CAIGE Project 2013-2018 Enhanced delivery of CIMMYT germplasm to Australia

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(Project activities initiated in 2013,however approval pending)

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Outputs

1. Targeted CIMMYT International Yield Trials (ESWYT and SAWYT) and associated data annually exported to Australia

2. Delivery of all special trait germplasm developed under the CIMMYT-GRDC Strategic Alliance Project agreements and all associated data to Australia

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Milestones

1. Shipment of 120 new CIMMYT elite germplasm included in ESWYT and SAWYT to Australia each year in October

2. Shipment of special trait germplasm developed under various CIMMYT-GRDC Strategic Alliance Projects to Australia each year by December

3. Export of various Australian wheat germplasm to CIMMYT (Mexico/Kenya/Turkey) for utilization by the CIMMYT-GRDC Strategic Alliance Projects by March 1st each year or as determined by the breeding programs

4. Delivery of all available phenotypic and genotypic data for the materials delivered to Australia by December each year

5. Data generated by CIMMYT on Australian wheat germplasm provided to Australian partners by December 31st each year

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Mexico based scientists contributed to the project

- **Bread Wheat Improvement and Rust Research group:**
  - **Ravi Singh- Head**
  - **Julio Huerta, Enrique Autrique (Breeding in general)**
  - **Suchismita Mondal (Drought and heat tolerance physiology)**
  - **Govindan Velu and Yuanfeng Hao (Breeding for enhanced Zn and Fe)**
  - **Sybil Herrera, Caixia Lan and Bhoja Basnet (Rusts)**

- **Pathology group:**
  - **Pawan Singh and Xinyao He (STB, SNB, Yellow Spot, Spot Blotch, FHB, KB)**

- **Quality group: Javier Pena, Carlos Guzman (end-use quality analysis)**

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Elite lines sent to Australia in 2013

- **Until 2012: Larger set, selected based on one year of yield data (and data for other traits)**
- **In 2013: Smaller set, selected based on multi-environment yield data (and data for other traits)**
- **200 entries shipped in October 2013 (milestones for CAIGE and ACRCP projects) selected from the same cohort used in 2012 but by using extensive data**
- **125 entries derived from Mexico-Kenya Shuttle Breeding**

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Elite lines sent to Australia in 2013

- A combined data file for materials sent in 2012 and 2013 provided to CAIGE coordinator
- Grain yield performance data from five environments (optimally irrigated- flat & bed plantings; high & intermediate drought stress; late sown heat stress) in Obregon 2012-13 added to 2011-12 data
- Agronomic data- heading, maturity, height, visual scoring
- Phenotypic data for stem rust (Ug99) along with gene postulation, yellow rust (Mexico, Kenya, Ecuador), leaf rust, Septoria tritici, Septoria nodorum, yellow spot, spot blotch, fusarium head scab, Karnal bunt
- Kernel weight, Test weight & detailed end-use quality data
- GBS marker data also available and can be provided on request

