PHYSIOLOGICAL AND GENETIC BASES OF WHEAT AND SOYBEAN RESPONSE TO BIOTIC AND ABIOTIC STRESS: APPLICATIONS TO BREEDING AND CROP MANAGEMENT IN THE SOUTH AMERICA CONE

CURRENT AND FUTURE WORLD CONTEXT

INCREASING DEMAND OF WHEAT AND SOYBEAN,
associated to world population increment and food quality improvement

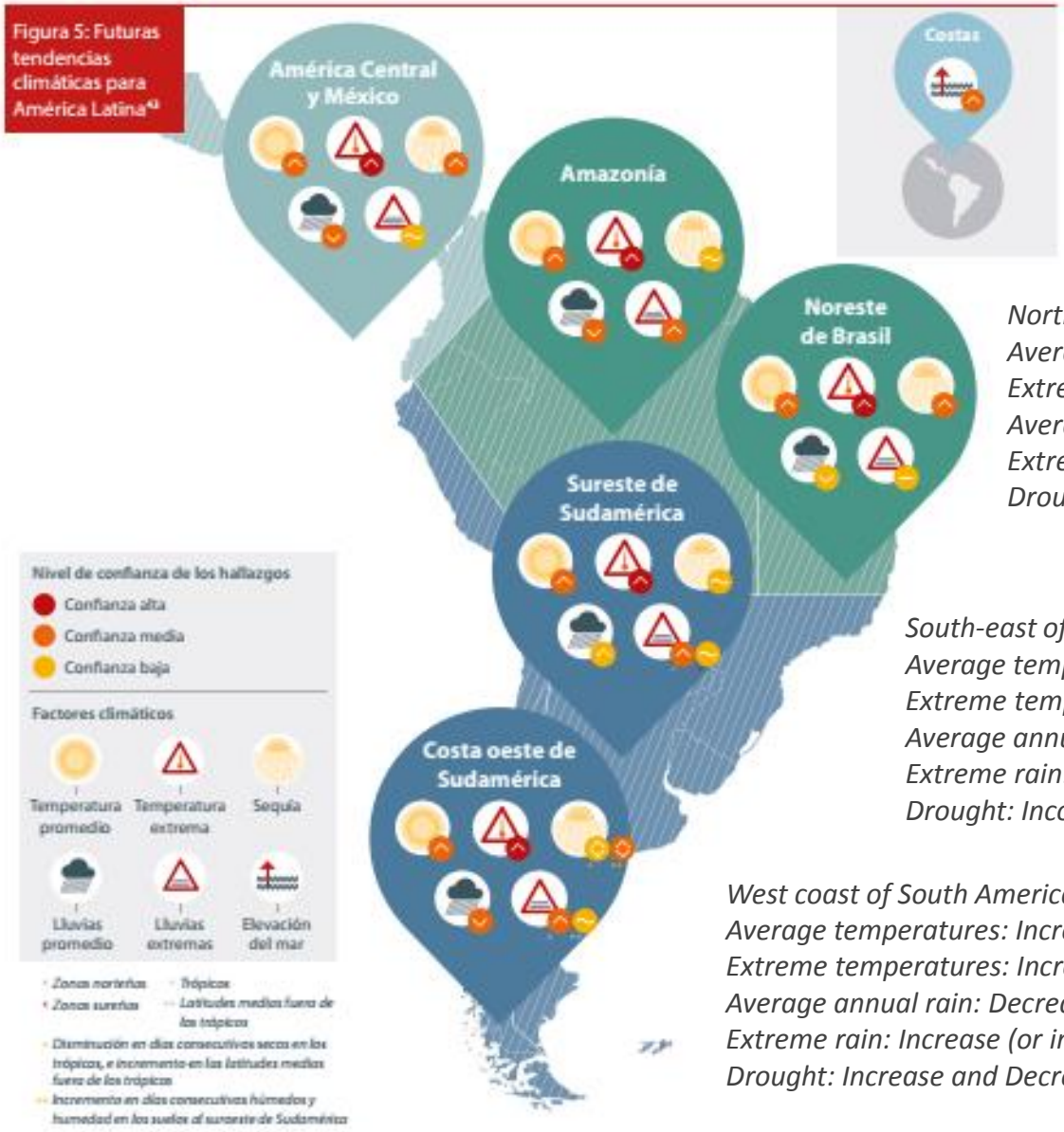
50% Wheat world production for 2050
19% Soybean flour for 2024
21% Soybean oil for 2024

Production level

- ~~Crop Area~~
  - High increment for soybean since mid 70’ (using vulnerable land and natural forest)
  - Stabilized for wheat since 60’
- Crop Yield – Stability ✓

CURRENT AND FUTURE WORLD CONTEXT

IPCC 2014. El Quinto reporte de evaluación del PCC. Qué implica para Latinoamérica?



