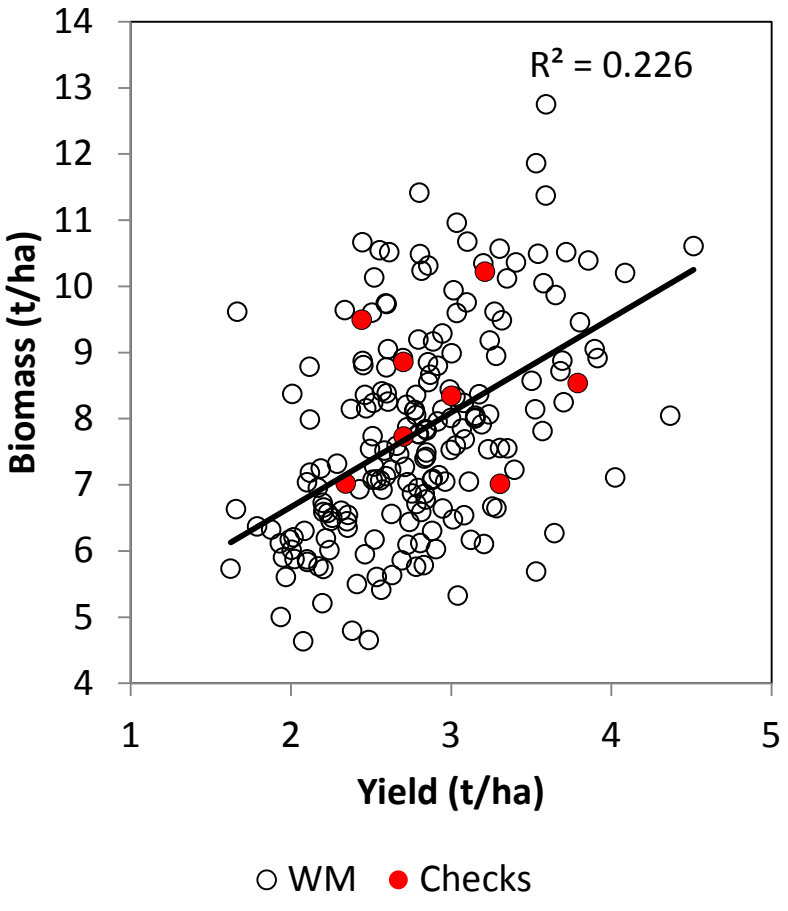
Mean grain yield level (t/ha) of selected elite bread wheat genotypes at 5 locations in Egypt, 2013/14

