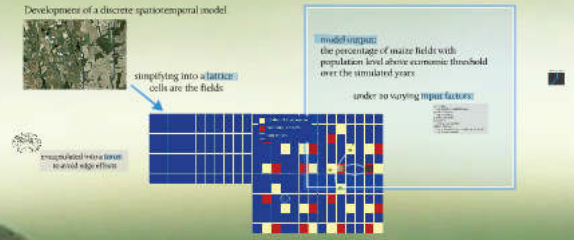
100% rotation necessary?

Which rotation strategy should be applied?

Biological facts lead us to a lattice model

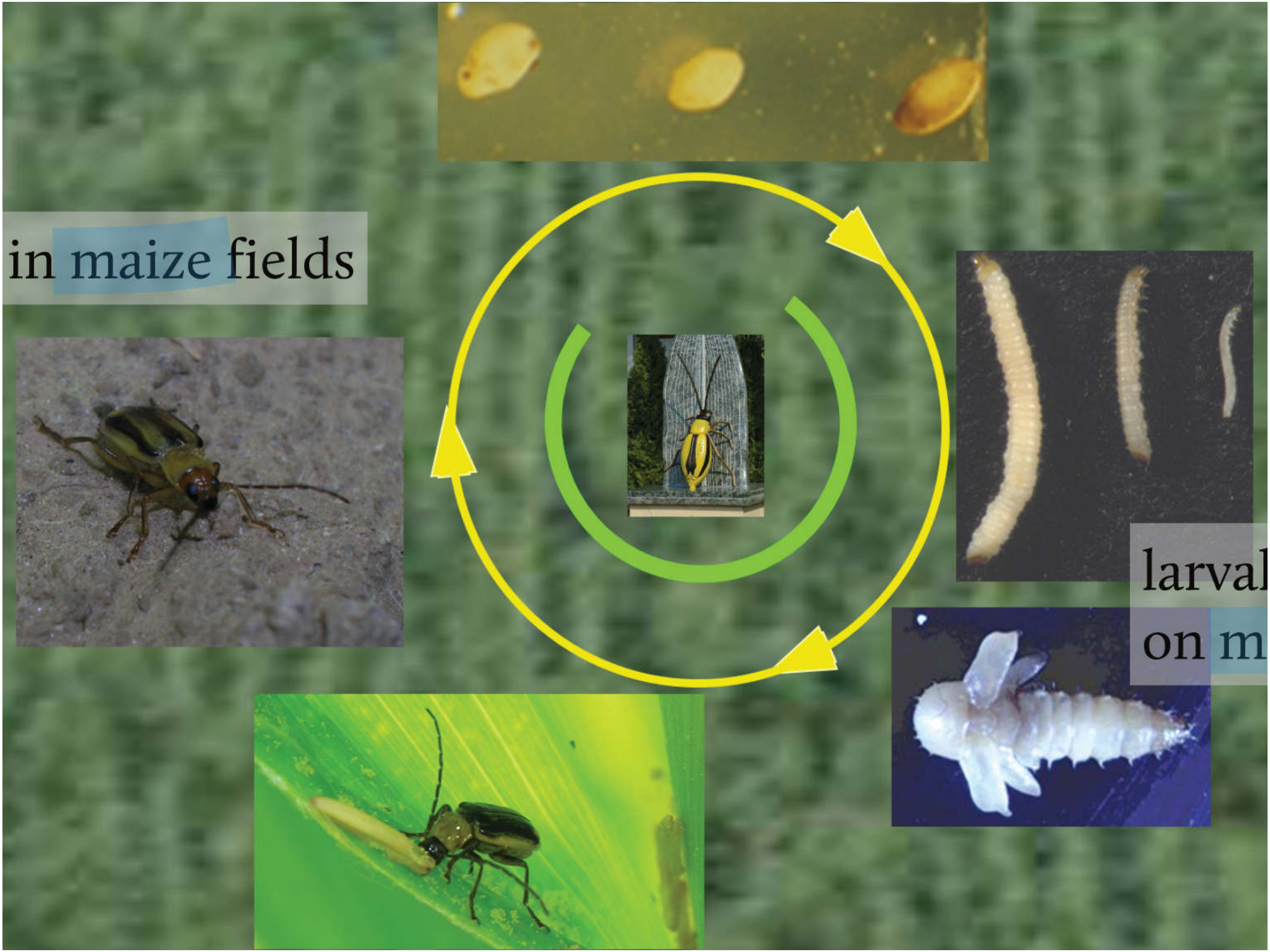


Objective:
simulation model for optimal crop rotation strategy against the pest

END
of the session

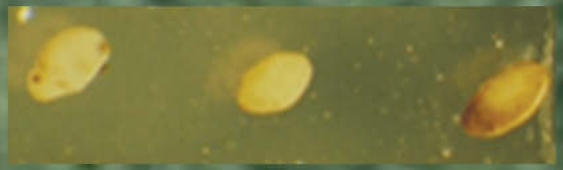
Further info on this model:
https://dx.doi.org/10.1016/j.agsy.2013.10.009


