

**Supplementary Table S10.** Performance of optimized machine learning models for differentiation rate prediction.

(A) Shooting rate

Model	CV $R^2$	Test $R^2$	RMSE	MAE	Model significance
Random Forest	-0.55	0.57	0.05	0.03	*
HistGradientBoosting	-0.63	0.39	0.06	0.04	†
K-Nearest Neighbors	-0.81	0.35	0.06	0.04	†
AdaBoost	-0.82	0.02	0.08	0.05	ns
Dummy model	-0.91	-0.04	0.08	0.07	ns

(B) Rooting rate

Model	CV $R^2$	Test $R^2$	RMSE	MAE	Model significance
Random Forest	0.59	0.78	0.15	0.11	**
Extra Trees	0.53	0.78	0.15	0.10	**
Gradient Boosting	0.53	0.77	0.15	0.10	**
HistGradientBoosting	0.50	0.72	0.17	0.11	**
AdaBoost	0.54	0.71	0.17	0.13	**

Note: Performance levels are classified according to Test  $R^2$ : \*\*  $\geq 0.75$  (excellent); \* 0.50–0.74 (good); † 0.25–0.49 (moderate); ns  $< 0.25$  (poor).