Next slides give summary of selected traits

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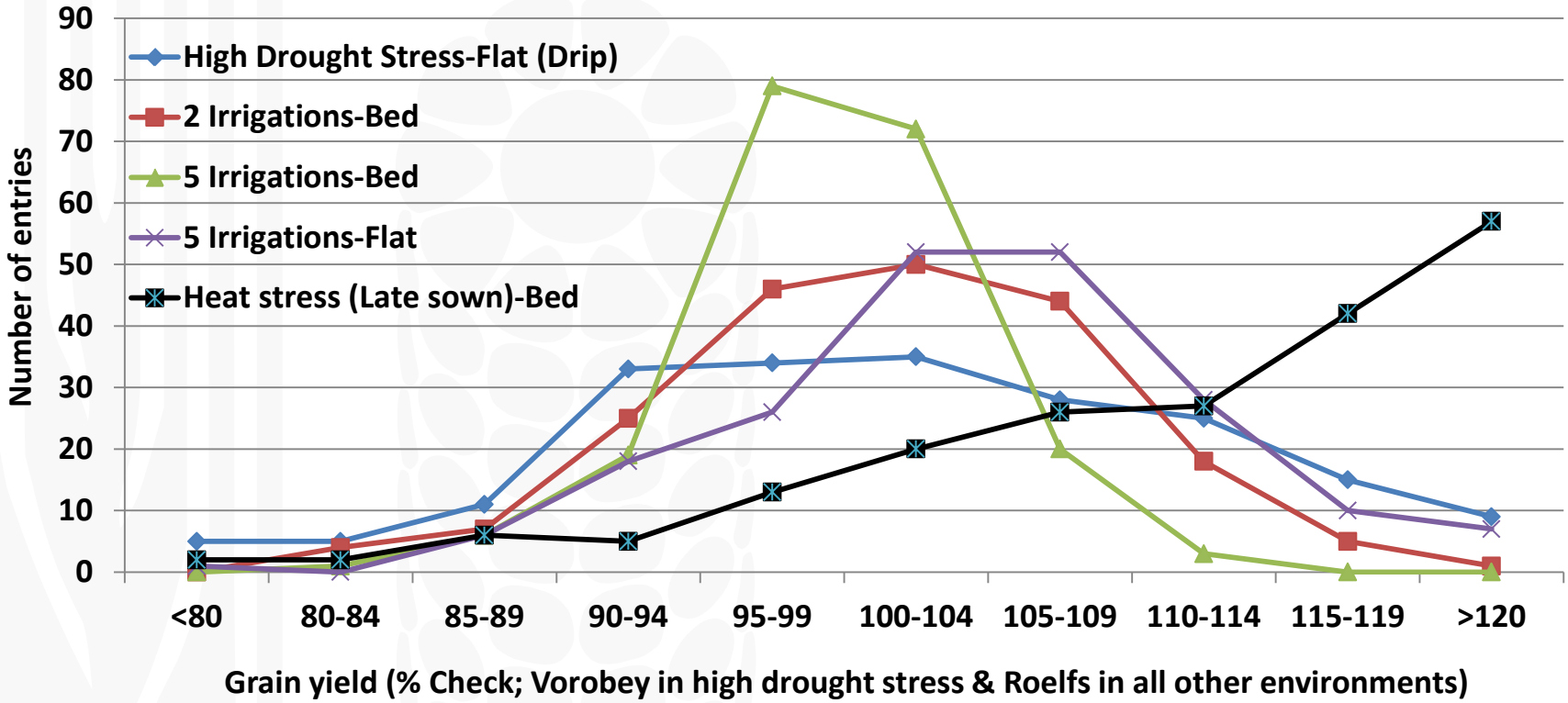
Grain yields of 200 entries under five environments, Cd. Obregon 2012-2013

