

# **A conceptual framework to better understand the role of phytobiome in field crop establishment**

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# What is crop establishment?

The very initial phase of a crop cycle that involves the seed germination and seedling emergence (SGE) process

Sowing



Seed imbibition



Seed germination



Seedling emergence



Crop establishment



## Why a special focus on crop establishment?

The most important and vulnerable phase of a crop cycle (Villalobos et al 2016).

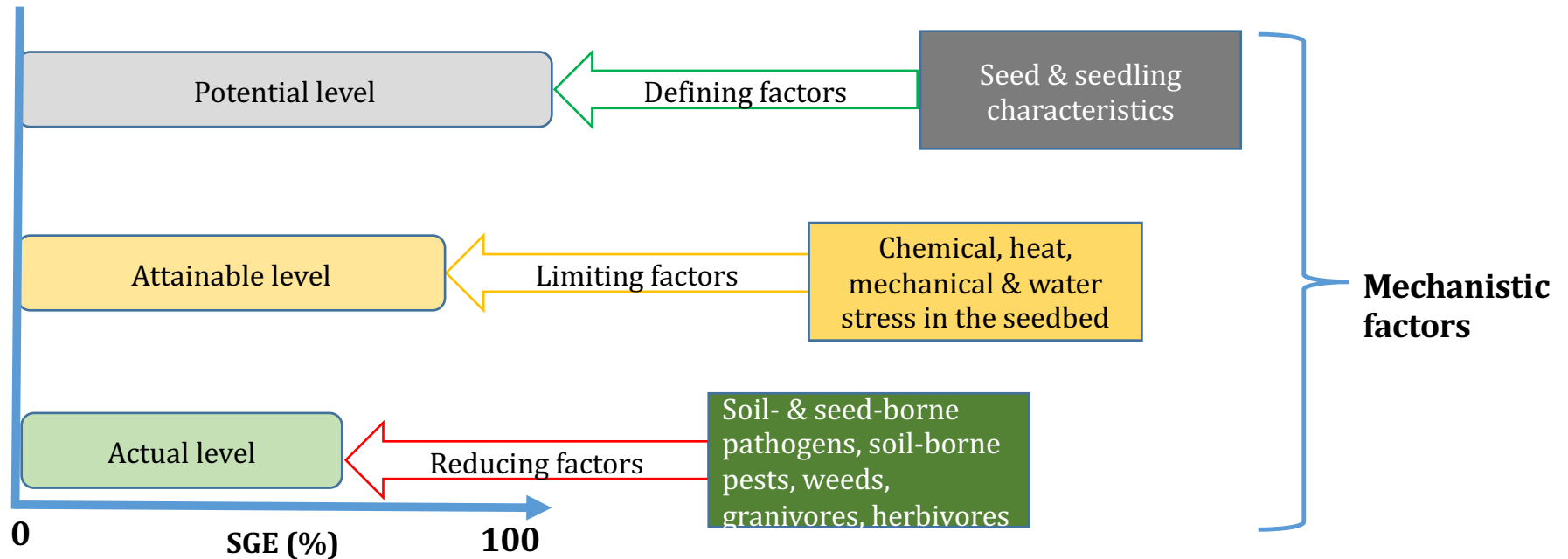
A poor crop establishment has several direct and indirect consequences.

Lower competitiveness towards weeds (quantitative and qualitative yield losses), increased weed seed bank



“*You reap  
what you  
sow !!!*”