Lattice models to help design IPM strategies for
future climate
example of Diabrotica

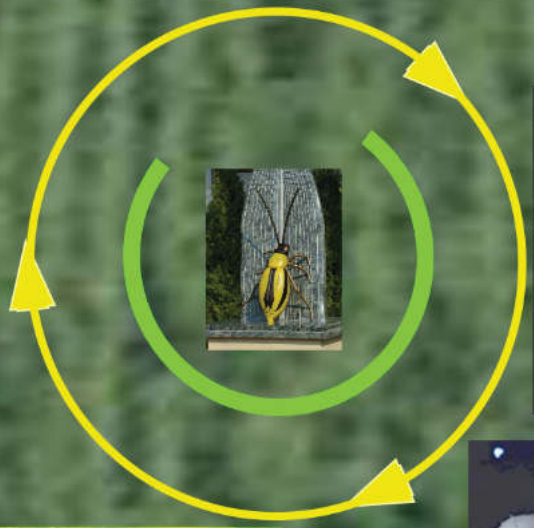

in maize fields
larval
on m

larval damage

feeding on roots → plant lodging → yield loss



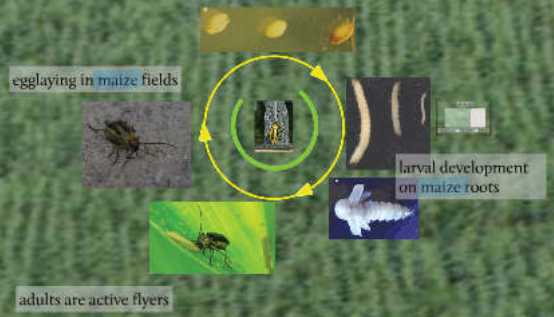
egglaying in maize fields

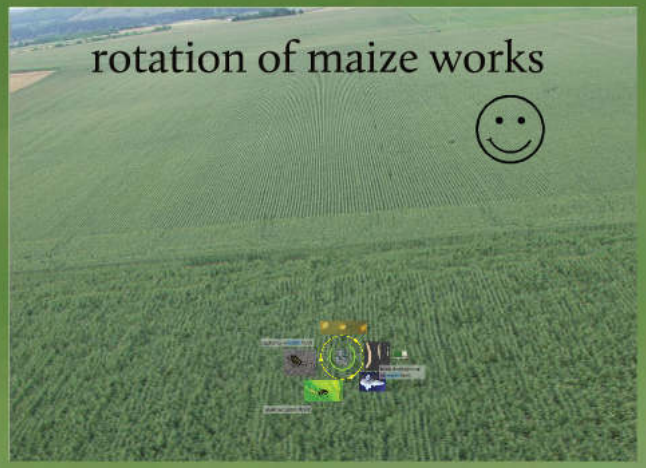


larval development
on maize roots

adults are active flyers

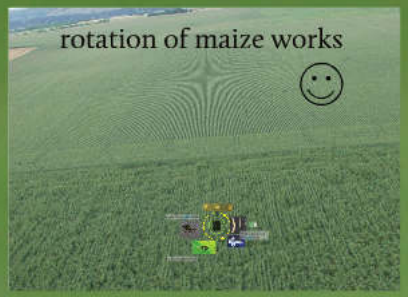
rotation of maize works





100% rotation necessary?

Which rotation strategy should be applied?



100% rotation necessary?