Many lines had significantly higher yields than checks



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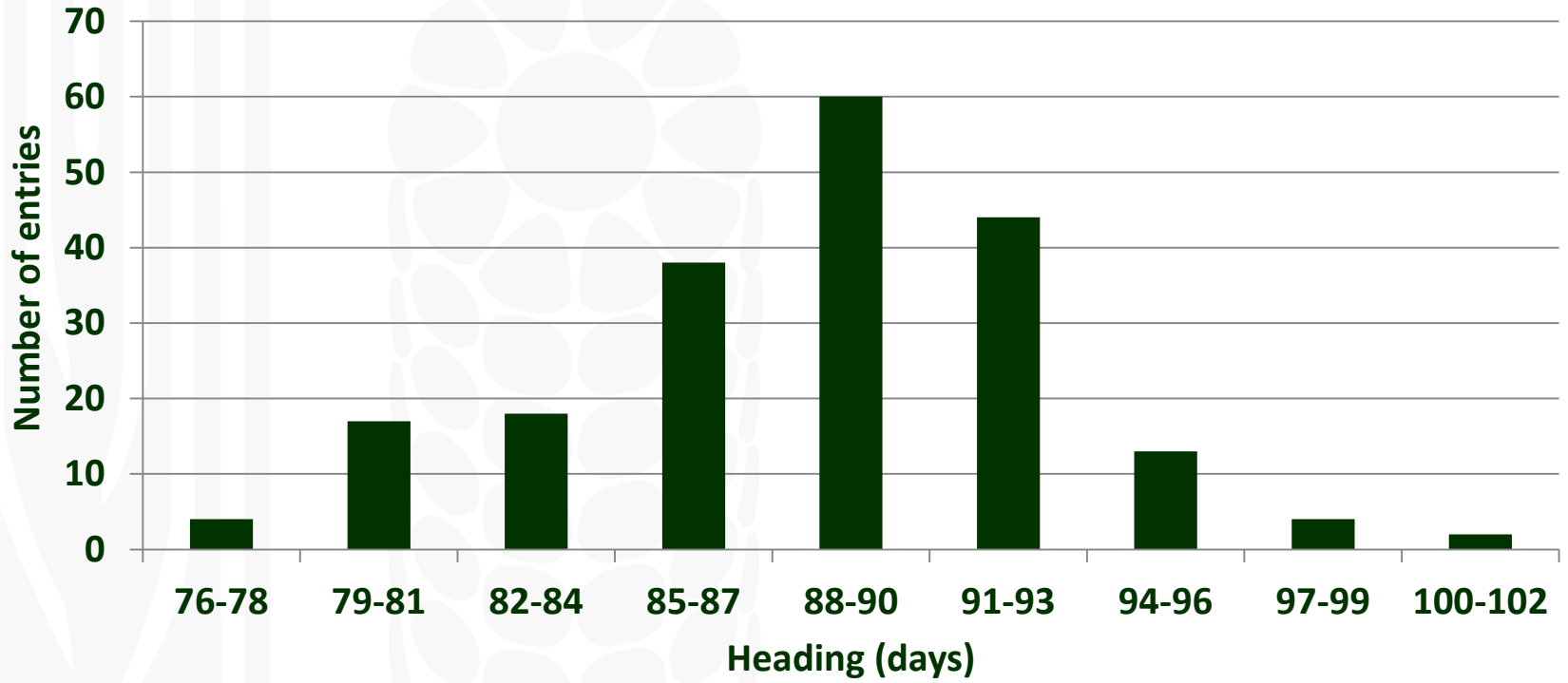
Heading variation in 200 entries

(mean 3 environments, Cd. Obregon 2012-13)

26 days variation in days to heading



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Ug99 resistance of 200 entries, Kenya 2012 & 2013

(evaluated when susceptible check Cacuke had necrotic plants following 100 S severity)

Over half of entries possessed APR and diversity for at least eight race-specific resistance genes

Resistance category	Stem rust Severity (%)	Entries No.	Entries %
Adult plant (acceptable levels):			
Near-immune resistant (NIR)	1	5	2.5
Resistant (R)	5-10	17	8.5
Resistant-Mod. Resistant (R-MR)	15-20	61	31
Moderately Resistant (MR)	30	24	12
Undesirable levels:			
Mod. Resistant-Mod. Susceptible (MR-MS)	40	10	5
Moderately Susceptible (MS)	50-60	8	4

Resistance category	Entries No.	Entries %
Race-specific:		
Sr13	7	3.5
Sr22	2	1
Sr25	12	6.0
Sr26	2	1
Sr1A.1R	4	2
SrND643	21	10.5
SrHuw234	1	0.5
Sr42 (*Sha7&SrTmp*)	22	11
SrWest	1	0.5