# Key factors affecting crop establishment



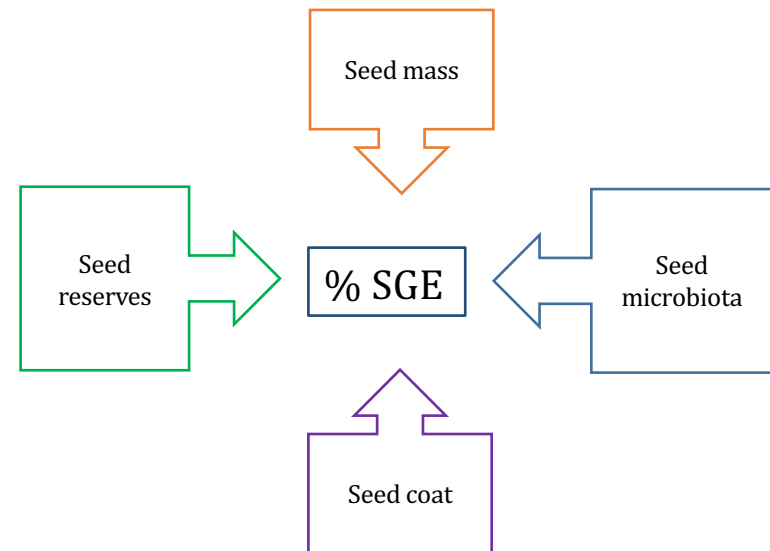
## And cropping practices!

Affect crop establishment through alterations of the mechanistic factors

# Defining factors affecting crop establishment



## Seed intrinsic characteristics



# Managing defining factors affecting crop establishment

Cropping practices

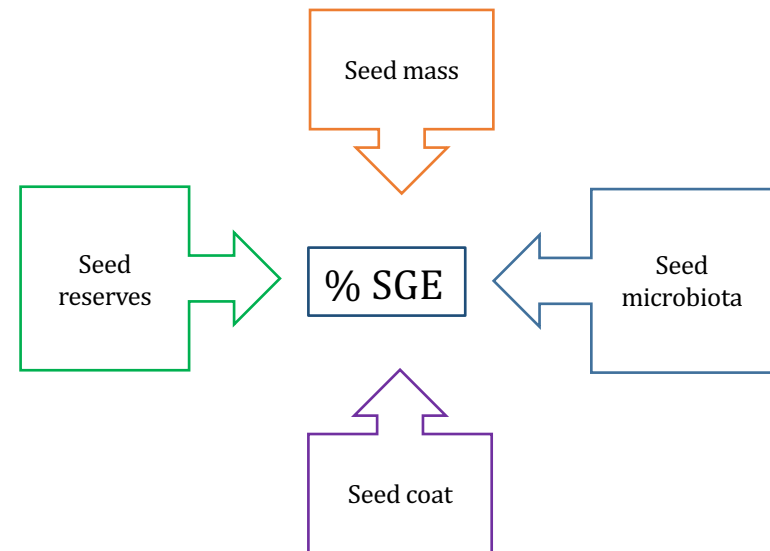
Crop varieties/species

The seed position within a plant

The mother plant environment  
(soil & climate)



Seed intrinsic characteristics

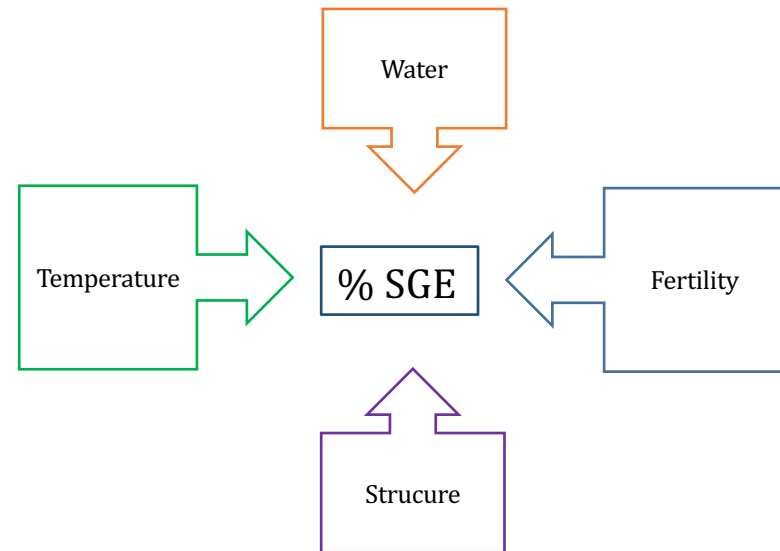




# Limiting factors affecting crop establishment



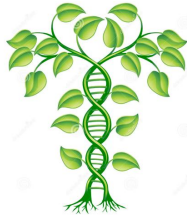
Seedbed physical and chemical components



