Chronology of plantation in perennial agroforestry systems : Is it better to plant olive trees in vineyards or grapevine in olive orchards?

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Agroforestry is of growing interest to winegrowers as a way of coping with climate change, thanks to the buffering effect of trees on the microclimate. Conversely, olive growers in France are interested in diversifying their production, for example by growing vines for wine or table grapes. However, trees and vines compete for light, water and nitrogen resources, and these competitions change across time, as the trees and vines grow and colonize the soil. This raises questions about the dynamics of planting: is it better to plant the trees first, and wait for the tree to be large enough to create a beneficial microclimate to protect the young vines? Or should the two species be planted at the same time, so that their architectural plasticity enables them to create spatial complementarities above and vbelow-ground? Or can the trees be planted in an existing vineyard (as many winegrowers wish to do, taking advantage of gaps in the vineyard to plant the trees) without the vine exerting too much competition on the young trees?

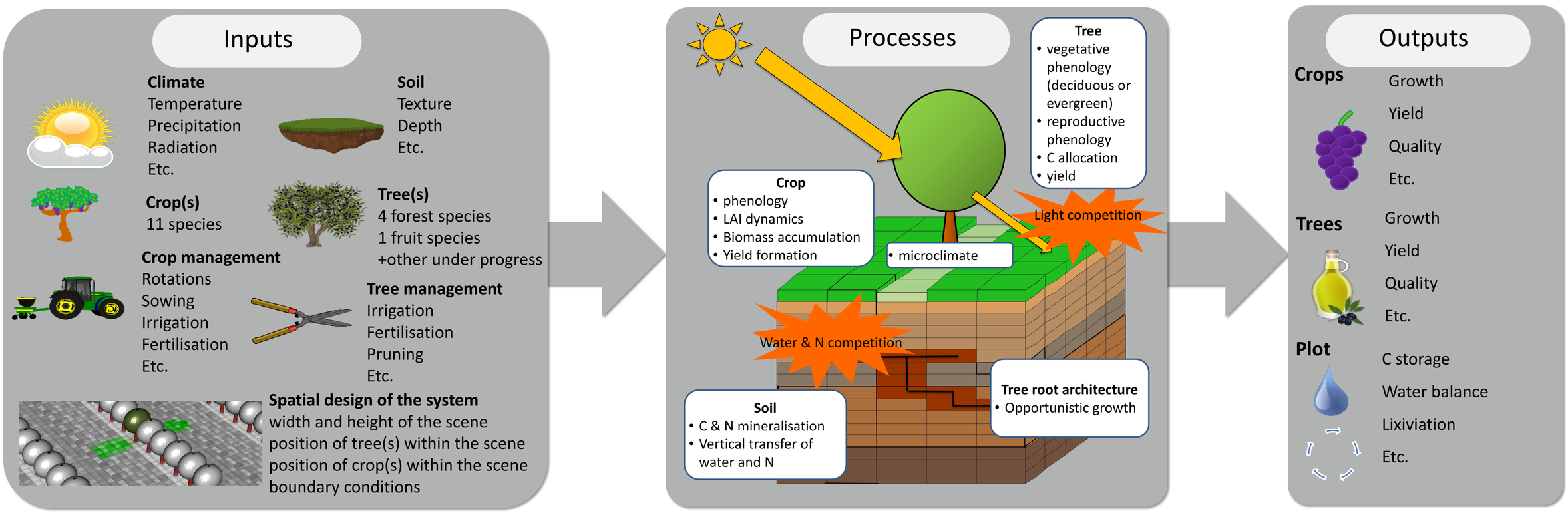

Figure 1: Description of the Hi-sAFe agroforestry model used to compare different olive-grapevine chronologies of plantation

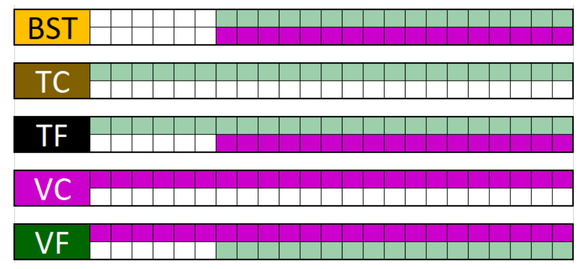

Figure 2: The 5 tested chronologies of plantation (olive green = presence of olive tree, purple=presence of grapevine). BST: both at the same time, TF: tree first (grapevine planted 6 years later), VF: vine first (olive tree planted 6 years later), TC: tree control (no grapevine) and VC: vine control (no olive tree).