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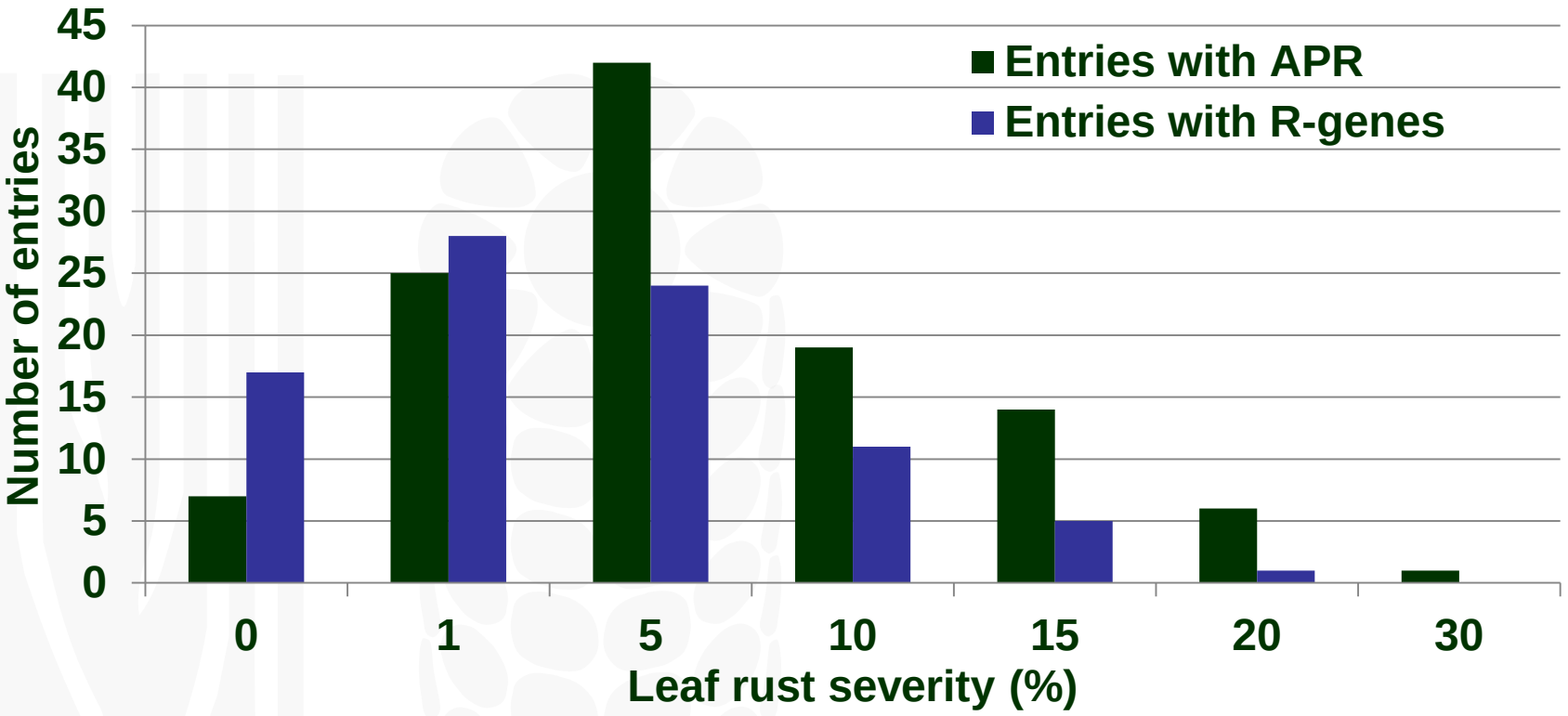
Leaf rust resistance of 200 entries, El Batan 2012

(Data recorded when leaves of susceptible checks became necrotic due to leaf rust)



No difference in leaf rust severity distribution for entries with APR versus R-genes