# Managing limiting factors affecting crop establishment

## Cropping practices

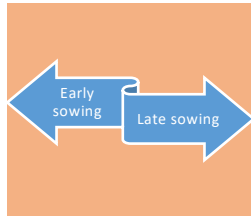
Crop varieties



Tillage (or not)



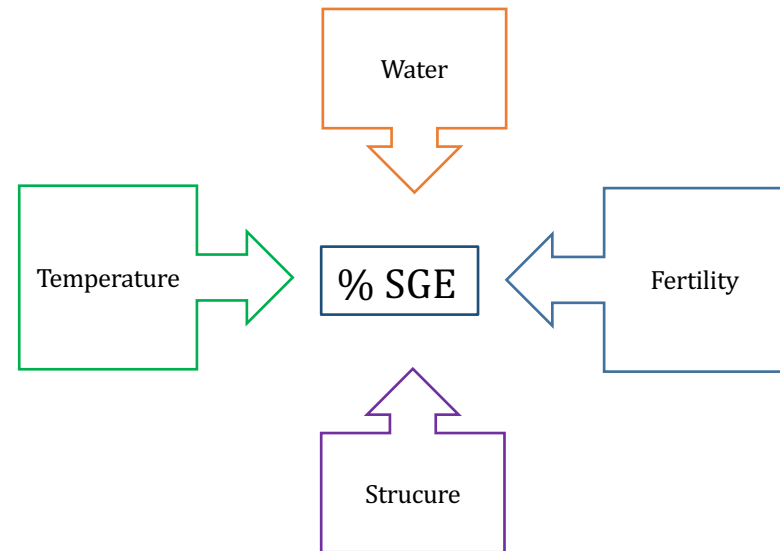
Shift in sowing date



Crop diversification  
(in space/time)



## Seedbed physical and chemical components

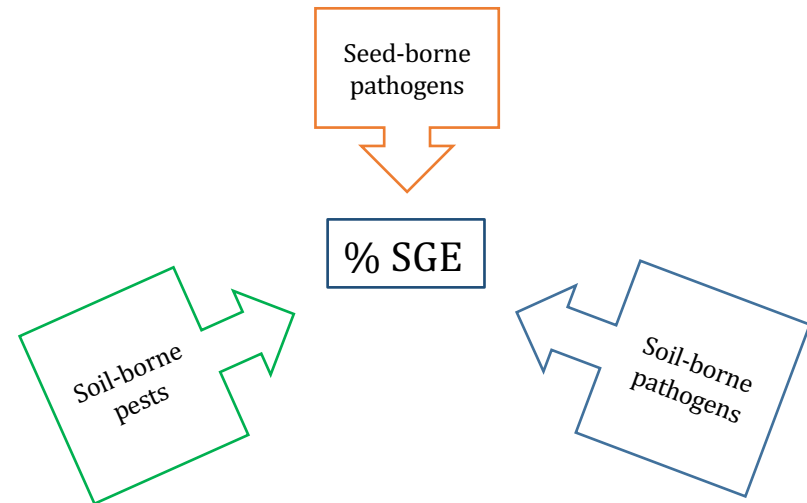




# Reducing factors affecting crop establishment



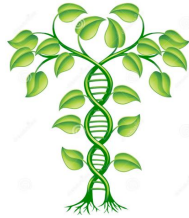
Seedbed biological components



# Managing reducing factors affecting crop establishment

## Cropping practices

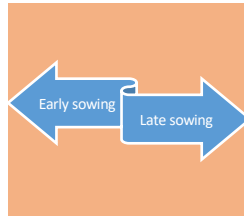
Crop varieties



Seed treatment/coatings



Shift in sowing date



Crop diversification  
(in space/time)