Pedigree	Yield (t/ha)					
	Average	Gemmeiza	Kom-Ombo	Matana	Sakha	SIDS
FLORKWA-2/6/SAKER'S'/5/RBS/ ANZA/3/KVZ/HYS //YMH/TOB /4/BOW'S'/7/DAJAJ-6	9.1	8.9	8.7	10.8	8.2	8.7
KAUZ'S'/SERI/4/CHEN/AEGILOPS SQUARROSA (TAUS)//FCT/3/STAR	9.0	8.6	10.6	12.2	6.3	7.4
BOUSHODA-1/4/SHUHA-2/3/BOW'S'/NKT'S'//TEVEE'S'	8.8	9.2	8.4	10.4	8.9	7.1
KASYON/GENARO 81//TEVEE-1/../4/CHEN /AEGILOPS SQUARROSA (TAUS) //BCN/3/KAUZ	8.6	8.5	8.7	9.7	8.5	7.7
SERI 82/SHUHA'S'//GRU90-204782/3/MUNIA/CHTO//MILAN	8.5	8.7	9.1	9.0	8.0	8.0
ATTILA 50Y//ATTILA/BCN/3/ STAR*3/MUSK-3	8.5	8.0	8.8	9.0	8.2	8.6
ATTILA 50Y//ATTILA/BCN/3/ STAR*3/MUSK-3	8.5	8.0	9.7	8.9	7.8	8.1
ATTILA 50Y//ATTILA/BCN/3/ STAR*3/MUSK-3	8.4	7.9	8.6	10.2	7.7	7.8
ATTILA 50Y//ATTILA/BCN/3/ STAR*3/MUSK-3	8.4	7.4	8.2	9.2	8.4	8.7
KAUZ//ALTAR 84/AOS 3/KAUZ/3/CATBIRD-10	8.4	8.3	11.1	7.3	7.8	7.4
KAUZ'S'/SERI/4/CHEN/AEGILOPS SQUARROSA (TAUS)//FCT/3/STAR	8.3	8.3	7.2	11.9	7.0	7.4
VEE7/KAUZ/9/CHUM/8/7*BCN	8.3	8.4	8.8	9.3	7.3	7.6
SERI.1B*2/3/KAUZ*2/BOW//KAUZ/4/KAUZ/FLORKWA-1	8.2	8.3	8.4	9.6	7.7	7.1
KAUZ//MON/CROW?S?/3/VEE/PJN//2*KAUZ	8.2	8.0	7.3	10.7	7.7	7.6
ATTILA 50Y//ATTILA/BCN/3/ STAR*3/MUSK-3	8.2	7.9	8.6	9.4	7.5	7.5
WEAVER/WL 3928//SW 89.3064/3/KAUZ//MON/CROW'S'	8.2	8.0	9.0	8.6	7.5	7.7
SERI.1B*2/3/KAUZ*2/BOW//KAUZ/4/TEVEE'S'/BOBWHITE #1	8.2	8.0	9.4	9.2	5.9	8.4
KATILA-15//MNCH/3*BCN	8.1	7.7	8.7	10.4	6.7	6.9
SERI 82/SHUHA'S'//GRU90-204782/3/MUNIA/CHTO//MILAN	8.1	8.3	6.9	9.5	8.3	7.4
DEBEIRA/4/KAUZ//ALTAR 84/AOS/3/KAUZ	8.0	7.7	10.5	9.1	6.2	6.7
Misr-1 (Check)	8.0	7.8	7.0	9.8	7.9	7.7
DEBEIRA (Check)	8.0	8.1	8.5	10.9	5.6	7.0
ATTILA-7 (check)	8.0	7.8	8.0	8.7	7.9	7.6