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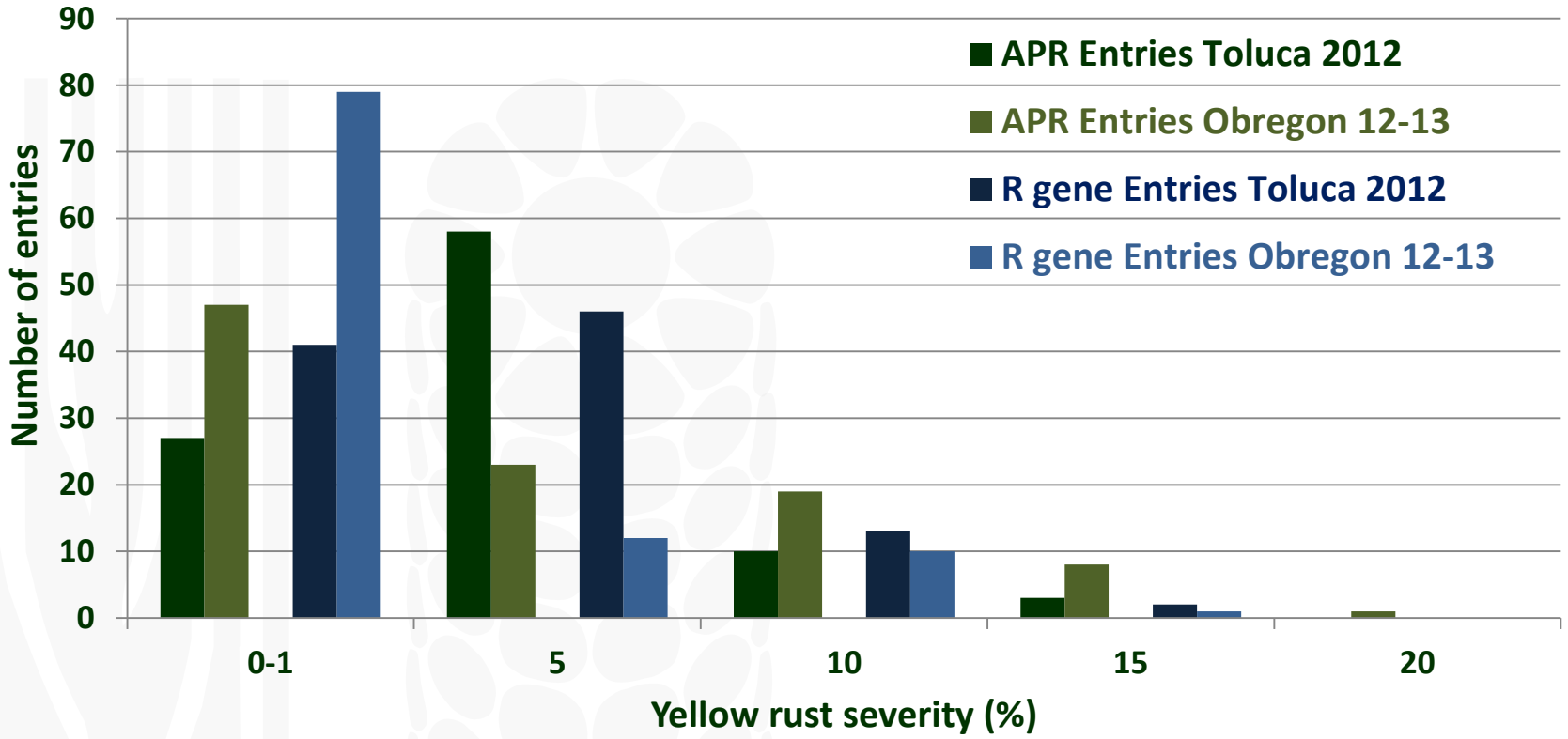
Yellow rust responses of 98 entries with APR and 102 entries with R-genes (with high to slight effects in seedlings) at Toluca and Cd. Obregon, Mexico

(data recorded when susceptible checks had dead leaves following 100% YR severity)



Entries with high levels of APR common with aggressive (WA type) *Yr31* virulent pathotype in Mexico

