Cannlytics

Cannabis Data Science

Cananbis Data Science #143

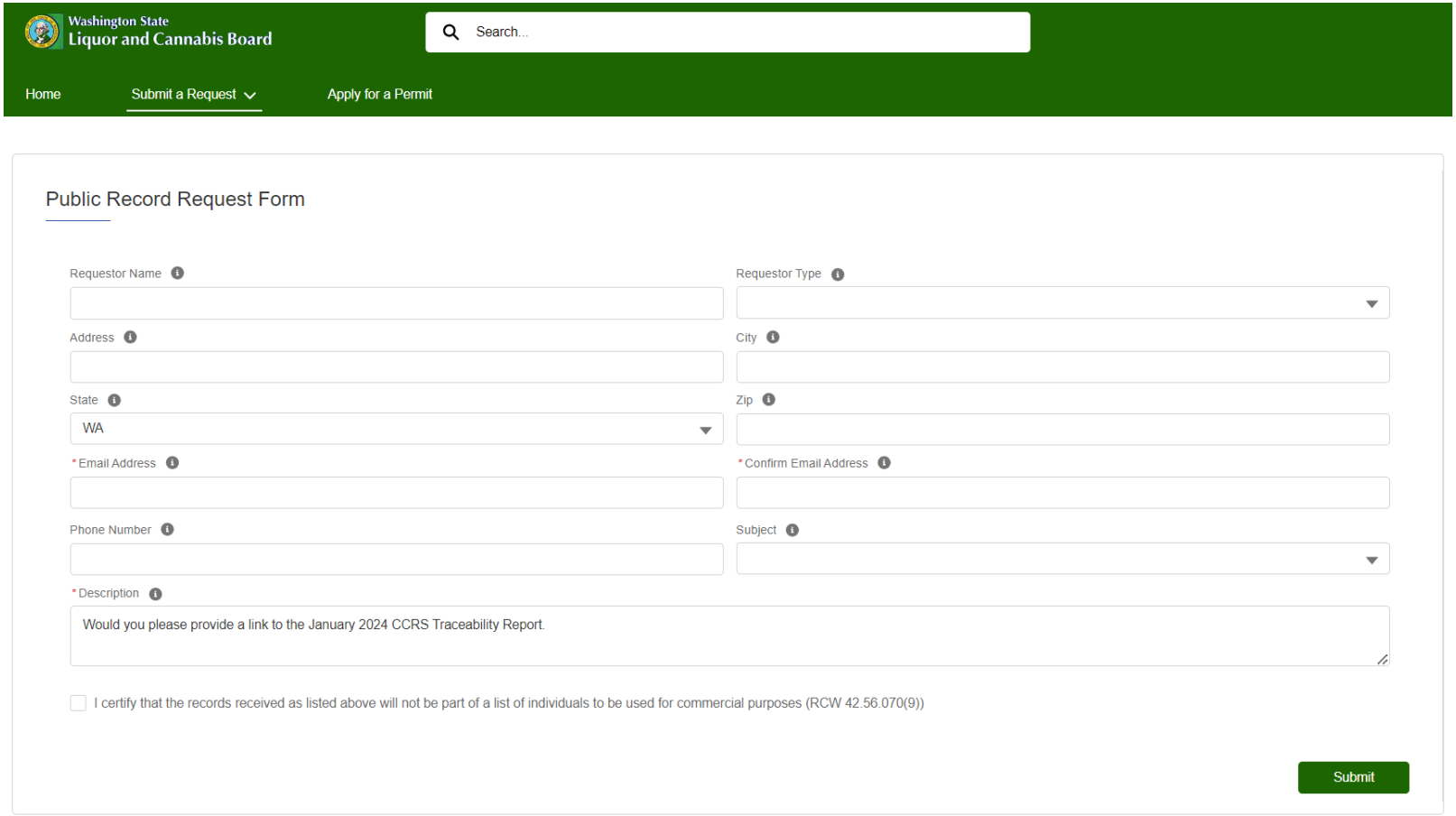
January 18th, 2024

Research Question

What factors may contribute to healthy cannabis plants?