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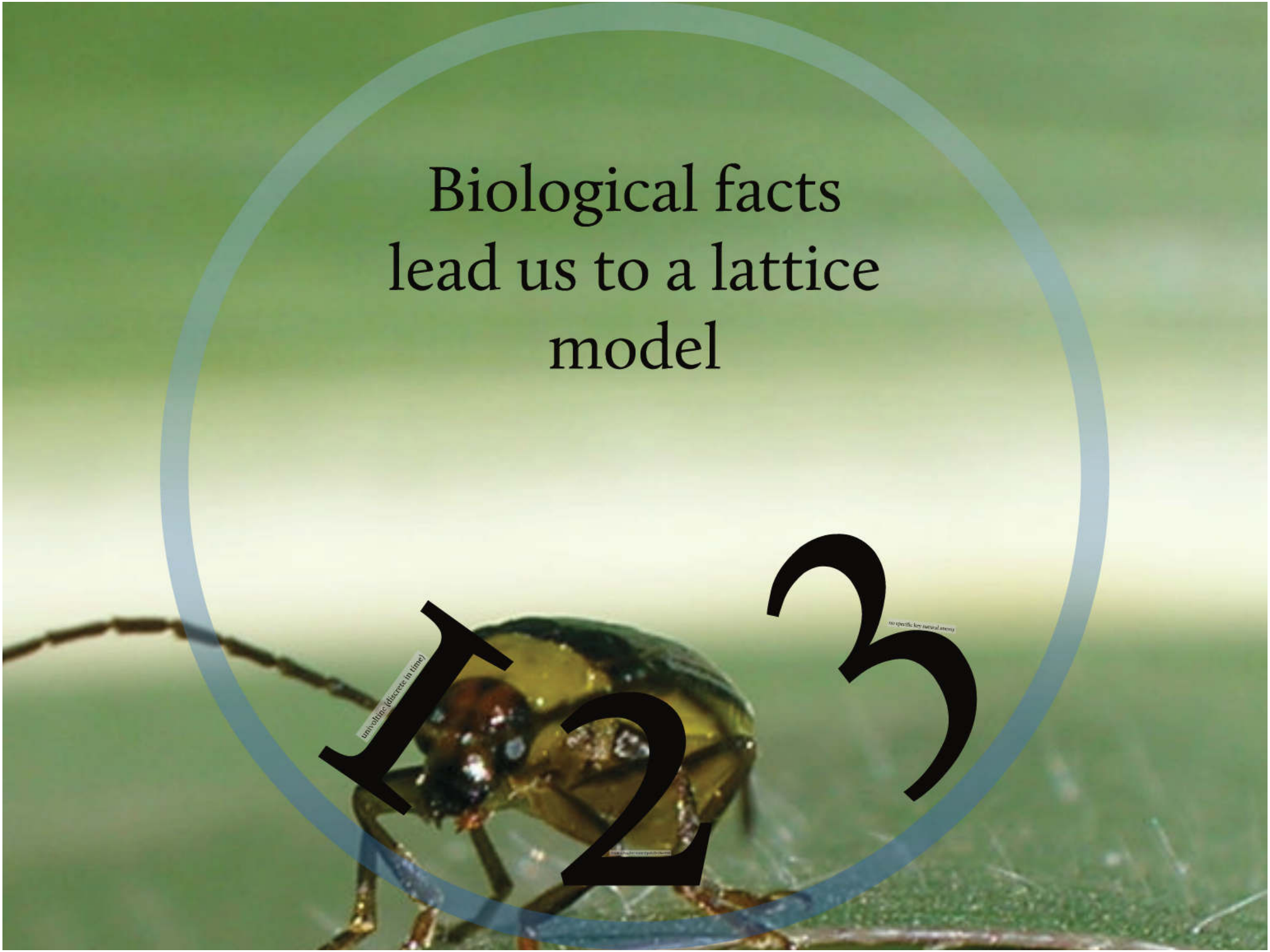
Objective:
simulation model for optimal crop rotation strategy against the pest


Biological facts
lead us to a lattice
model
1
2
3
univolting (discrete in time)
no specific key natural enemy

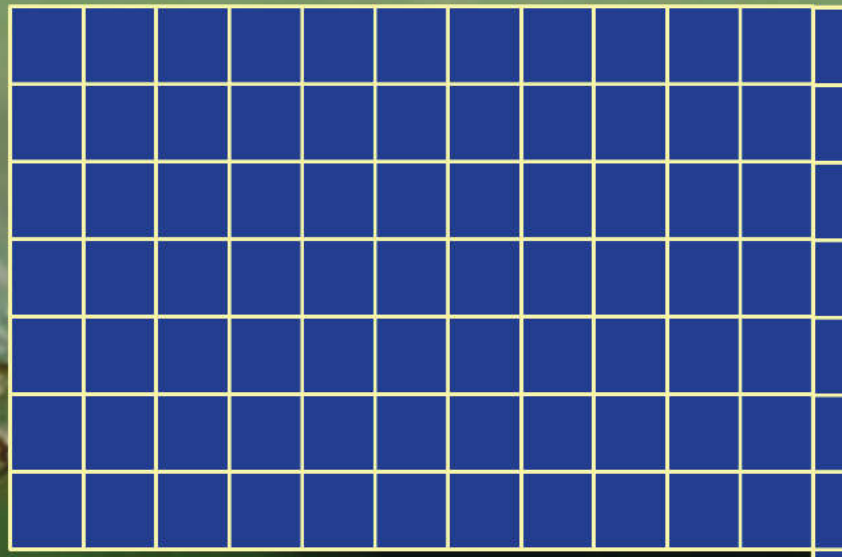

univoltine (discrete in time)

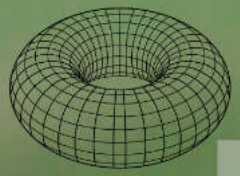

closely related to maize (spatially discrete)