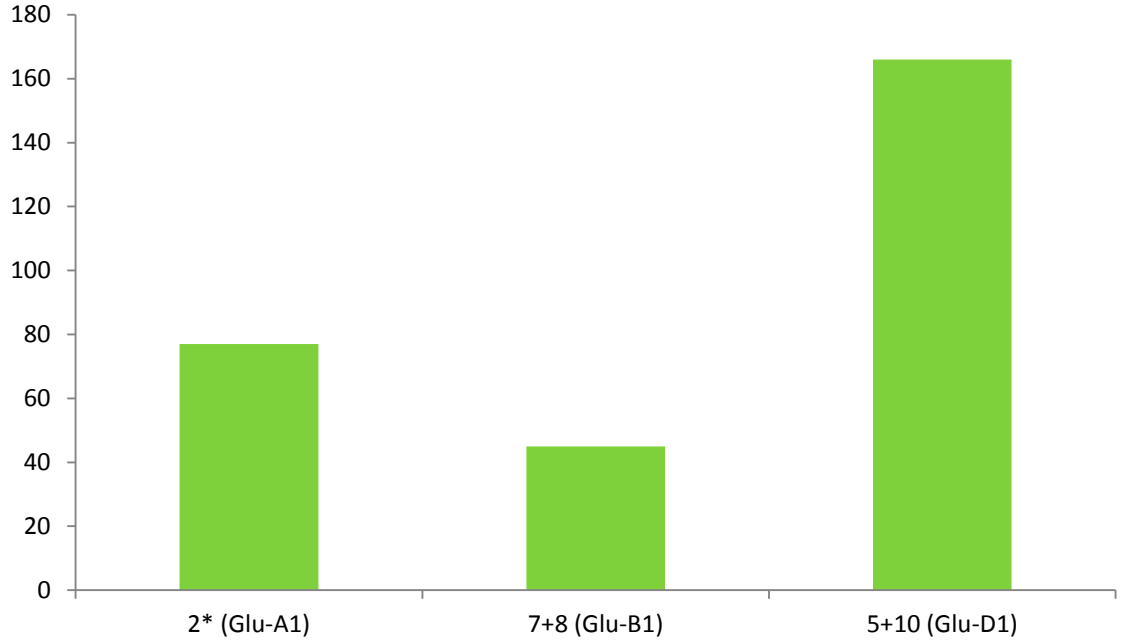
Grain yield performance of elite SBW genotypes at Merchouch (Morocco) and Wadmedani (Sudan), 2014				
Pedigree	Selection History	Marchouch	Wad Madani	Average
SERI.1B//KAUZ/HEVO/3/AMAD/4/ATTILA//PSN/BOW/3/ATTILA/5/KAUZ'S'/SHUHA-15	ICW06-50236-11AP-0AP-0AI	8.8	3.1	5.9
SERI 82/SHUHA'S'//GRU90-204782/4/PASTOR/3/KAUZ*2/OPATA//KAUZ	ICW05-0528-9AP-0AP-0AP-5	7.6	3.3	5.5
HUBARA-7/4/PASTOR/3/KAUZ*2/OPATA//KAUZ	AISBW05-0397-1AP-0AP-0AI	7.3	2.6	5.0
KAUZ//ALTAR 84/AOS/3/MILAN/DUCULA	AISBW05-0103-7AP-0AP-0AI	7.3	3.1	5.2
KAUZ//MON/CROW?S?/3/VEE/PJN//2*KAUZ	ICW05-0512-18AP-0AP-0AP-	7.2	3.5	5.4
GIRWILL-13/2*PASTOR-2	ICW03-20004-9AP-15AP/0T	7.1	3.0	5.0
CHILERO-1/4/VEE'S'/3/HORK/4MH//KAL-BB/5/PFAU/MILAN	ICW05-0634-11AP-0AP-0AP-	7.1	3.5	5.3
HUBARA-5/5/CHEN/AEGILOPS SQUARROSA (TAUS)//BCN/3/VEE#7/BOW/4/PASTOR	AISBW05-0420-8AP-0AP-0AI	7.1	3.1	5.1
VEE/PJN//2*KAUZ/3/SHUHA-4/FOW-2	ICW06-00166-10AP-0AP -1	7.0	3.0	5.0
ATTILA*2/PBW65//PFAU/MILAN	ICW05-0450-1AP-0AP-0AP-1	7.0	3.2	5.1
SERI 82/SHUHA'S'//GRU90-204782/3/MUNIA/CHTO//MILAN	AISBW05-0252-1AP-0AP-0AI	6.9	3.5	5.2
KAUZ//ALTAR 84/AOS 3/KAUZ/3/SHUHA-4//NS732/HER/4/QAFZAH-33	ICW06-50344-3AP-0AP-0AP	6.8	3.1	5.0
QAFZAH-23/SOMAMA-3//GOUMRIA-3	ICW04-20130-6AP-0AP-0AP-	6.8	3.6	5.2
VEE7/KAUZ//PFAU/MILAN/3/MILAN/PASTOR	ICW06-50253-3AP-0AP-0AP	6.7	3.1	4.9
BOUSHODA-1/5/CHEN/AEGILOPS SQUARROSA (TAUS)//BCN/3/VEE#7/BOW/4/PASTOR	AISBW05-0315-4AP-0AP-0AI	6.7	3.2	4.9
SHIHAB-16	CMSS97M00652S-0B-0AP-1/	6.6	3.8	5.2
PASTOR-2/HUBARA-5	ICW04-0037-4AP-0AP-0AP-3	6.6	4.2	5.4
YMI #6/GEN//TIA.1/3/VEE#5//DOVE/BUC/4/MILAN/PASTOR	ICW05-0527-5AP-0AP-0AP-2	6.5	3.5	5.0
WEAVER/WL 3928//SW 89.3064/3/SOMAMA-3/4/BOW/PRL//BUC/3/WH576	ICW06-50235-9AP-0AP-0AP	6.2	3.9	5.0
KAUZ'S'/FLORKWA-1//GOUMRIA-3	ICW04-0160-5AP-0AP-0AP-5	6.1	3.8	5.0
ATTILA	CHECK	6.0	3.8	4.9
DEBIRA	CHECK	5.5	3.1	4.3
HIDDAB	CHECK	4.9	2.7	3.8
Average		6.6	3.3	4.9
CV (%)		9.6	18.2	12.3
SED (t/ha)		0.6	0.4	0.4