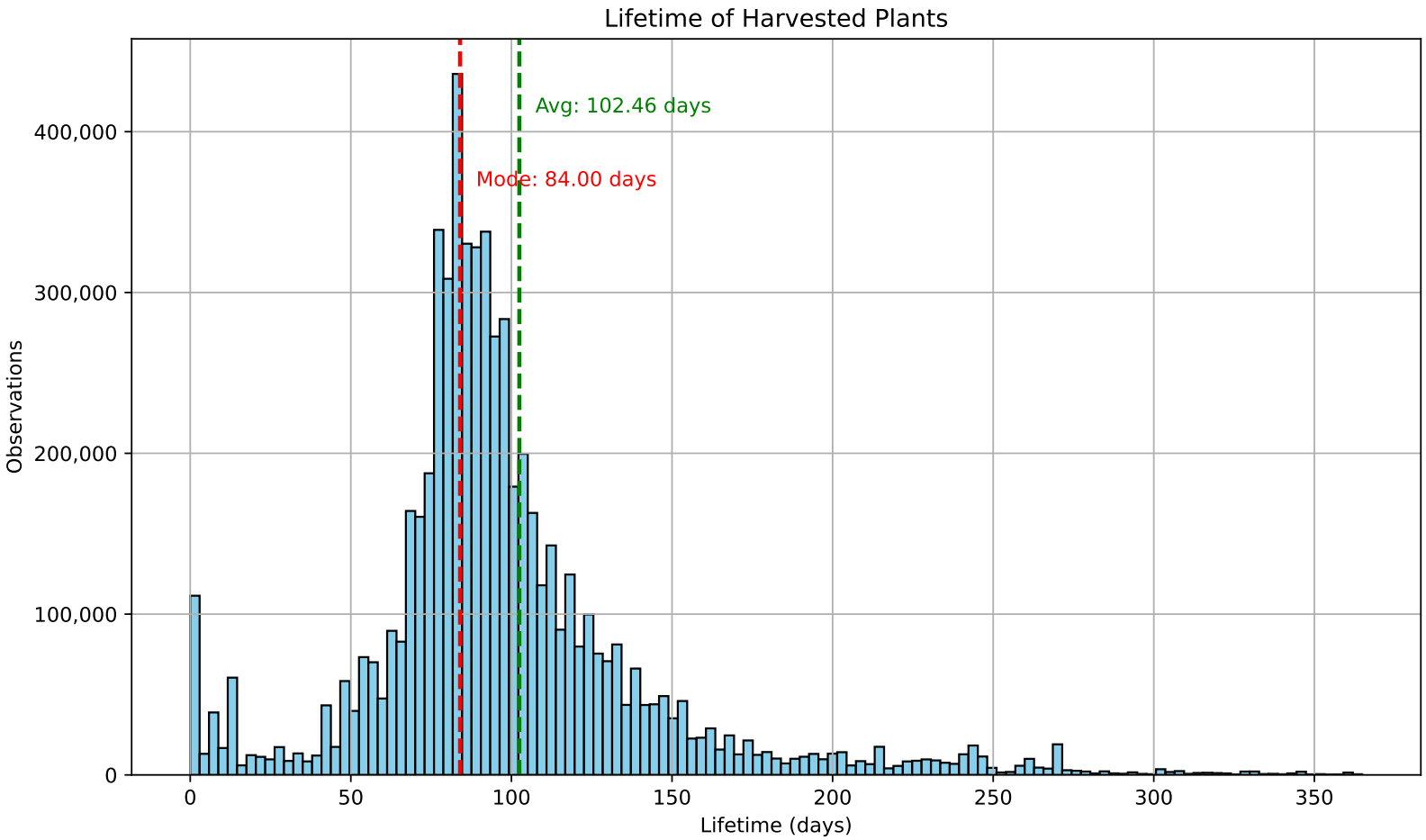
- Genetics (e.g. strain)
- Environment
- Cultivator-specific techniques
- Plant source (seed or clone)
- Year planted
- Month planted
- Application of **pesticides**

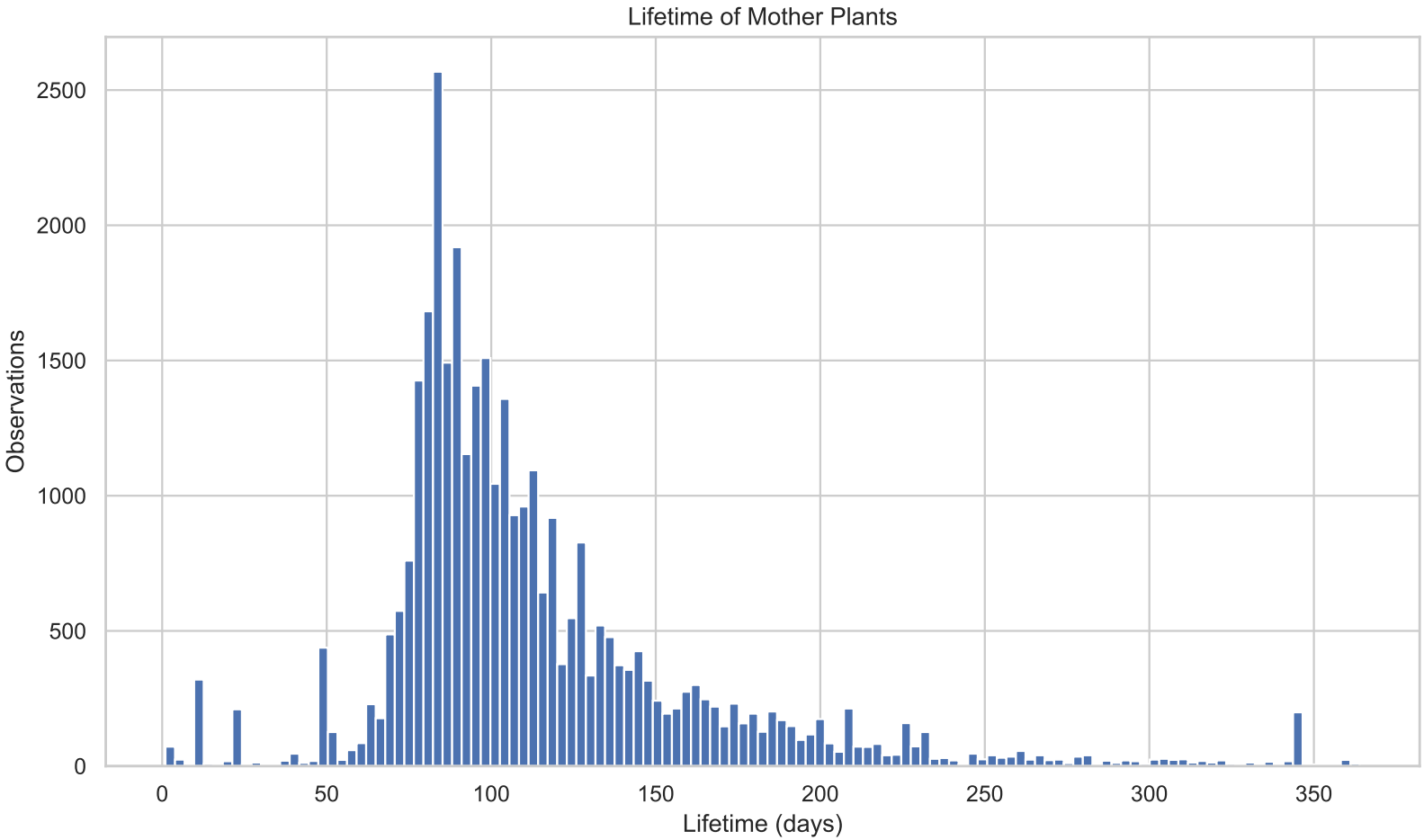
Washington State Traceability Data.