no specific key natural enemy

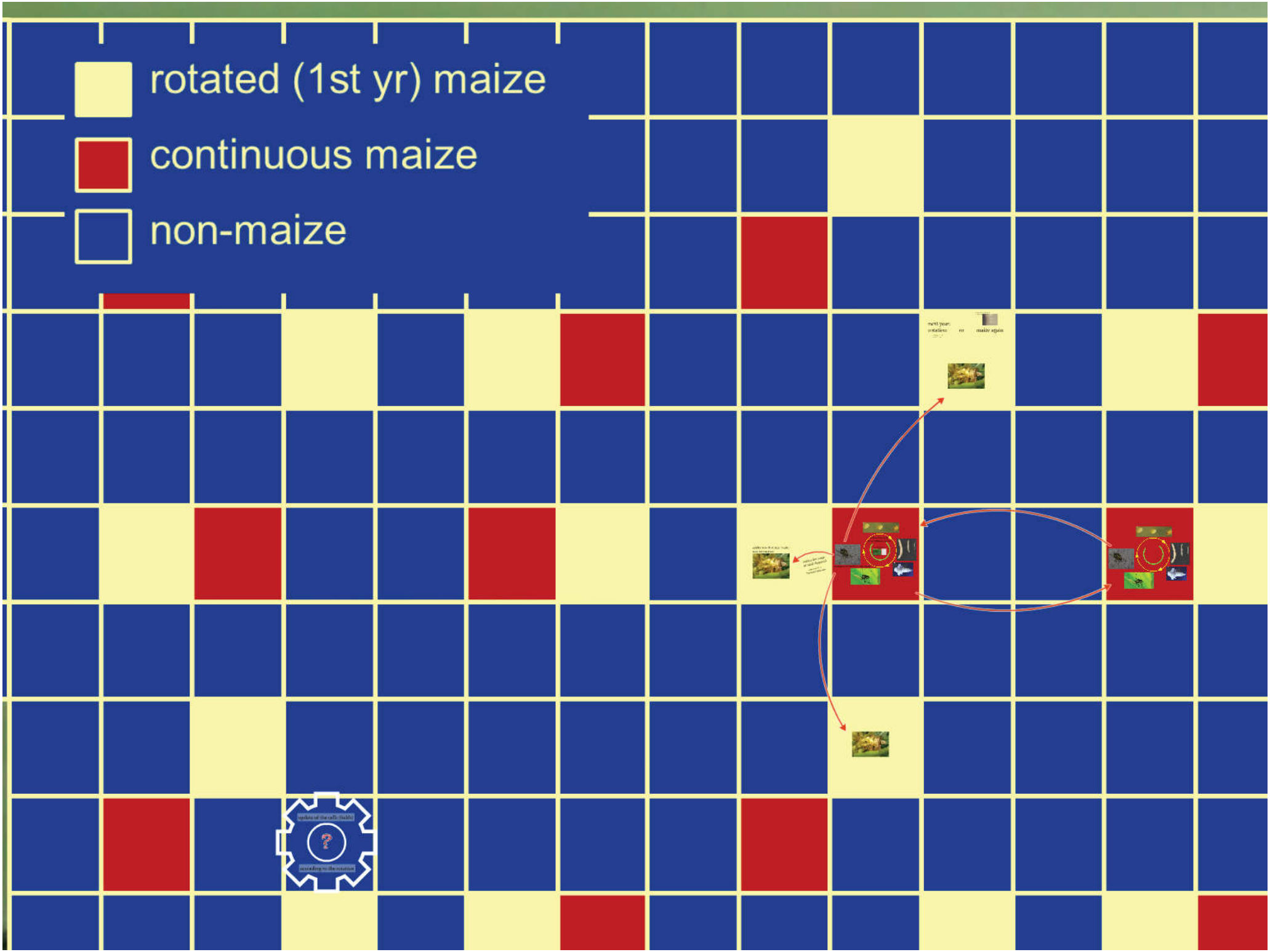
Development of a discrete spatiotemporal model