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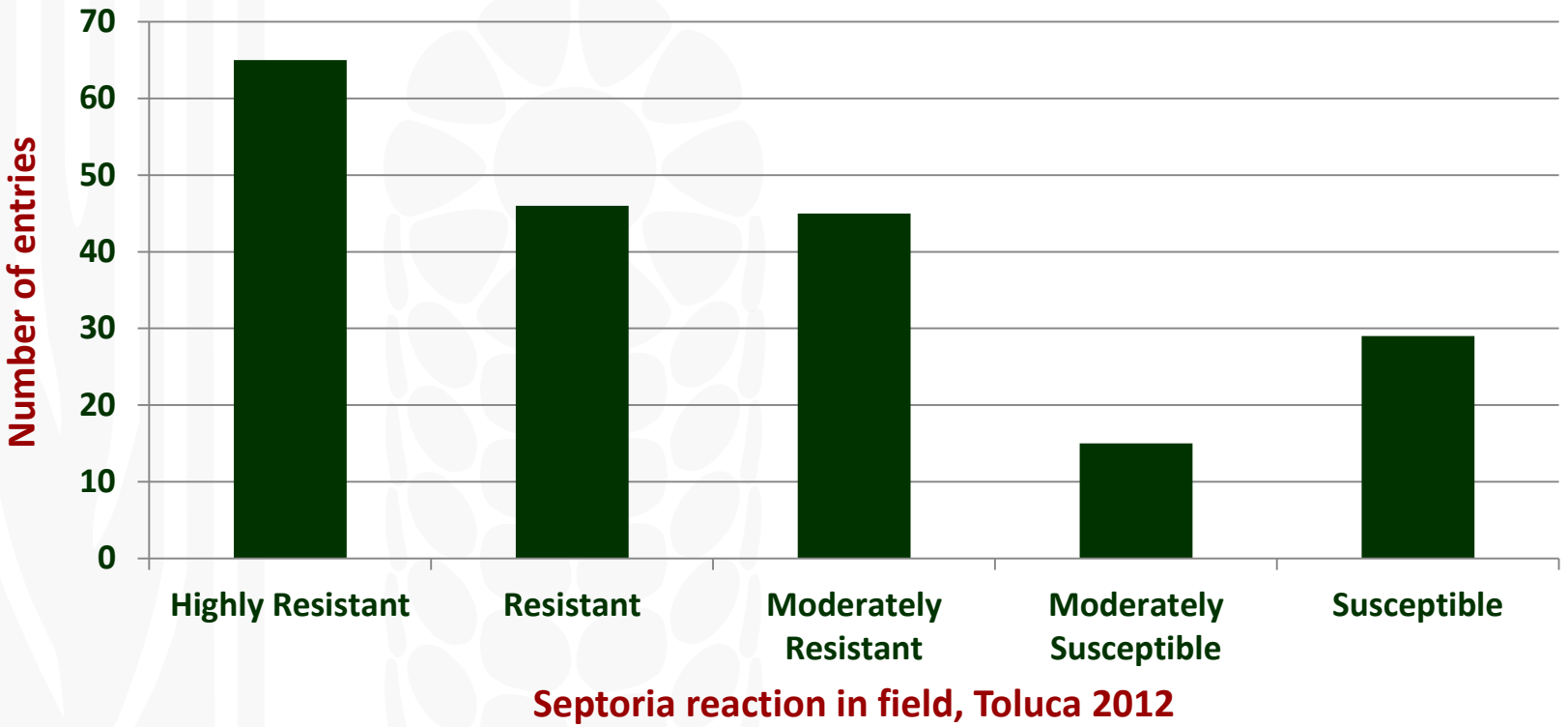
Septoria tritici bloch resistance in 200 entries