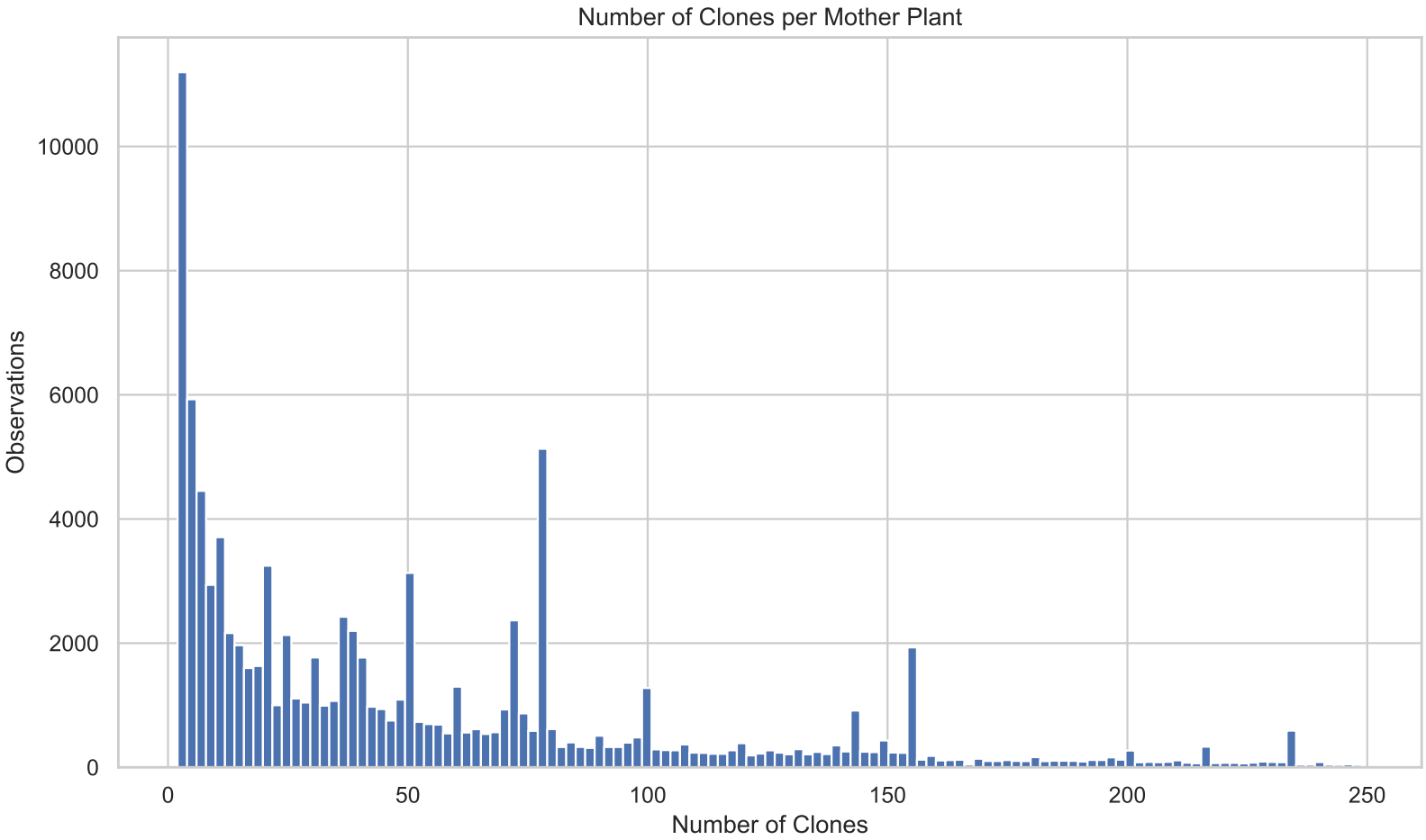


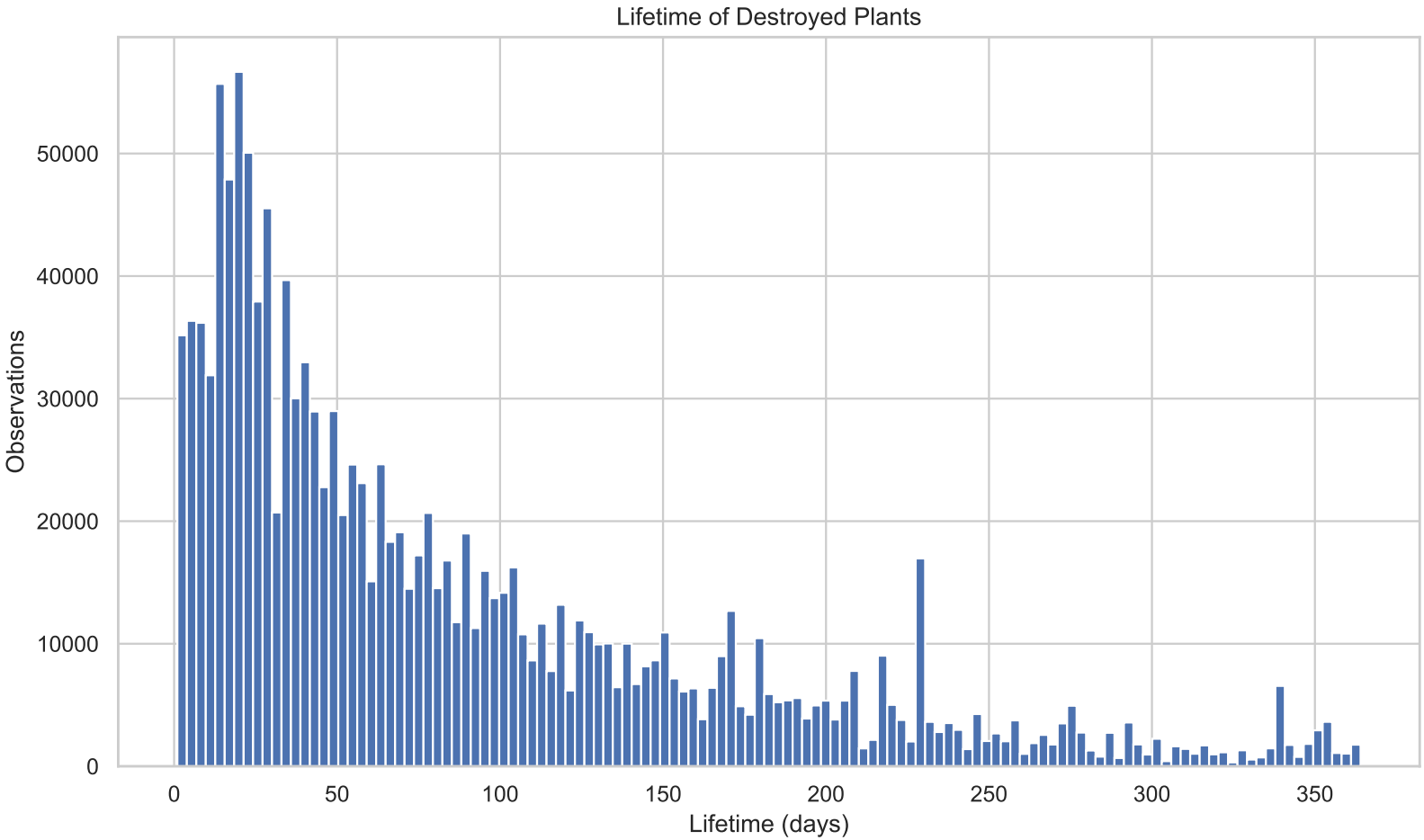
WSLCB Cultivation Data 2022 through 2023

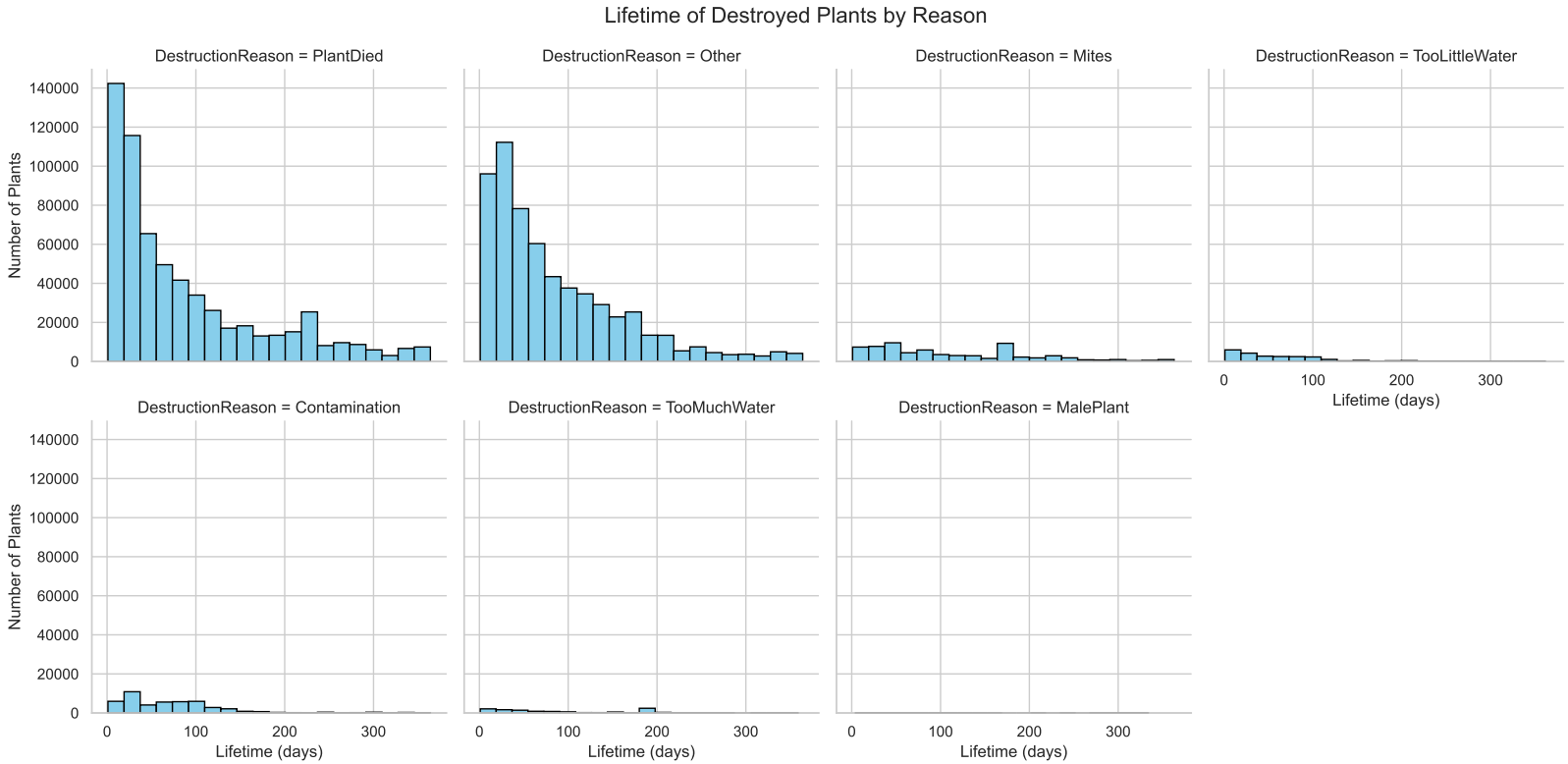
	2022	2023	Percent Change
Cultivators	607	538	-11%
Areas	9,531	3,157	-67%
Strains	11,834	14,662	24%
Mother Plants	46,270	41,830	-10%
Destroyed Plants	794,600	495,456	-38%
Harvested Plants	3,592,215	1,875,483	-48%