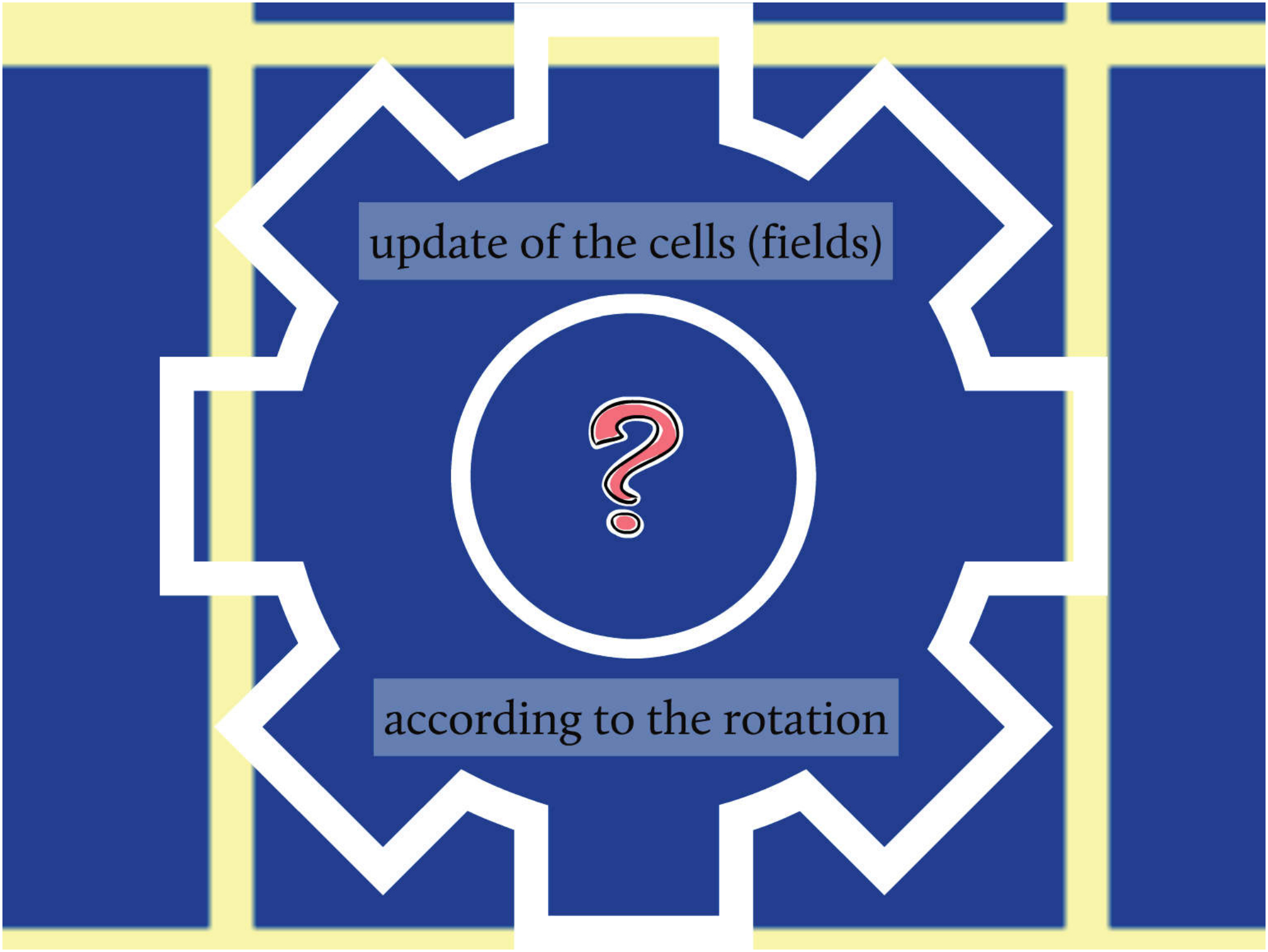
simpifying into a lattice
cells are the fields