North-east of Brazil
Average temperatures: Increase
Extreme temperatures: Increase
Average annual rain: Decrease
Extreme rain: Inconsistency
Drought: Increase

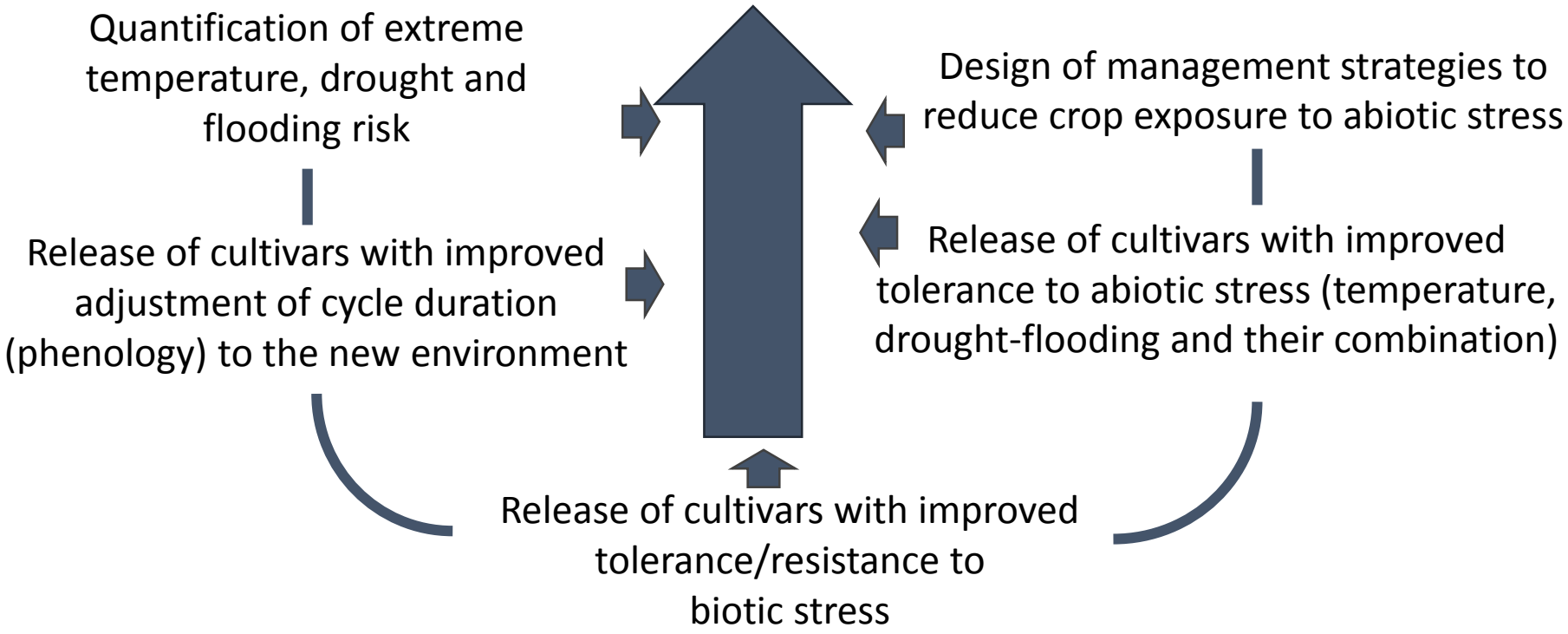
South-east of South America
Average temperatures: Increase
Extreme temperatures: Increase
Average annual rain: Increase
Extreme rain: Increase (or inconsistency)
Drought: Inconsistency

West coast of South America
Average temperatures: Increase
Extreme temperatures: Increase
Average annual rain: Decrease
Extreme rain: Increase (or inconsistency)
Drought: Increase and Decrease

CURRENT AND FUTURE WORLD CONTEXT

Wheat and soybean FARM YIELD and STABILITY may decrease due to direct impacts of flooding, high temperature and/or drought or due to indirect impacts by changing disease dynamics

How can we increase FARM YIELD and STABILITY within the context of climate change?