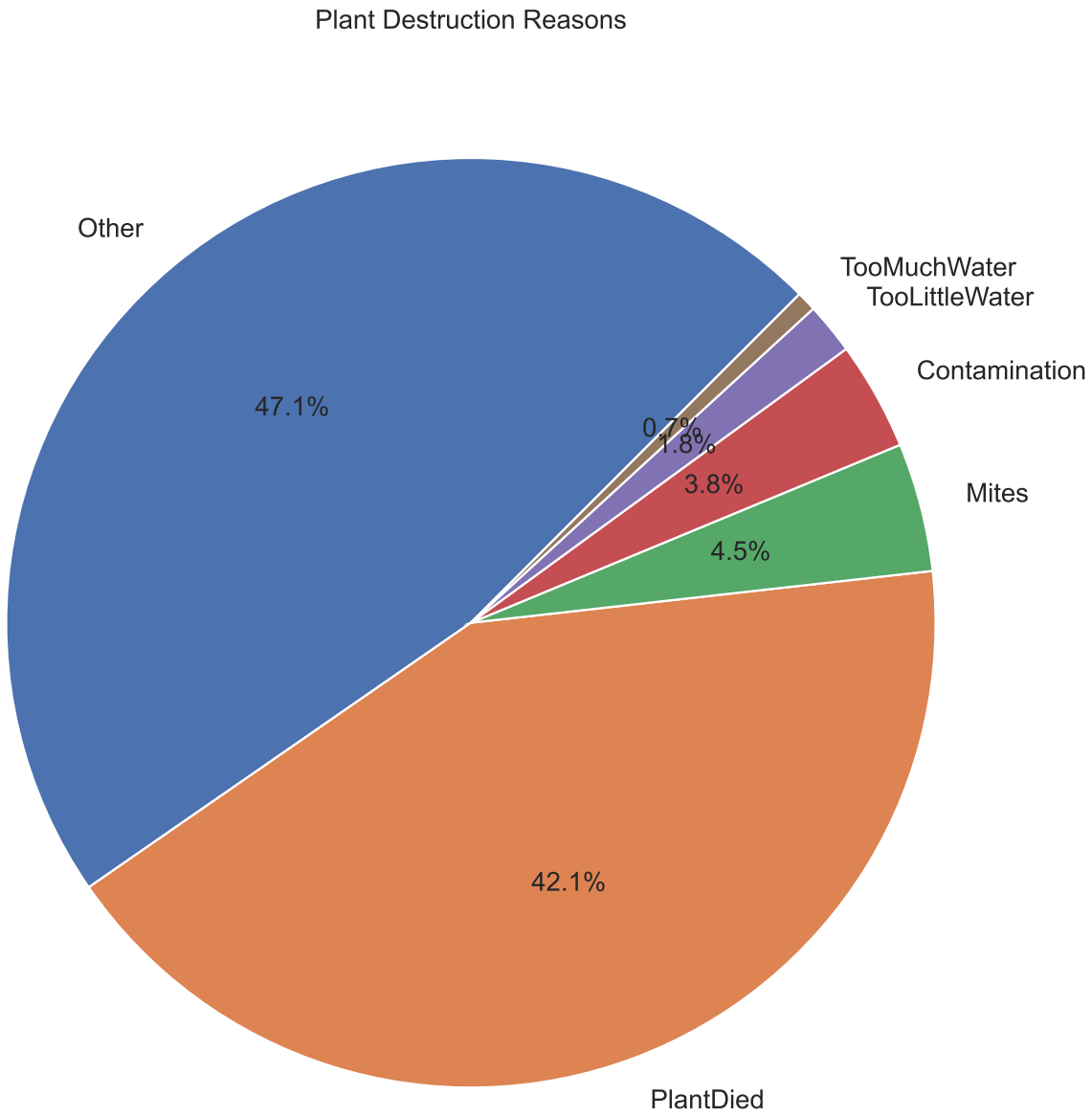

Lifetime of Harvested Plants
Avg: 102.46 days
Mode: 84.00 days
Observations
400,000
300,000
200,000
100,000
0
0
50
100
150
200
250
300
350
Lifetime (days)