## Seedbed biological components

Seed-borne  
pathogens

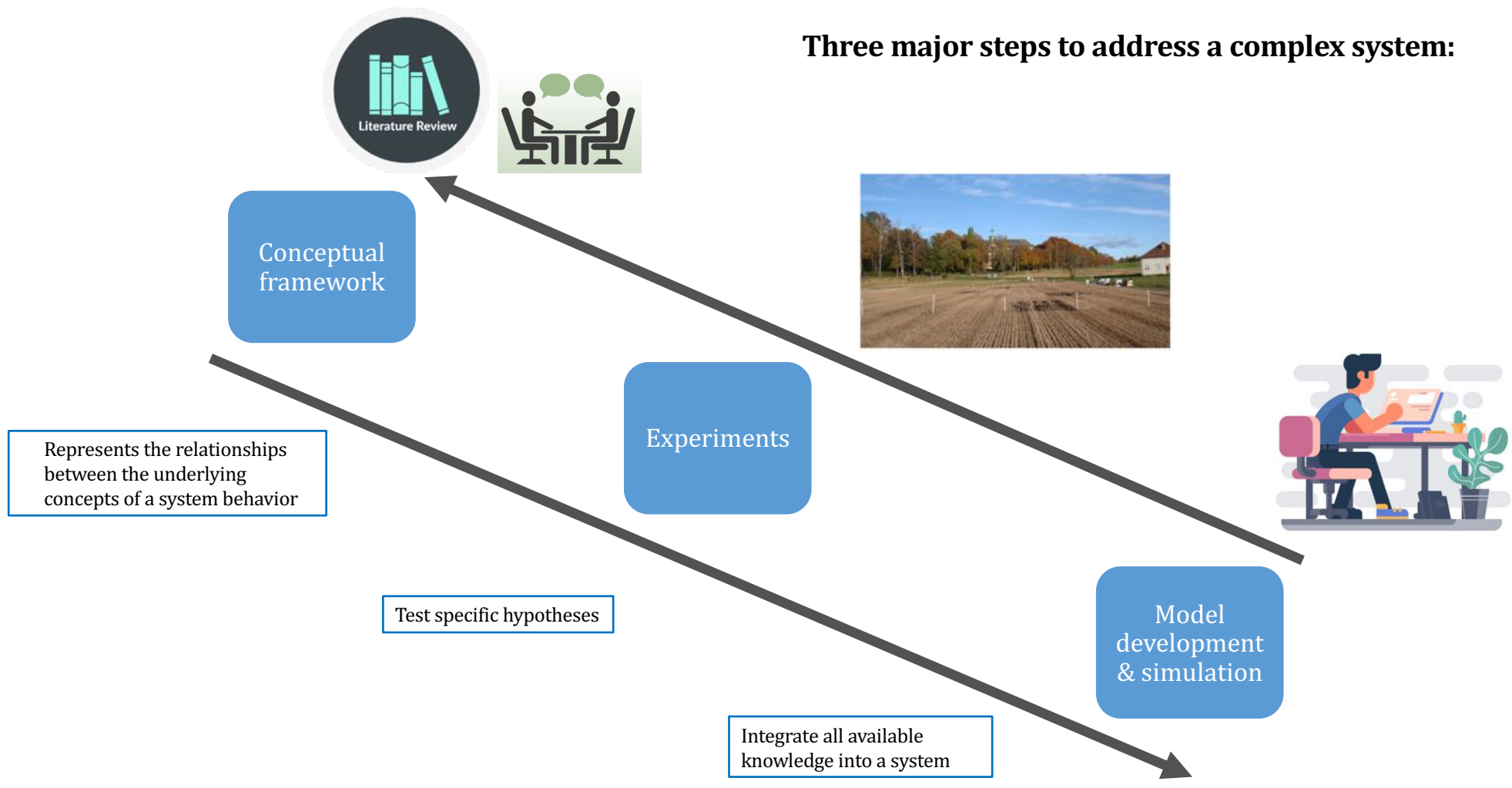
% SGE

Soil-borne  
pests

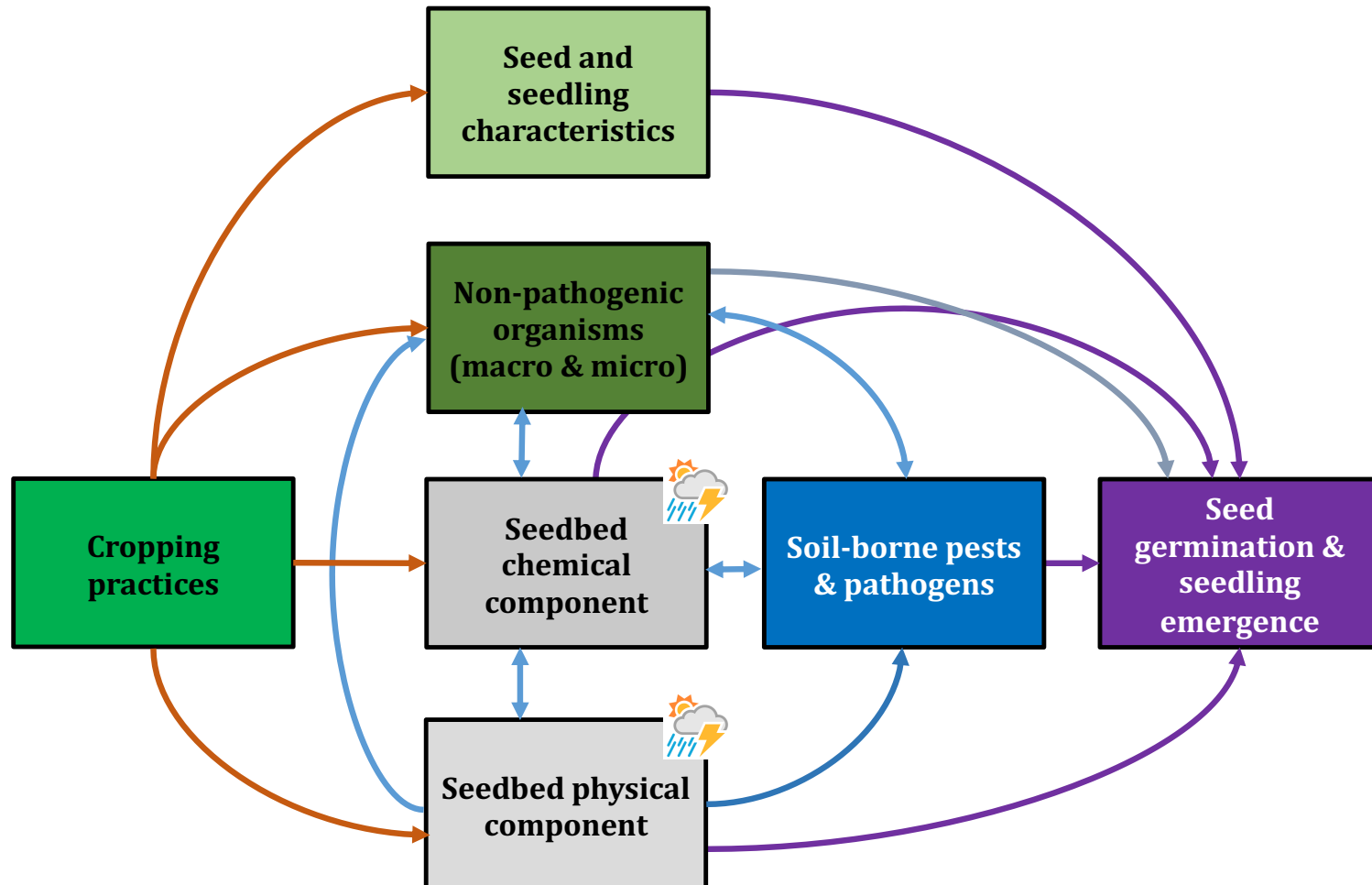
Soil-borne  
pathogens

# How to address such a complex system?

Three major steps to address a complex system:



## A conceptual framework: putting the pieces of the puzzle together



## Conclusions

- The crop establishment phase is affected by a number of factors and their interactions,
- Studies on individual components affecting this phase are useful but not sufficient to understand the entire system,
- A holistic research approach is needed to address this complex system,
- The phytobiome research represents a good initiative to this objective which is also an occasion for interdisciplinary research and transnational collaboration.



## **Acknowledgements**

- **The IPC organizing committee**
- **Thanks for your attention!**