Correlation of yield with biomass and canopy temperature in 200 elite genotypes at Wadmedani, Sudan, 2014

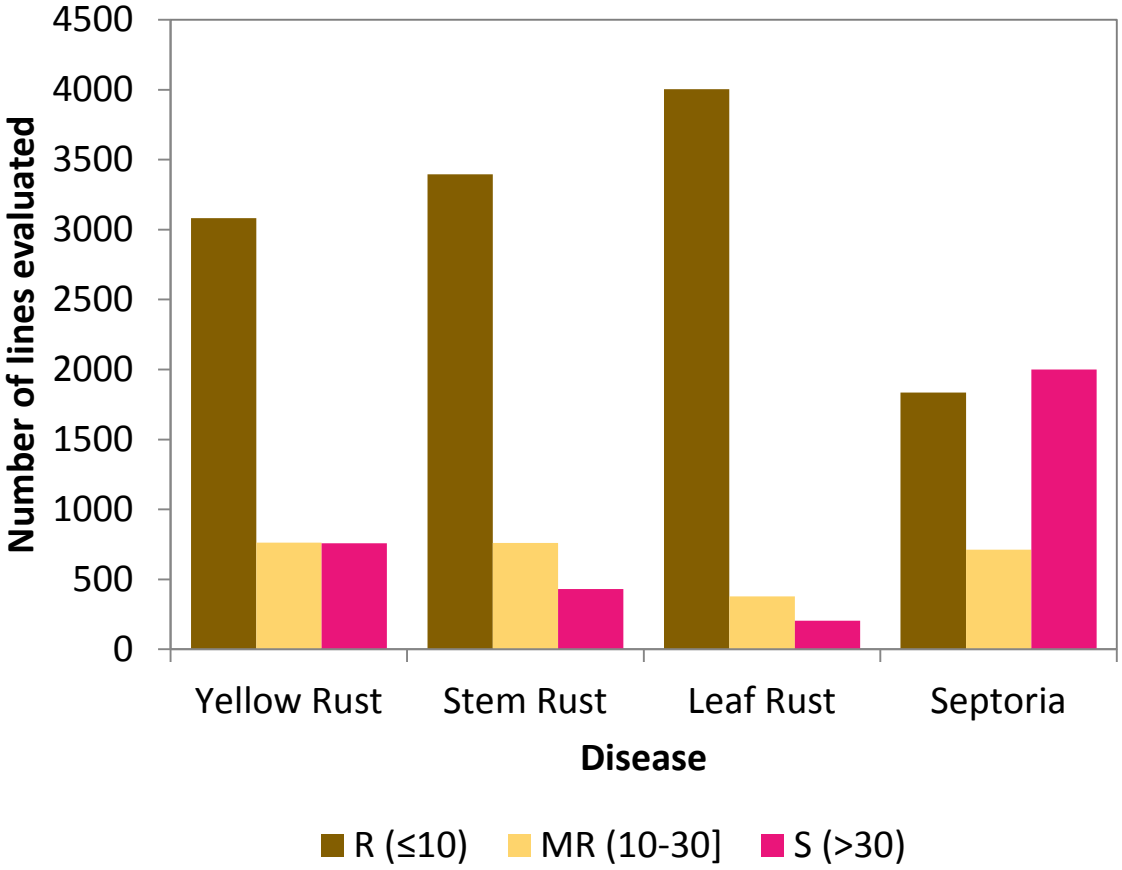