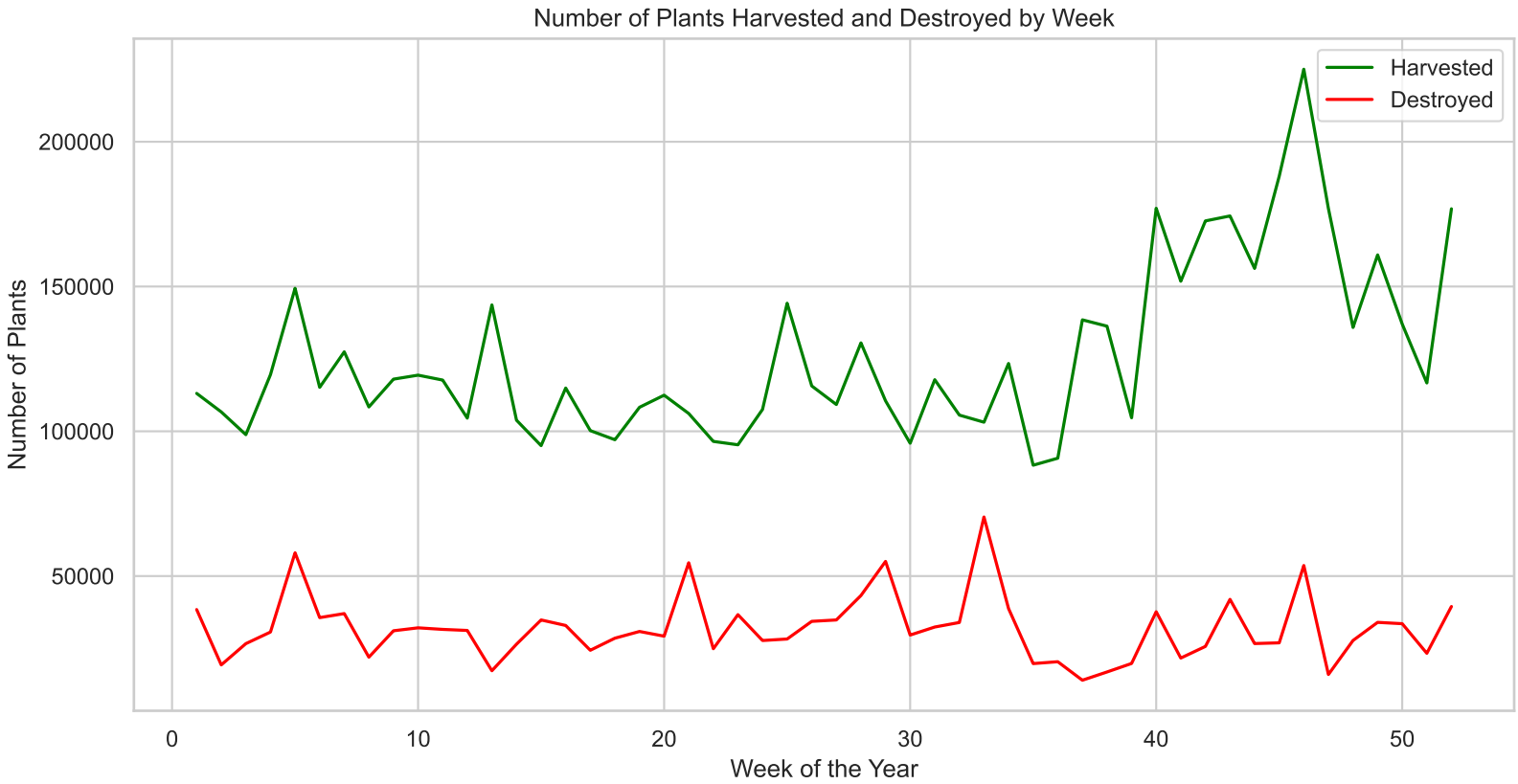

Lifetime of Mother Plants
Observations
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
Lifetime (days)