Large proportion of entries show high to moderate resistance in Mexico

Sources of resistance diverse, include synthetic wheats and mostly quantitative



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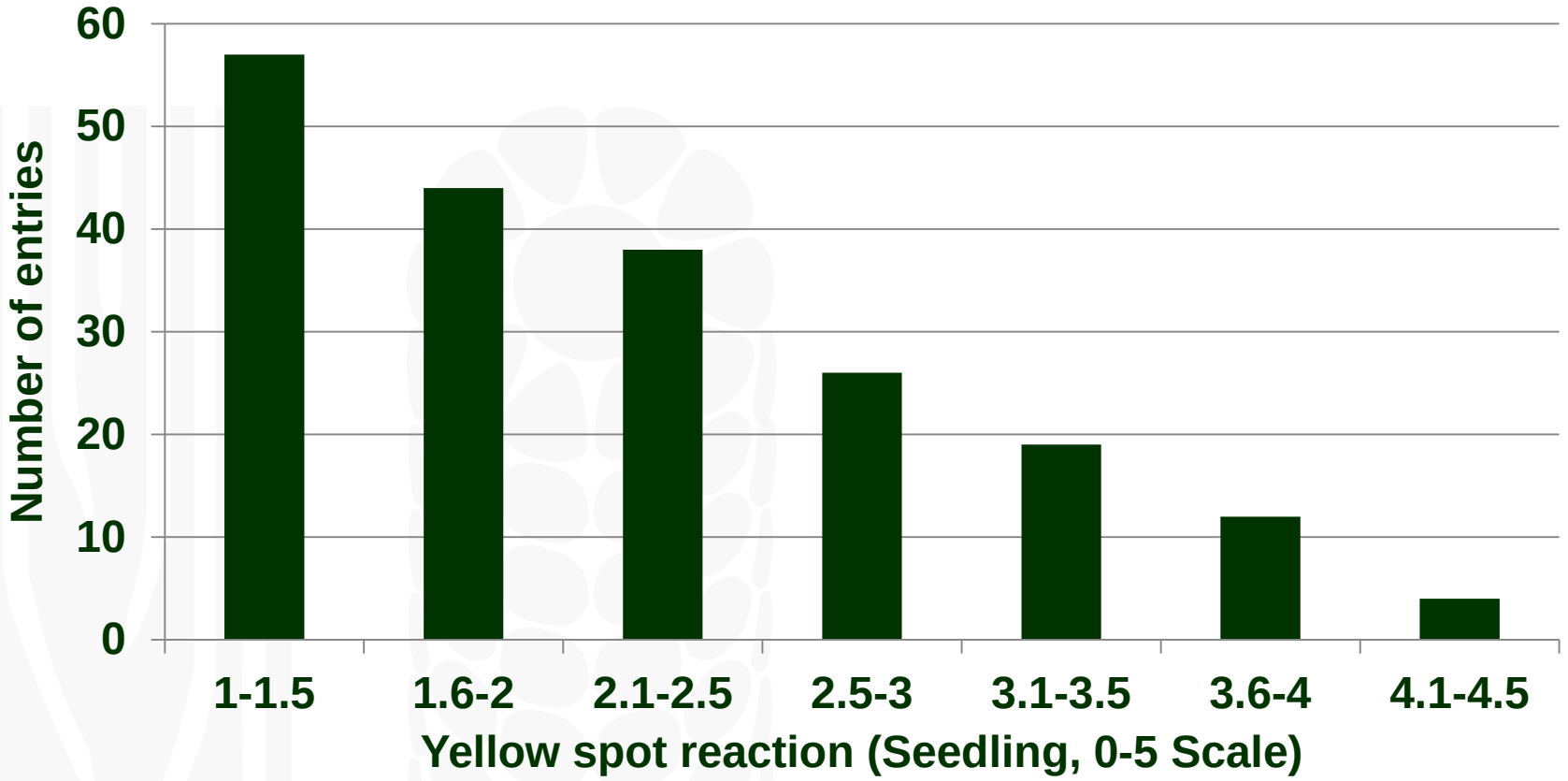
Yellow (Tan) Spot Resistance in 200 Entries

