

Re-thinking strategies for monitoring plant pathogens virulence diversity and their corresponding sources of resistance to move towards a more effective disease control

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Background

- Angular leaf spot (ALS) caused by *Pseudocercospora griseola* and Anthracnose (ANT) by *Colletotrichum lindemuthianum* are major diseases of common bean in the Tropics and Sub-tropics, causing yield losses of up to 80-100%



Fig 1. Bean field, ALS infected leaf and Anthracnose severely infected bean pods

- There is generally high pathotypic and genetic diversity of both ALS and ANT pathogens in Uganda

Year	Disease	Incidence (%)	Severity
2010	ALS	40-99	21-80
2014	ALS	33.7-60	20.7-45
2016	ALS		24-84
2016	ANT		12-48
2022	ALS	81- 92	5.1-7.9
2022	ANT	1.4-2.7	1.14-1.8

Table 1. Trends in the incidence and severity of ALS and ANT diseases in Ugandan bean Agro-ecologies

- Pathogenic diversity of both pathogens varies among bean Agro-ecologies, often distinguished by rainfall/humidity, temperature and altitudes

Disease	No. of Isolate	No. of Race	Year
ANT	19	6	1972
ANT	52	15	2006
ANT	74	21	2009
ALS	45	12	2014
ANT	51	28	2016
ANT	112	51 (38 new races)	2023
ALS	> 200	> 50	unpublished

Table 2. Trends indicating number of isolates and pathotypes/ races obtained from ALS and ANT in Uganda and N.Tanzania.

- An efficient way to control pathogenic diversity is through identification of sources of resistances to both diseases

- Diverse pathogens require constant surveillance by implementing effective and coordinated monitoring systems

- An effective monitoring strategy should involve multiple stakeholders interested in reducing the effect of diseases on crop production

Methodology

- Under the Plant health initiative (PHI) from CG centers, we defined a workplan that integrates researchers but also strategic partners from national programs and farmers in the regions where diseases are limiting production
- Our strategy uses Sentinel nurseries deployed at multiple sites with high disease prevalence to generate reliable and systematic infection data (Fig 2)
- Sentinel nurseries consist of genetically diverse genotypes capable of capturing race variability under natural infection

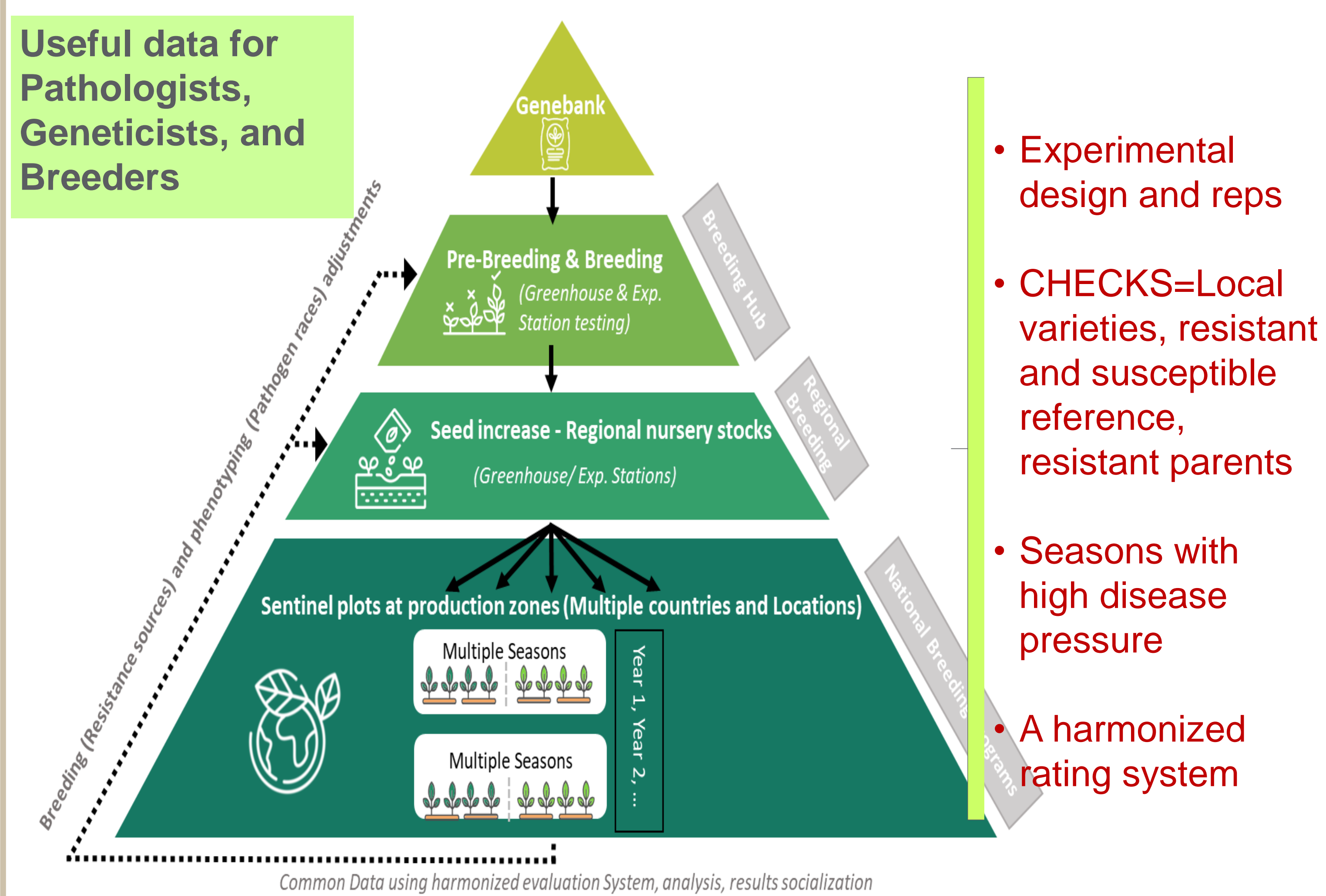


Fig 2. A generalized pyramid indicating the harmonized execution of the Sentinel strategy by the different partners among the regions

Main Challenges

- Maintenance of the seed stocks for all partners covering representative environments
- Stable funding for implementation across countries and seasons/years
- Unreliable seasons due to frequent occurrence of droughts

Prospects of the strategy

- Fast track the virulence diversity of races of ANT and ALS in South & East Africa
- Map pathogen diversity at regional level and establish priorities for breeding and other management measures
- Generate recommendations for breeding programs about the most recommended source of resistance
- Exploit the genetic diversity of beans to find sources of resistance to multiple biotic constraints and train regional partners in disease assessment
- Maintain sentinel trials for early monitoring to identify pathogen virulence patterns for consecutive seasons across regions

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