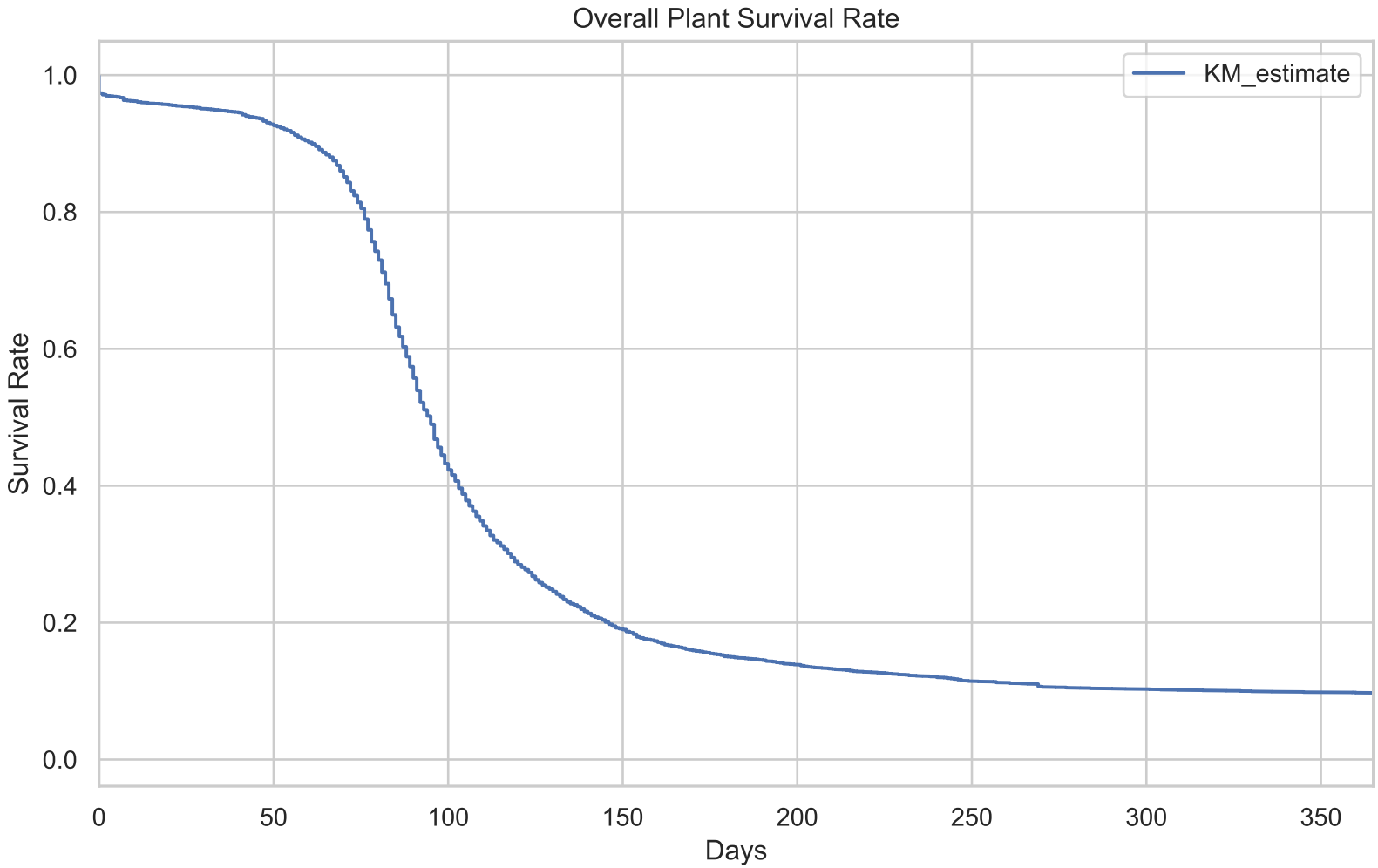

Number of Clones per Mother Plant
Observations
10000
8000
6000
4000
2000
0
0
50
100
150
200
250
Number of Clones