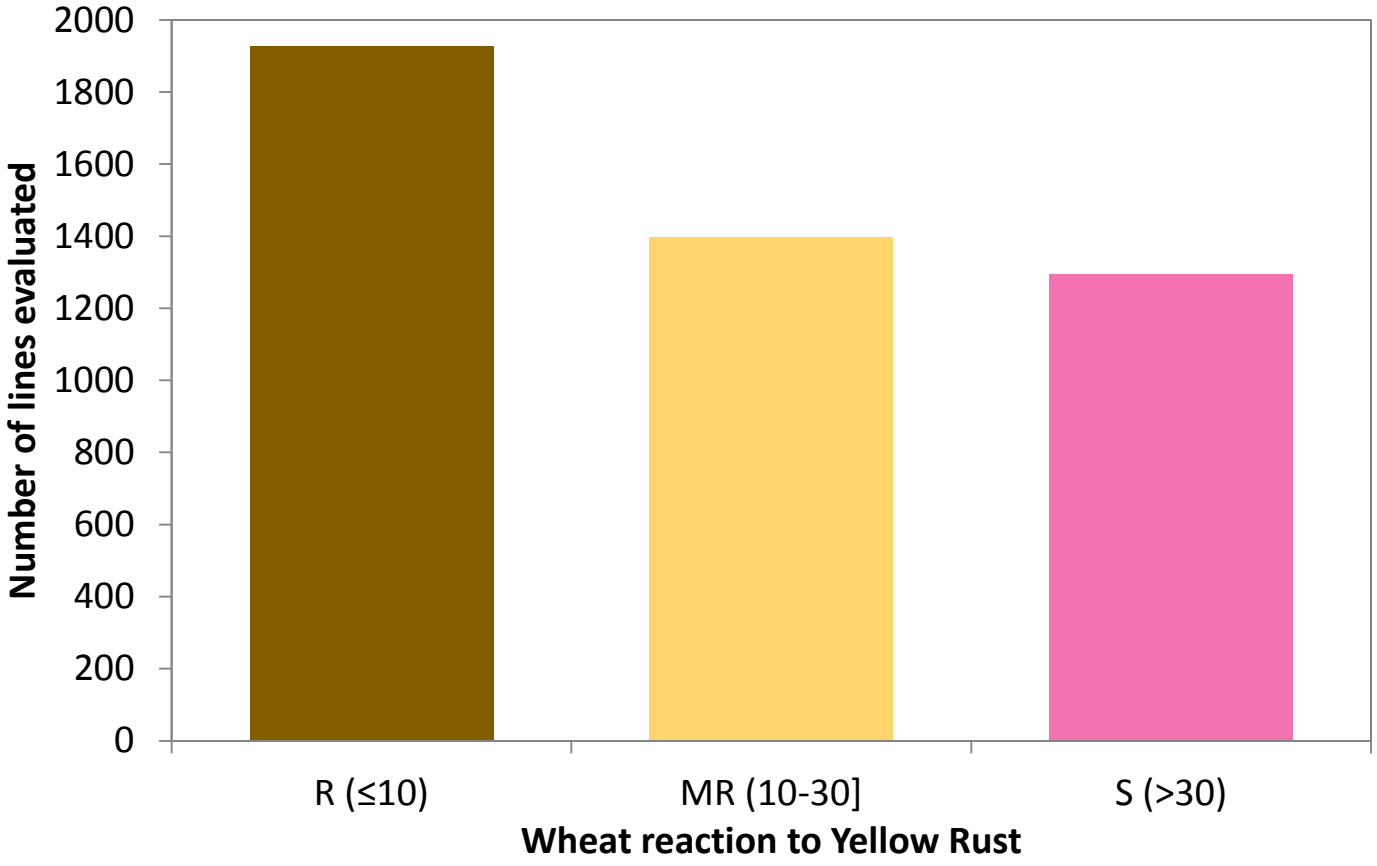
Frequency of HMW Glutenin Alleles in 200 elite spring bread wheat genotypes at Marchouch, 2014

