

$$Y_{ijkl} = \beta_0 + \beta_j^d + \beta_\ell^v + (\beta^d \beta^t)_{jk} + (\beta^d \beta^v)_{j\ell} + (\beta^d \beta^t \beta^v)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk} + \varepsilon_{ijkl}$$

$$Y_{ijkl} = \beta_0 + D_j + V_\ell + (DT)_{jk} + (DV)_{j\ell} + (DTV)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk} + \varepsilon_{ijkl}$$

$$\ln [\mathbb{E} (Y_{ijkl} | \text{density, training, variety})] = \beta_0 + \beta_j^d + \beta_\ell^v + (\beta^d \beta^t)_{jk} + (\beta^d \beta^v)_{j\ell} + (\beta^d \beta^t \beta^v)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}$$

$$\ln [\mathbb{E} (Y_{ijk\ell} | \text{density, training, variety})] = \beta_0 + D_j + V_\ell + (DT)_{jk} + (DV)_{j\ell} + (DTV)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}$$

$$\text{logit}(P_{ijkl}) = \beta_0 + \beta_j^d + \beta_\ell^v + (\beta^d \beta^t)_{jk} + (\beta^d \beta^v)_{j\ell} + (\beta^d \beta^t \beta^v)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}$$

$$\text{logit}(P_{ijkl}) = \beta_0 + D_j + V_\ell + (DT)_{jk} + (DV)_{j\ell} + (DTV)_{jk\ell} + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}$$

$$\begin{cases} \text{Block :} & \gamma_{0i} \sim \mathcal{N}(0, \sigma_1^2) \\ \text{Density :} & \gamma_{0ij} \sim \mathcal{N}(0, \sigma_2^2) \\ \text{Training :} & \gamma_{0ijk} \sim \mathcal{N}(0, \sigma_3^2) \end{cases}$$

$$\varepsilon_{ijkl} \sim \mathcal{N}(0, \sigma_\varepsilon^2)$$

$$\begin{aligned}
Y_{ijkl} = & \beta_0 + \beta_1 \text{density}(\text{medium}) + \beta_2 \text{density}(\text{high}) + \beta_3 \text{variety}(\text{Calypso}) + \beta_4 \text{variety}(\text{Keitt}) \\
& + \beta_5 \text{density}(\text{medium}) \times \text{training}(\text{SL}) + \beta_6 \text{density}(\text{high}) \times \text{training}(\text{SL}) \\
& + \beta_7 \text{density}(\text{medium}) \times \text{variety}(\text{Calypso}) + \beta_8 \text{density}(\text{high}) \times \text{variety}(\text{Calypso}) \\
& + \beta_9 \text{density}(\text{medium}) \times \text{variety}(\text{Keitt}) + \beta_{10} \text{density}(\text{high}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{11} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{12} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{13} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{14} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk} + \varepsilon_{ijkl}
\end{aligned}$$



$$\begin{aligned}
\ln [\mathbb{E} (Y_{ijkl} | \text{density, training, variety})] = & \\
& \beta_0 + \beta_1 \text{density}(\text{medium}) + \beta_2 \text{density}(\text{high}) + \beta_3 \text{variety}(\text{Calypso}) + \beta_4 \text{variety}(\text{Keitt}) \\
& + \beta_5 \text{density}(\text{medium}) \times \text{training}(\text{SL}) + \beta_6 \text{density}(\text{high}) \times \text{training}(\text{SL}) \\
& + \beta_7 \text{density}(\text{medium}) \times \text{variety}(\text{Calypso}) + \beta_8 \text{density}(\text{high}) \times \text{variety}(\text{Calypso}) \\
& + \beta_9 \text{density}(\text{medium}) \times \text{variety}(\text{Keitt}) + \beta_{10} \text{density}(\text{high}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{11} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{12} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{13} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{14} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}
\end{aligned}$$

$$\begin{aligned}
\text{logit}(P_{ijkl}) = & \beta_0 + \beta_1 \text{density}(\text{medium}) + \beta_2 \text{density}(\text{high}) + \beta_3 \text{variety}(\text{Calypso}) + \beta_4 \text{variety}(\text{Keitt}) \\
& + \beta_5 \text{density}(\text{medium}) \times \text{training}(\text{SL}) + \beta_6 \text{density}(\text{high}) \times \text{training}(\text{SL}) \\
& + \beta_7 \text{density}(\text{medium}) \times \text{variety}(\text{Calypso}) + \beta_8 \text{density}(\text{high}) \times \text{variety}(\text{Calypso}) \\
& + \beta_9 \text{density}(\text{medium}) \times \text{variety}(\text{Keitt}) + \beta_{10} \text{density}(\text{high}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{11} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{12} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Calypso}) \\
& + \beta_{13} \text{density}(\text{medium}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \beta_{14} \text{density}(\text{high}) \times \text{training}(\text{SL}) \times \text{variety}(\text{Keitt}) \\
& + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk}
\end{aligned}$$

$$\left\{ \begin{array}{l} i = 1, 2, 3 \\ j = 1 \text{ (Low)}, 2 \text{ (Medium)}, 3 \text{ (High)} \\ k = 1 \text{ (Conv)}, 2 \text{ (SL)} \\ \ell = 1 \text{ (1243)}, 2 \text{ (Calypso)}, 3 \text{ (Keitt)} \end{array} \right.$$

$$Y_{ijkl} = \beta_0 + \beta_j^{\text{GC}} + \beta_k^{\text{trt}} + \beta_\ell^{\text{var}} + (\beta^{\text{GC}} \beta^{\text{trt}})_{jk} + (\beta^{\text{GC}} \beta^{\text{var}})_{j\ell} + (\beta^{\text{trt}} \beta^{\text{var}})_{k\ell} + (\beta^{\text{GC}} \beta^{\text{trt}} \beta^{\text{var}})_{jkl} + \varepsilon_{ijkl}$$

$$\varepsilon_{ijkl} \sim \mathcal{N}(0, \sigma^2 \Lambda_i)$$

$$\begin{aligned}
Y_{ijkl} = & \beta_0 + \beta_1 \text{variety}(\text{Calypso}) + \beta_2 \text{variety}(\text{Keitt}) + \beta_3 \text{treatment}(3) + \beta_4 \text{treatment}(5) \\
& + \beta_5 \text{variety}(\text{Calypso}) \times \text{treatment}(3) + \beta_6 \text{variety}(\text{Keitt}) \times \text{treatment}(3) \\
& + \beta_7 \text{variety}(\text{Calypso}) \times \text{treatment}(5) + \beta_8 \text{variety}(\text{Keitt}) \times \text{treatment}(5) \\
& + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk} + \varepsilon_{ijkl}
\end{aligned}$$

Est-ce que ce ne serait pas mieux de mettre : au lieu de  $\times$  pour les interactions ?

$$\begin{aligned}
Y_{ijkl} = & \beta_0 + \beta_1 \text{variety}(\text{Calypso}) + \beta_2 \text{variety}(\text{Keitt}) + \beta_3 \text{treatment}(3) + \beta_4 \text{treatment}(5) \\
& + \beta_5 \text{variety}(\text{Calypso}) : \text{treatment}(3) + \beta_6 \text{variety}(\text{Keitt}) : \text{treatment}(3) \\
& + \beta_7 \text{variety}(\text{Calypso}) : \text{treatment}(5) + \beta_8 \text{variety}(\text{Keitt}) : \text{treatment}(5) \\
& + \gamma_{0i} + \gamma_{0ij} + \gamma_{0ijk} + \varepsilon_{ijkl}
\end{aligned}$$