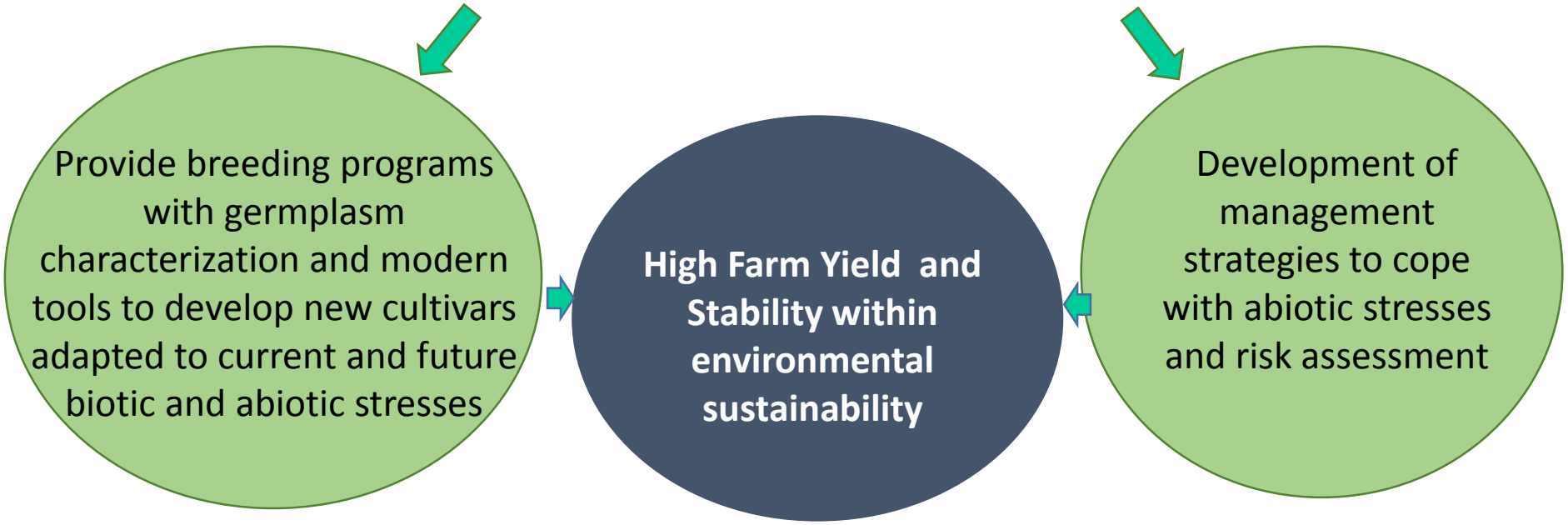


PROJECT GENERAL OBJECTIVES

(i) Characterization of regional germplasm to biotic and abiotic stresses (flooding, drought and /or high temperature)

(ii) Identification of physiological and genetic bases associated with high yield and stability under such stresses

(iii) Development of agronomic simulation models to quantify abiotic stress risk according to different crop management strategies.

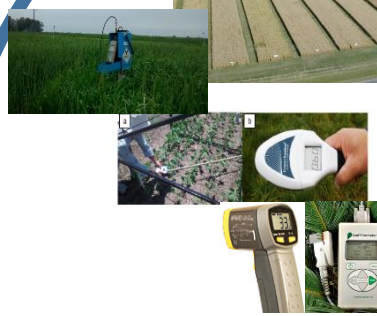


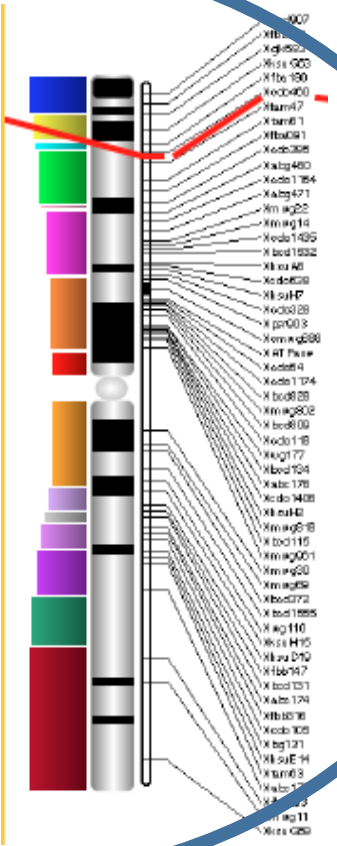
APPROACH
Multidisciplinary teams at regional level

