ROSE PRESERVATION STUDY PROTOCOL

Project Multivariate and Hierarchical Data DL

Group 8

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1. Research question

Which compound can preserve the freshness of cut roses for the longest time?

2. Hypotheses

The rose longevity of each compound group will be compared to the control group (distilled water).

- **Null hypothesis**: There is no difference in the rose longevity (in days) between roses in distilled water and roses with any of the 14 compounds.
  $\beta_k \leq 0$ with k the effect of compound k on the longevity of the rose
- **Alternative hypothesis**: At least one compound gives longer rose longevity than distilled water $\beta_k > 0$ with k the effect of compound k on the longevity of the rose.

3. Study design

- **Study settings**

All experiments will be conducted in the Castle basement with constant temperature, humidity and intensity of light.

- **Study design:** randomized controlled trial.

- **Study subjects**

We will include two types of roses (Hybrid tea and Floribunda spices) from Jean-Baptiste's gardens. Only flower buds with a diameter of about 1 cm, with an angle between lower and upper part not less than 170^o deviation (measured by a goniometer), without dark petals and at the beginning of blooming will be selected for experiment.

- **Procedure of the experiment**

Ten evaluators will be randomly assigned to cut the roses, one from each bush across different gardens in one morning and immediately put in distilled water buckets and transported to the basement. These roses will be randomly assigned to be placed into 15 compound groups, stratified by rose type, and gardens.

The outcome will be assessed by 10 trained evaluators daily until the rose does not meet the freshness criteria. The evaluators will be blinded to the compound the rose is placed in when they proceed the evaluation.

- **Outcome measurement**

Rose longevity: the number of days after harvest (day 0) to the day the flowers do not meet the freshness criteria. The freshness criteria is defined as (1) Angle - not less than 150^o and (2) Petals - not more than 3 petals with changed colour. If one of the two criteria are not met, the rose is declared not fresh and is discarded.

4. Statistical analysis

Mixed-effect Poisson regression model will be fitted. The compounds, rose types and gardens are included as fixed effects. Evaluators will be included as random effects. Family-wise significance level is set at 0.05 . The Holm-Bonferroni method will be used to correct for multiple comparisons.

The model is specified as below:

$$log(E(Y_{ij})) = \beta_0 + b_j + \sum_{k=2}^{15} (\beta_{1k} * Compound_{ij}) + \beta_2 * Species_{ij} + \beta_3 * Garden_{ij}$$

$E(Y_{ji}) = \lambda$: mean number of days that rose *i* assessed by evaluator *j* remained fresh. Y ~ Po(λ)

β_0: intercept

b_j : random effect of the evaluators. $b \sim N(0, \sigma^2)$

β_{1k}: fixed effect of compound

$Compound$: dummy variable. Takes the value 1 if the rose is in compound (*)ij, 0 if the rose is in distilled water.

β_2: fixed effect of species.

$Species$: dummy variable. Takes the value 1 for Floribunda, 0 for Hybrid Tea

β_3: fixed effect of garden subplot

$Garden_{ij}$: dummy variable. Takes value 1 for garden subplot North, 0 for garden subplot South.

5. Pilot experiment for sample size

We are requesting 40 roses placed in distilled water (compound 1): 10 roses from 2 species, from 2 gardens, rated by 1 evaluator.

As our model is a Poisson regression model, the pilot experiment will provide us an estimate of the mean which is equal to the variance in a Poisson regression model. By that way, we will be able to calculate a sample size and eventually request a modification of the effect size that would be more compatible with our workforce.