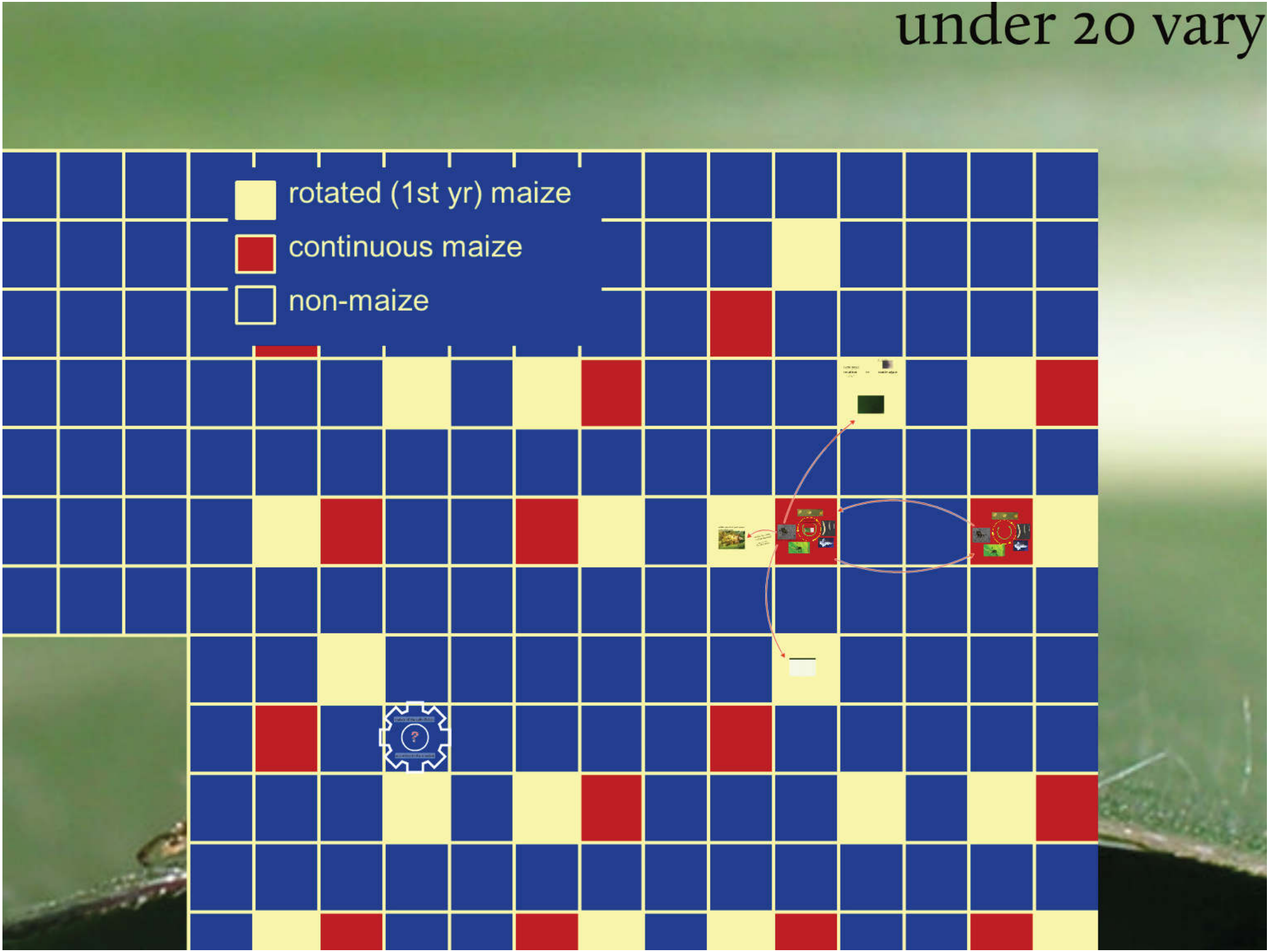


encapsulated into a torus
to avoid edge effects


rotated (1st yr) maize
continuous maize
non-maize


update of the cells (fields)
?
according to the rotation

under 20 vary



entire life cycle
in continous maize

larval damage

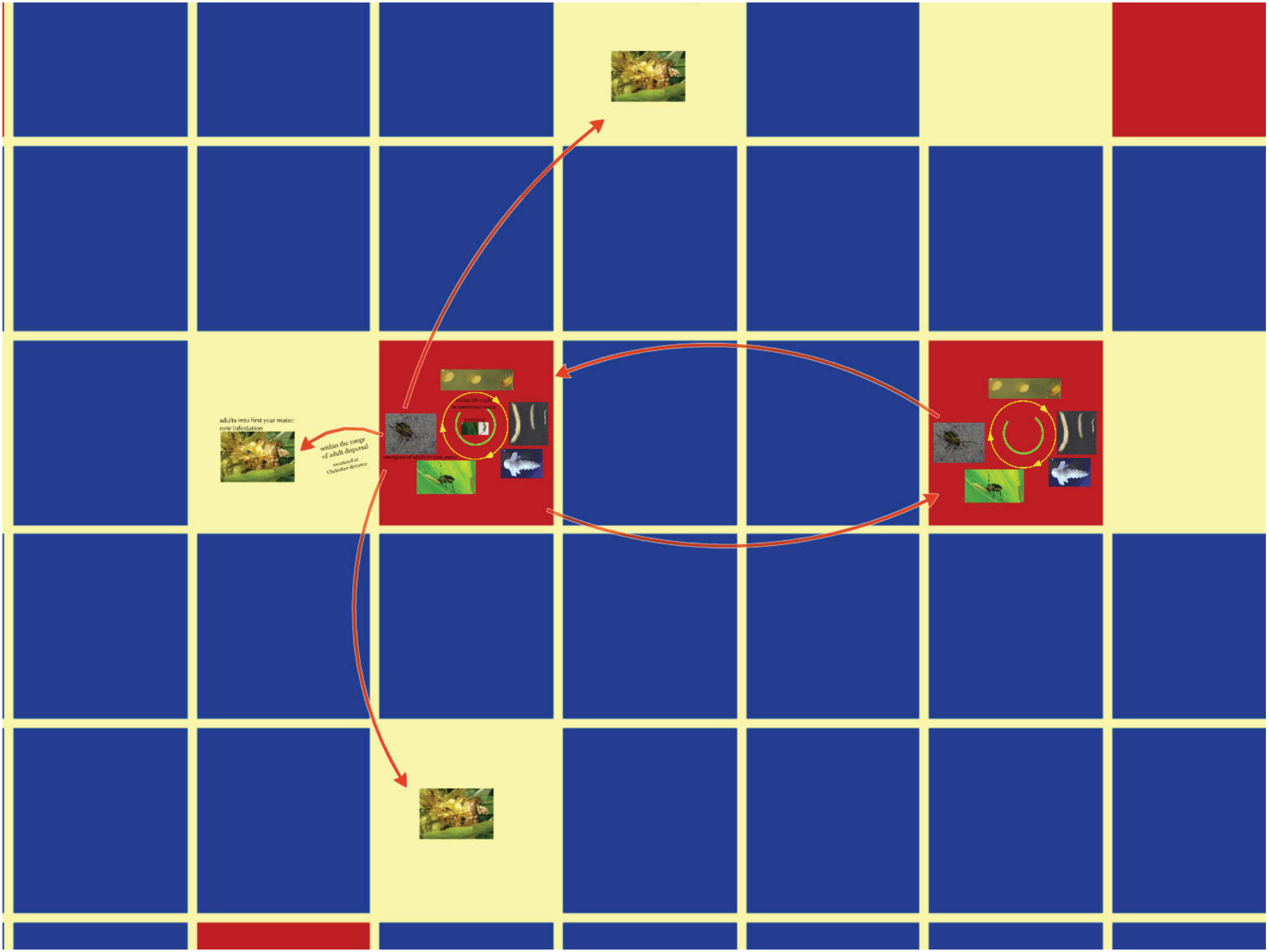
emergence of adults in cont. maize

within the range
of adult dispersal

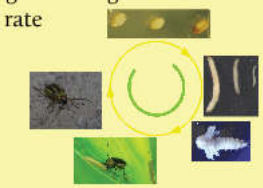
measured as
Chebishev distance

emergen

adults into first year maize: new infestation


adults into first year maize:
new infestation
within the range
of adult dispersal
recovered at
Chebindwet distance