Phenotyping

Genotyping

Modelling





Decision support for management strategies and abiotic stress risk assessment ⟷ Release of improved cultivars ⟷ Genes identification; Germplasm characterization

PROJECT GENERAL ACTIVITIES

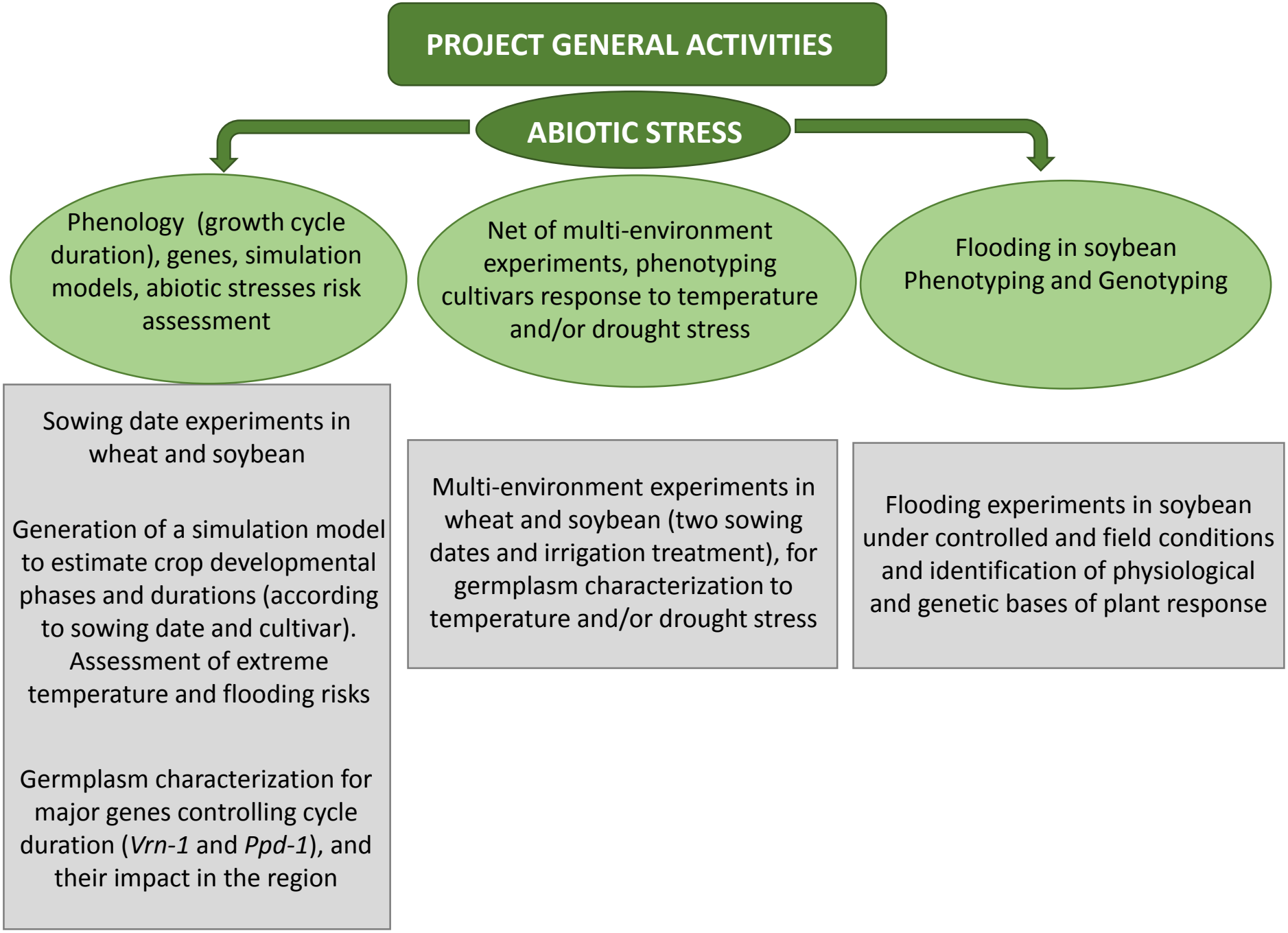
BIOTIC STRESS

Wheat-Nurseries for disease observation in regional germplasm (Leaf Rust, Yellow Rust, Pyricularia blast, Scab, Septoria)