Many resistant & moderately resistant entries based on seedling evaluation



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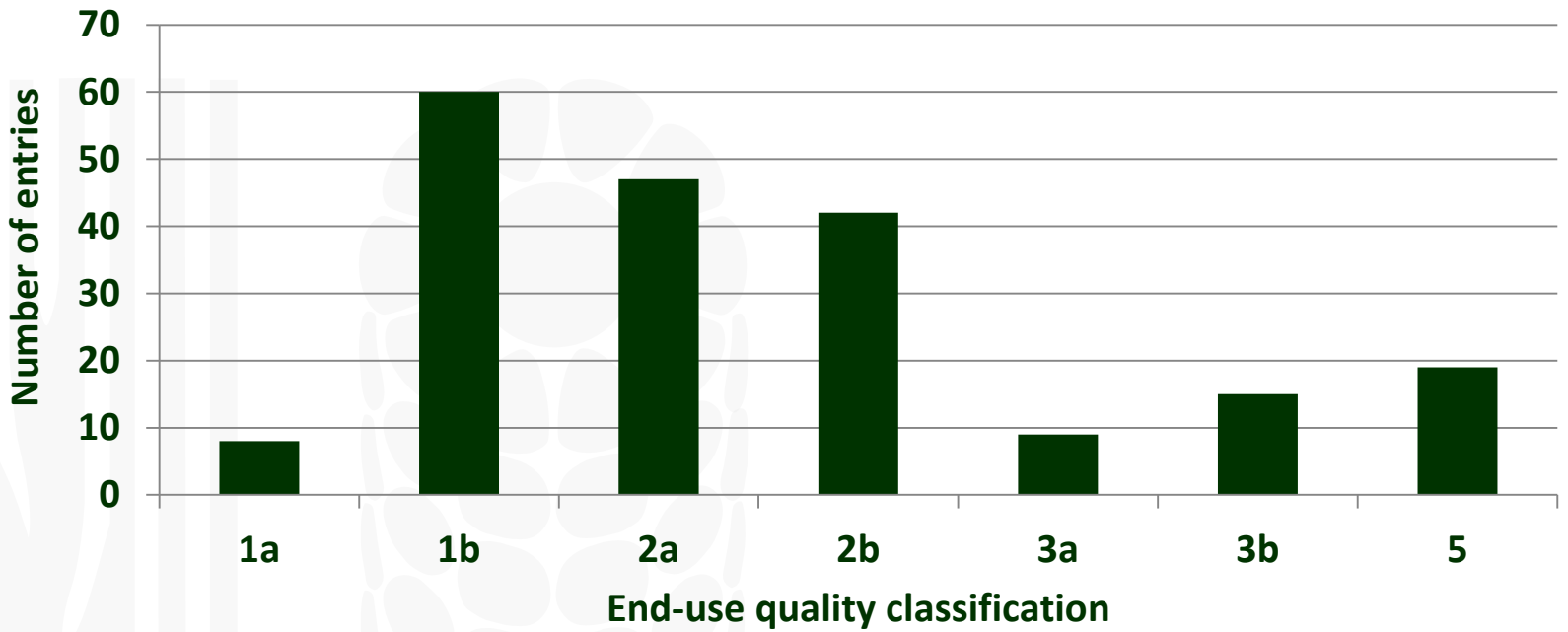
End-use quality (CIMMYT classification) of 200 entries grown under optimally irrigated environment in Obregon 2013-14

Quality profile significantly increased in new germplasm



- **Most entries either good for industrial or flat bread products (quality types 1a-3b).**
- **Very significant reduction in tenacious wheat types (quality type 5) in new germplasm (only 10% entries)**
- **Obregon grain has no LMA issues as all entries have high HFN values**

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Conclusion

- Exchange of germplasm and information is going well under CAIGE project
- Significant progress towards enhancing grain yields under irrigated, drought and heat stress environments is evident
- Good progress in building APR to Ug99 stem rust. New diversity for race-specific resistance genes also incorporated.
- Stripe rust, leaf rust and resistance to various leaf spotting diseases significantly enhanced
- End-use quality improved in new germplasm, which should aid the utilization of CIMMYT germplasm by Australian breeding programs

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