offspring according to
growth rate



next year:

rotation or maize again

no offspring at all

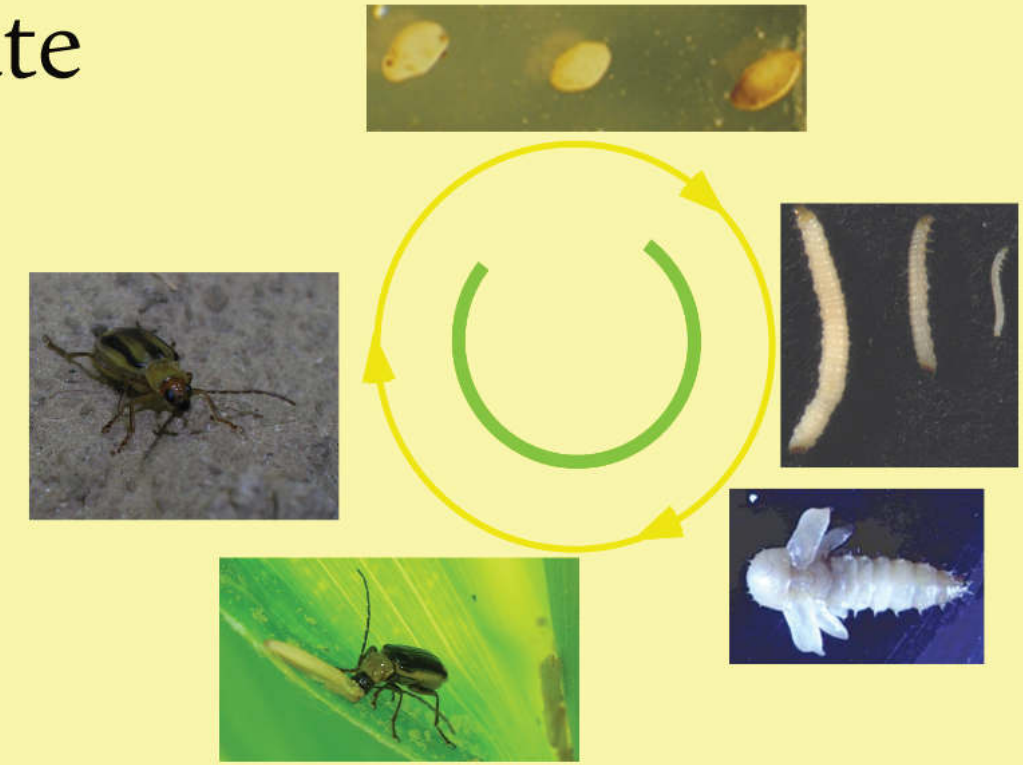
rotation has 100% efficacy

rotation

no offspring at all

rotation has 100% efficacy

offspring according to
growth rate



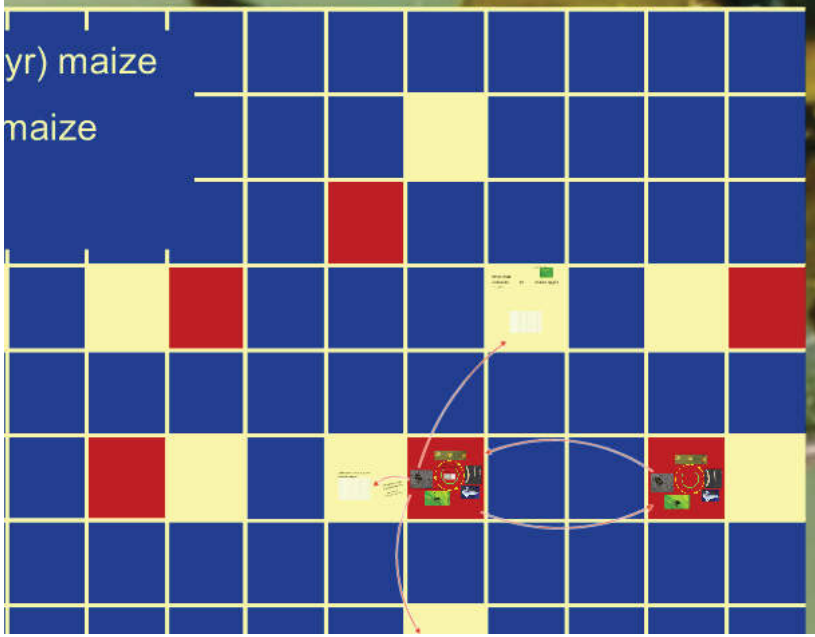
maize again

model output:

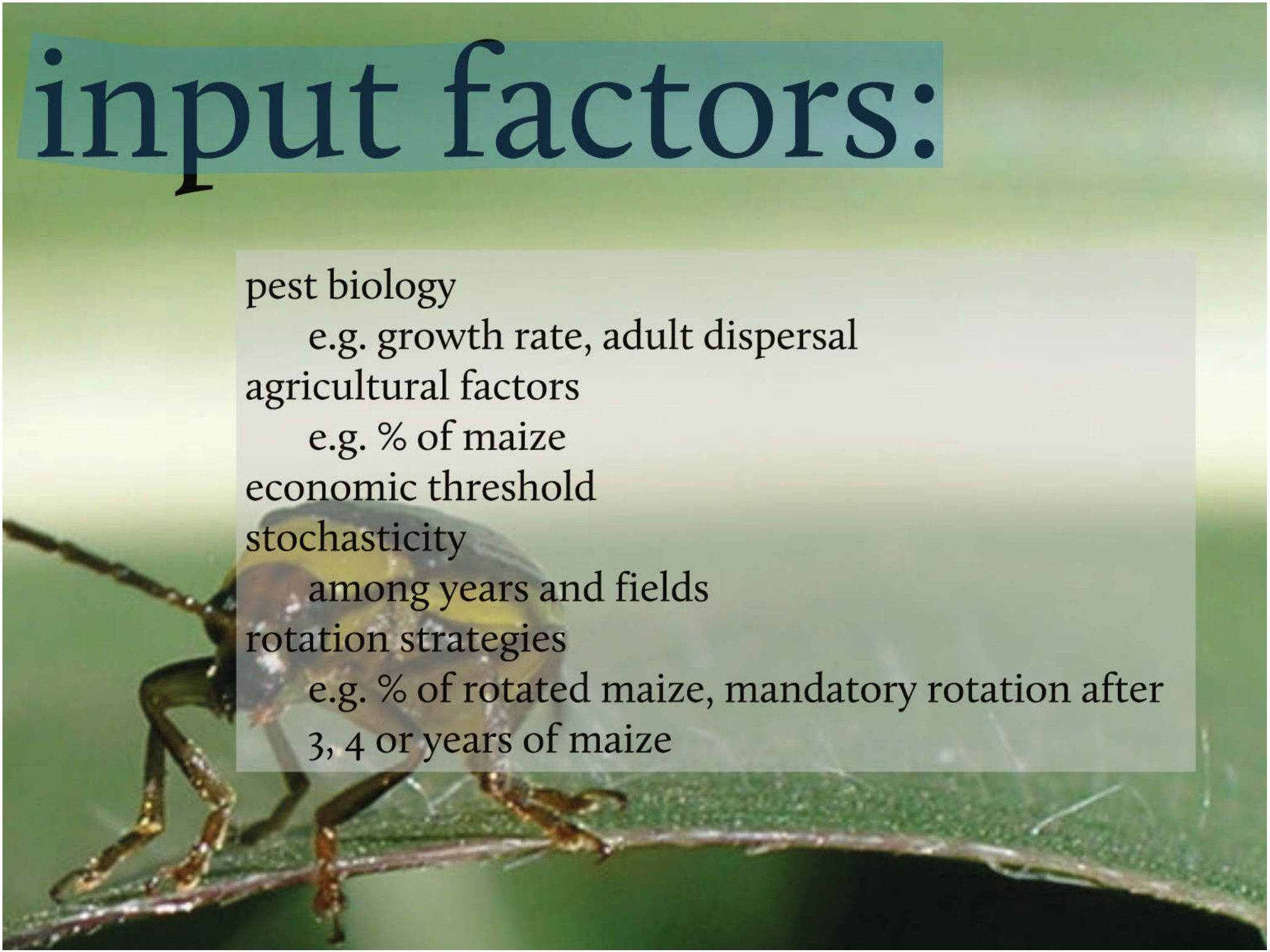
the percentage of maize fields with population level above economic threshold over the simulated years

under 20 varying input factors:

pest biology
    e.g. growth rate, adult dispersal
agricultural factors
    e.g. % of maize
economic threshold
stochasticity
    among years and fields
rotation strategies
    e.g. % of rotated maize, mandatory rotation after 3, 4 or years of maize



input factors:

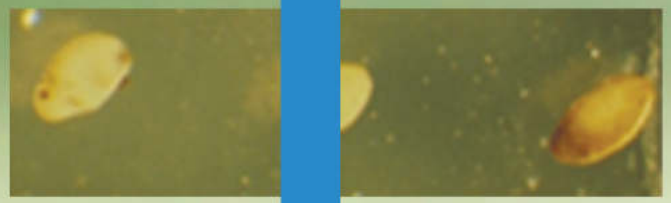


pest biology
    e.g. growth rate, adult dispersal
agricultural factors
    e.g. % of maize
economic threshold
stochasticity
    among years and fields
rotation strategies
    e.g. % of rotated maize, mandatory rotation after 3, 4 or years of maize


'Where' to place other control option?

two discrete time steps per year

'Where' to place other control option?




END
of the session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