Soybean- Nurseries for disease observation in regional germplasm (Asian Soybean Rust and Soybean Charcoal Rot)

Validation of new protocol to determine Soybean Charcoal Rot in control conditions

Identification and functional validation of genes of Asian Soybean Rust pathogen -*P Pachyrhizi*- feasible to use in development of resistant soybean plants


PROJECT GENERAL ACTIVITIES
ABIOTIC STRESS
Phenology (growth cycle duration), genes, simulation models, abiotic stresses risk assessment
Net of multi-environment experiments, phenotyping cultivars response to temperature and/or drought stress
Flooding in soybean Phenotyping and Genotyping
Sowing date experiments in wheat and soybean
Generation of a simulation model to estimate crop developmental phases and durations (according to sowing date and cultivar). Assessment of extreme temperature and flooding risks
Germplasm characterization for major genes controlling cycle duration (*Vrn-1* and *Ppd-1*), and their impact in the region
Multi-environment experiments in wheat and soybean (two sowing dates and irrigation treatment), for germplasm characterization to temperature and/or drought stress
Flooding experiments in soybean under controlled and field conditions and identification of physiological and genetic bases of plant response

PROJECT MAIN PRODUCTS

Improved germplasm characterization for breeding programs to develop new cultivars adapted to current and future biotic and abiotic stresses

Biotic stress
Phenotype response to Leaf Rust, Yellow Rust, Pyricularia blast, Scab, Septoria, Asian soybean rust, Soybean Charcoal Rot

Identification of at least one gen of -P Pachyrhizi- feasible to use in development of resistant soybean plants to Asian Soybean Rust.

Abiotic stress
Genetic constitution for major genes controlling cycle duration in wheat lines and their impact on adaptation to the region

Physiological traits associated to better performance under drought and/or high temperature in wheat and soybean lines

Genes identification for flooding tolerance in soybean lines

Decision support systems for risk assessment and management strategies

Simulation model available on-line to determine the best combination of sowing date and cultivar for a given environment

Regional map quantifying the risk of abiotic stress in wheat and soybean

BUDGET

	FUNDING REQUEST									
	INIA CH	INIA UY	IPTA PY	INTA AR	FAUBA AR	EMBRAPA BR	UFRGS BR	UNMDP	UDELAR	TOTAL
Goods and Servicies (max 30%)	6731	21263	9232	34887	11709	10080	10388		5306	**109597**
Consultants and Specialists (max 60%)	4487	14147	18582	26649		22680	20776	4726	5836	**117883**
Trip and perdiem payments (max 30%)	15991	5598	3372	24375	2692	5040	3463	5041	1769	**67339**
Consumables (max 40%)	13178	7866	7164	30686	15586	10080	8310	6675	6234	**105780**
Training (max. 20%)	1780	2080	2528	11862	4881				1326	**24458**
Disemination (max 20%)	3141	5885	422	8134	2243	2520	2885	5041	1474	**31745**
Administrative expenses (max 10%)	5330	166		7213			5194	1193	1724	**20821**
Incidentals (5%)	2665	1360	843	7661	1938		956	1193	796	**17412**
External audit (max 5%)				7213						**7213**
Total request	**53304**	**58366**	**42142**	**158680**	**39049**	**50400**	**51971**	**23869**	**24466**	**502247**

	FONDOS CONTRAPARTIDA									TOTAL
Salaries	74478	341154	284790	314160	58644	59238	65000	55490	108000	**1360954**
Infraestructure and equipment	35000	3075	62661	84000	25000	292610	20000	7500	45000	**574846**
Funds from other grants	2000			55000	13600	73152	15000	12841	75000	**246593**
Total Counterpart	**111478**	**344229**	**347451**	**453160**	**97244**	**425000**	**100000**	**75831**	**228000**	**2182393**
Total grant	**164782**	**402595**	**389593**	**611840**	**136293**	**475400**	**151971**	**99700**	**252466**	**2684641**