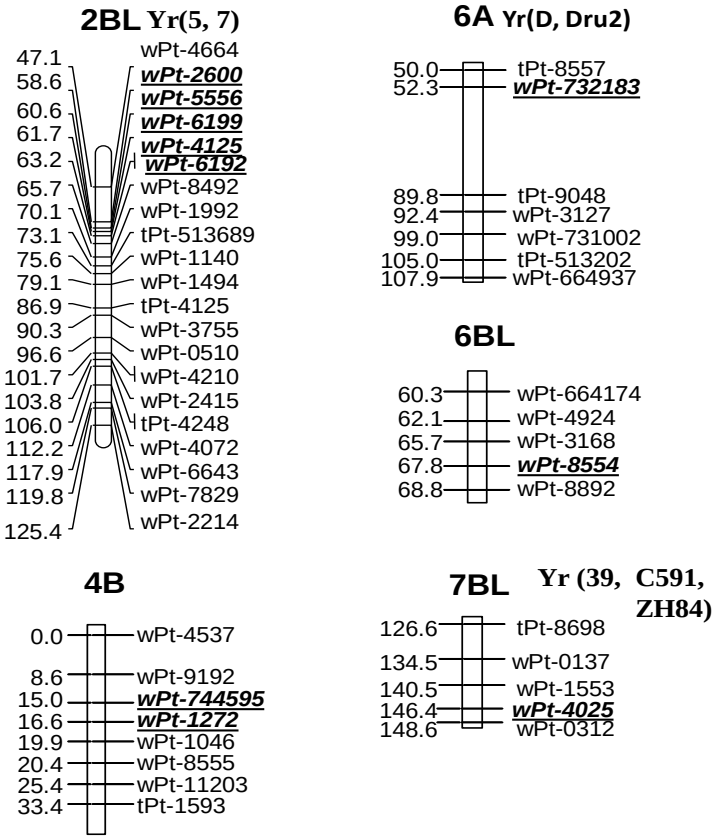


Response of 4600 ICARDA's spring bread wheat genotypes to rusts and septoria at Kulumsa, Ethiopia, 2014



Disease resistance 4619 Spring Bread Wheat preliminary yield trial lines in Marchouch (2013/14)





Marker	Chr	Pos	P	FDR	R^2
wPt-2600	2BL	58.6	0.00310	0.0003	5.6
wPt-5556	2BL	60.6	0.00113	0.0001	6.6
wPt-6199	2BL	61.7	0.00191	0.0002	6.2
wPt-6192	2BL	63.2	0.000062	0.000063	7.1
wPt-4125	2BL	63.2	0.00276	0.0003	5.6
wPt-744595	4BS	15.0	0.00178	0.0002	6.0
wPt-1272	4BS	16.6	0.00178	0.0002	6.0
wPt-732183	6AS	52.3	0.00002	0.00003	8.3
wPt-8554	6BL	67.8	0.00161	0.0001	6.7
wPt-4025	7BL	146.4	0.00446	0.0003	5.4

Association mapping profiles of resistance to *P.tritici*. Consensus linkage maps are based on information from Diversity Arrays Technology PTL. On the left, values are genetic distance in centimorgans (cM). On the right, diversity array technology markers (bold) are significantly associated with resistance to YR. On the far right side, the reported *Yr* genes are indicated.

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SNP markers significantly associated to grain yield in 200 wheat genotypes at Wadmedani, Sudan, 2014