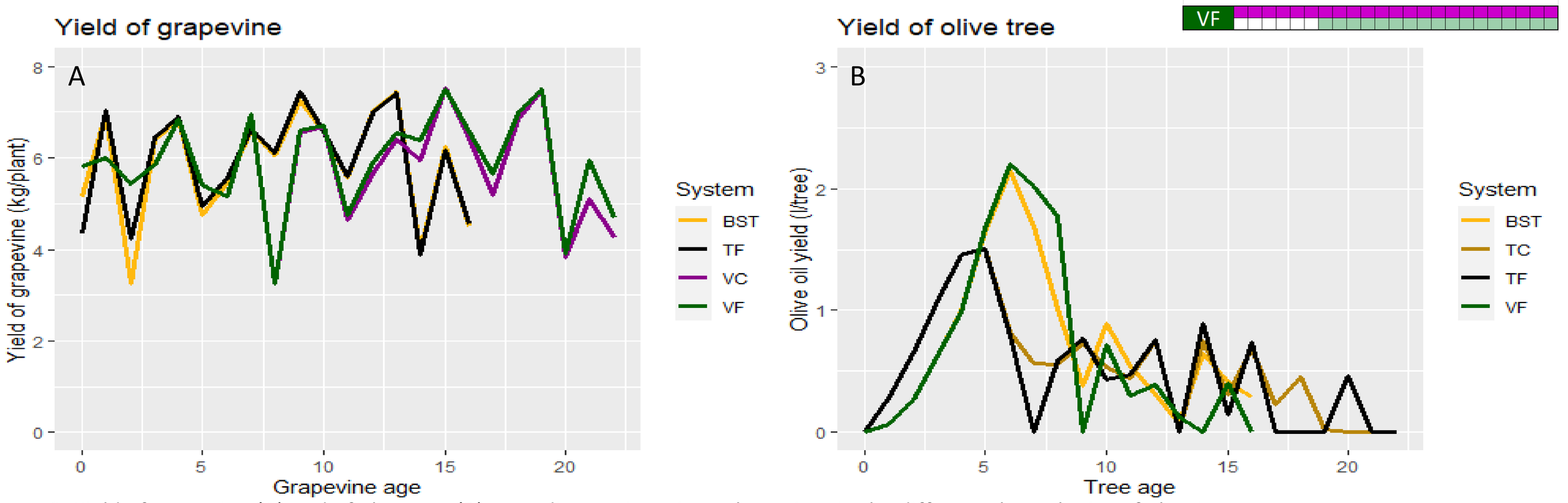

Figure 3: Yield of grapevine (A) and of olive tree (B) according to time since plantation, in the different chronologies of planting

- Compare grapevine yield in VF vs VC: the competition by trees has a minimal impact on grapevine yield
- Compare vine yield in VF vs VC in years 14, 17, 21 & 22: the grapevine benefits from the microclimate created by olive trees in “bad” years
- Compare vine yield in year 3 of BST (young trees) vs TF (older trees): the beneficial effect of tree microclimate increases with tree age
- Compare olive yield in VF vs BST: initially olive trees perform better when planted in existing vineyard but this is reversed when trees get older due to several no-yield years in VF; there are also more no-yield years in VF than in TC
- The simulated yield of olive trees is very low and shows an unexpected production pattern (early peak of production): wrong parameterization?

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There is a good potential for olive-grapevine associations planted at the same time, which could help stabilize grapevine yield, under the condition that tree management is adapted to reduce the phenomenon of irregularity of production of olive trees.

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