Modelling the effects of cropping systems on the dynamics of a parasitic weed, Phelipanche ramosa, in interaction with the non-parasitic weed flora

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Introduction. The current decrease in herbicide use may increase and diversify weed flora in crops as well as companion bioagressors spreading via weeds. Among these bioagressors is *Phelipanche ramosa*, a parastic plant which is very harmful on oilseed rape.

Aim. To develop a model (called PHERASYS) of the effects of cropping systems on parasite dynamics, in interaction with non-parasitic weed hosts.

Model structure (Fig. 1)

▪ processes common to parasitic and non-parasitic weeds were based on FLORSYS (e.g. seed movements during tillage)

▪ stages specific to parasite were based on literature (e.g. seed germination stimulated by host root exsudates)

▪ FLORSYS output variables are used as PHERASYS input variables

Cropping system · Weather · Soil texture

FLORSYS
→ Seed movements = *f(tillage, soil structure)*
→ Soil structure and hydrothermal conditions
→ PHERASYS (14 equations)

Crop + weed density
Crop + weed root lengths
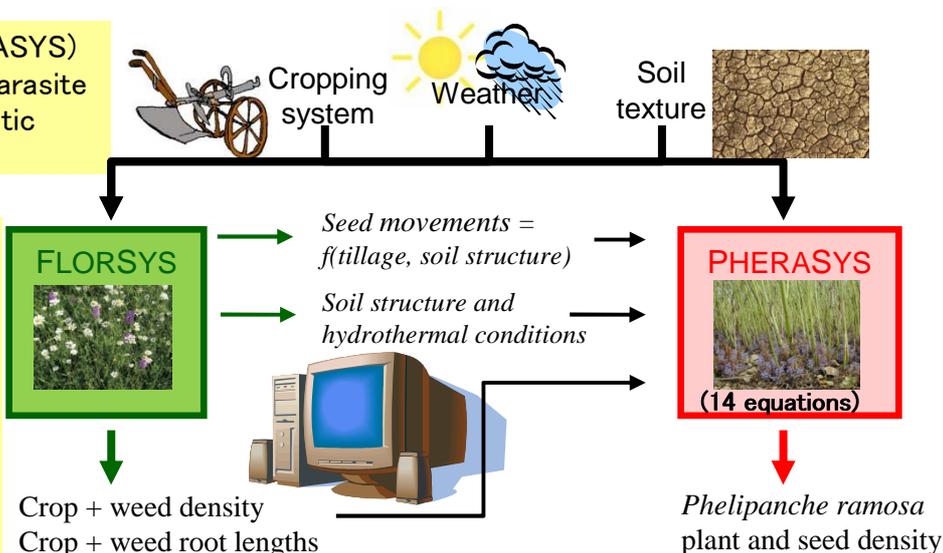
Phelipanche ramosa plant and seed density

Figure 1. Input and output variables of the newly developed PHERASYS model predicting the dynamics of the parasitic weeds *Phelipanche ramosa*, in interaction with soil environment and weed variables predicted by the existing FLORSYS model developed for non-parasitic weeds (Colbach *et al.*, 2010)
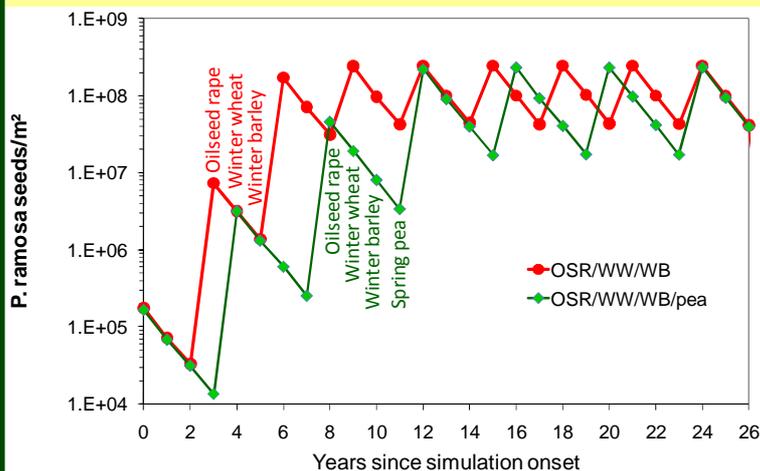
Simulation results

Figure 2. Density of *Phelipanche ramosa* soil seed bank after crop harvest with time simulated with PHERASYS for 2 different rotations in the absence of non-parasitic weeds
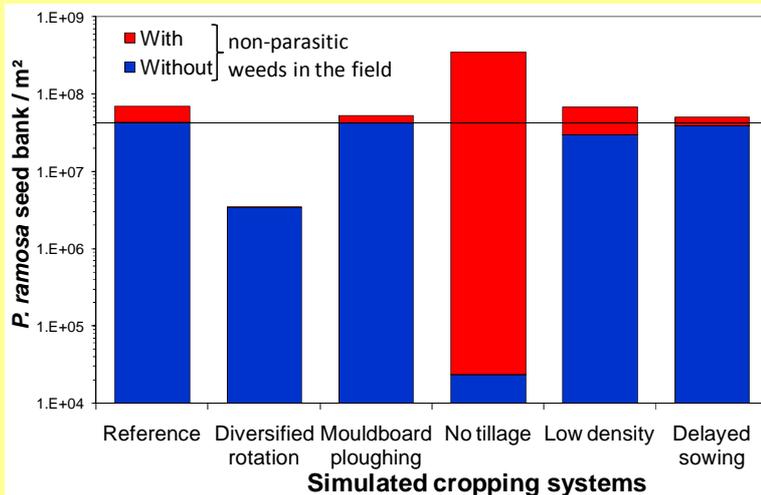

Figure 3. *Phelipanche ramosa* soil seed bank before oilseed rape in different cropping systems with an oilseed rape/winter wheat/winter barley rotation after 12 years of simulation with PHERASYS, either with or without non-parasitic weeds

Conclusion

– Mechanistic models of cropping systems effects on the dynamics of parasitic weeds are feasible
– Need for models predicting crop root growth
– Need for knowledge on parasite fixation, emergence and reproduction on different crop and weed species

Literature:
Colbach N. , Gardarin A., Munier-Jolain (2010) FLORSYS: a mechanistic model of cropping system effects on weed flora based on functional relationships with species traits. *Proc. 15th International EWRS Symposium, 12–15 July 2010, Kaposvár, Hungary* 157–158