SNP	Chromosome	Position	P.value	R2	FDR_Adjusted_P-values	Effect
TG0019	1A	.	6.02E-05	0.0752	0.0900	-0.2199
TG0041	1A	.	0.000871868	0.0511	0.3722	-0.1943
Ku_c19858_2078	5A	.	6.19E-06	0.0966	0.0555	-0.2575
wsnp_Ex_rep_c66689_65010988	5A	.	2.57E-05	0.0831	0.0864	-0.2394
Excalibur_rep_c111129_125	5A	.	3.28E-05	0.0809	0.0864	-0.2222
RAC875_rep_c113313_607	5A	.	3.86E-05	0.0794	0.0864	-0.2295
BS00022071_51	5A	.	6.02E-05	0.0752	0.0900	-0.2199
wsnp_Ex_c31799_40545478	5A	.	0.000131337	0.0681	0.1508	-0.2093
RAC875_c9984_1003	5A	.	0.000134607	0.0679	0.1508	-0.2203
Excalibur_c7729_144	5A	56.9	0.000191637	0.0646	0.1711	-0.2109
Kukri_c10033_724	5A	.	0.000207685	0.0639	0.1711	-0.2008
wsnp_Ex_c2702_5013188	5A	.	0.000209981	0.0638	0.1711	-0.1940
RAC875_c30566_230	5A	56	0.000309335	0.0603	0.2311	-0.1974
RAC875_c13931_205	5A	56	0.000400496	0.0580	0.2491	-0.1952
RAC875_rep_c116420_103	5A	.	0.000400496	0.0580	0.2491	-0.1952
BobWhite_c23736_153	5A	.	0.000530549	0.0555	0.2973	-0.1769
wsnp_Ku_c20011_29589089	5A	53.7	0.000781558	0.0521	0.3722	-0.1788
Kukri_c29560_455	5A	53.7	0.000781558	0.0521	0.3722	-0.1788
wsnp_AJ612027A_Ta_2_1	5A	.	0.000871868	0.0511	0.3722	-0.1943
wsnp_Ex_c31799_40545376	5A	56.9	0.000974359	0.0501	0.3971	-0.1811
wsnp_Ex_c11120_18022932	5A	52.9	0.001195076	0.0484	0.4480	-0.1774

Capacity building: short and long term trainings

Short term training : Classical and Molecular Approaches in Wheat Breeding

MSc & PhD Students

Name	Sex	Country	Degree level	Study area
Sahar Bennani	F	Morocco	PhD	Drought tolerance
Samira El-Hanafi	F	Morocco	PhD	Hybrid wheat
Sawsan Tawkaz	F	Syria	PhD	Doubled haploid techniques
Yewbdar Shewaye	F	Ethiopia	M.Sc.	Yellow rust
Choghag Demirjian	F	Lebanon	M.Sc.	Drought tolerance
Sofian	M	Sudan	PhD	Heat stress
Tilahun Mekonnen	M	Ethiopia	PhD	Septoria
Mathewos Ashamo	M	Ethiopia	PhD	Stem and leaf rust

Publications in 2014

W. Tadesse, F.C. Ogbonnaya, A. Jighly, K. Nazari, S. Rajaram, and M. Baum. 2014. Association Mapping of Resistance to Yellow Rust in Winter Wheat Cultivars and Elite Genotypes Crop Sci. doi: 10.2135/cropsci2013.05.0289

W. Tadesse, M. Nachit, O. Abdalla and S. Rajaram (2014). Wheat Breeding at ICARDA: Achievements and Prospects in the CWANA Region . In Alain Bonjean, Bill Angus and Maarten van Ginkel (eds) World Wheat BooK Volume 3.

W. Tadesse, S. Rajaram, F. C. Ogbonnaya, M. Sanchez-Garcia, Q. Sohail, and M. Baum (2014) Wheat Breeding: Challenges and Prospects in the 21st Century. Springer

W. Tadesse, O. Abdalla, S. Rajaram, F. Ogbonnaya, A. Hagras, M. Keser, R. Sharma, K. Nazari, M. Sanchez-Garcia, Q. Sohail, A. Abdalat and M. Baum (2014) Bread wheat breeding for yellow rust resistance at ICARDA: Current status and prospects. Second International Yellow rust Conference, April 28-May1, Izmir, Turkey

W. Tadesse, F. C. Ogbonnaya, O. Abdella, M. El Bouhssini, S. Lhaloui, A. Ammar and M. Baum (2014) Identification and development of elite bread wheat genotypes with high yield potential and Hessian fly resistance. International Plant Resistance to Insects work shop, April 14-17, Marrakech, Morocco

W. Tadesse (2014) Wheat Improvement for Dry land Agriculture. In: 53rd All India Wheat and Barley Meet, 22-25 August, Jabalpur, India

Acknowledgements

- ICARDA's Wheat Team+ M.Sc. and PhD students
- NARSs in the CWANA
- INRA-Morocco; ARC-EGYPT; AUB & AREC-Lebanon; EIAR-Ethiopia; ARC-Sudan and Turkey
- WHEAT CRP; GRDC; AfDB, EU-IFAD

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Thank you