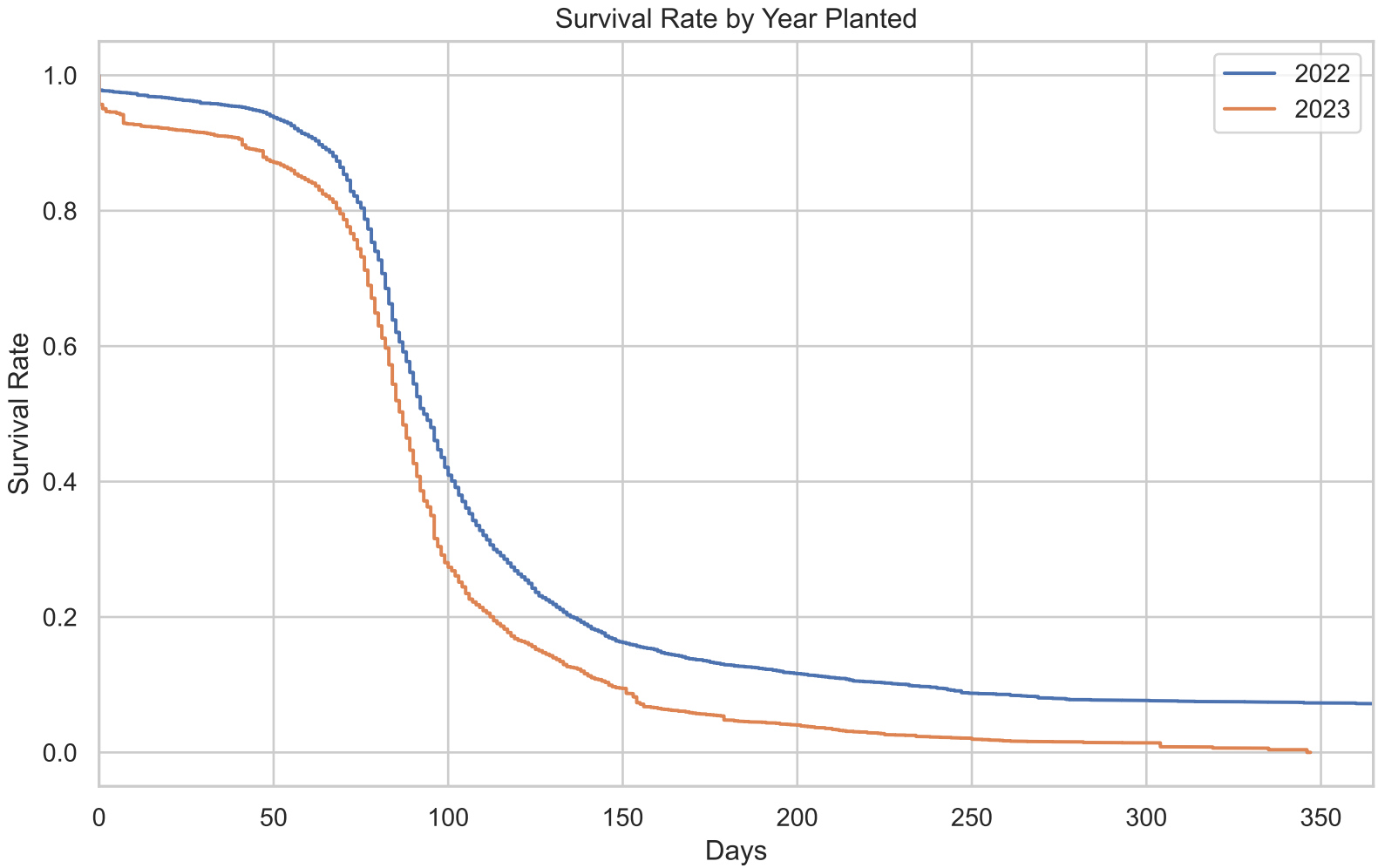

Lifetime of Destroyed Plants
Observations
0
10000
20000
30000
40000
50000
0
50
100
150
200
250
300
350
Lifetime (days)

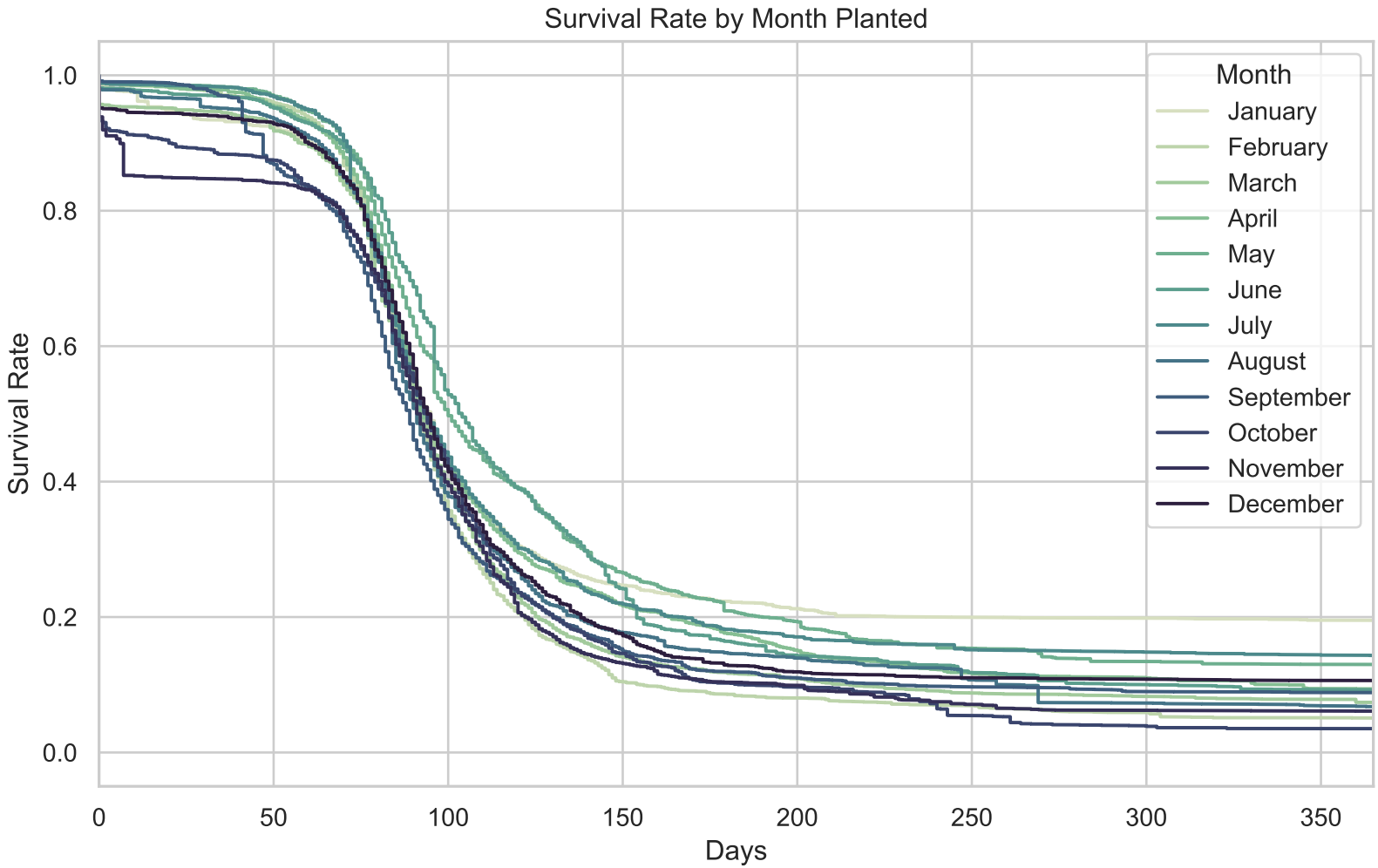

Lifetime of Destroyed Plants by Reason
DestructionReason = PlantDied
DestructionReason = Other
DestructionReason = Mites
DestructionReason = TooLittleWater
DestructionReason = Contamination
DestructionReason = TooMuchWater
DestructionReason = MalePlant
Number of Plants
Lifetime (days)
0
20000
40000
60000
80000
100000
120000
140000
100
200
300

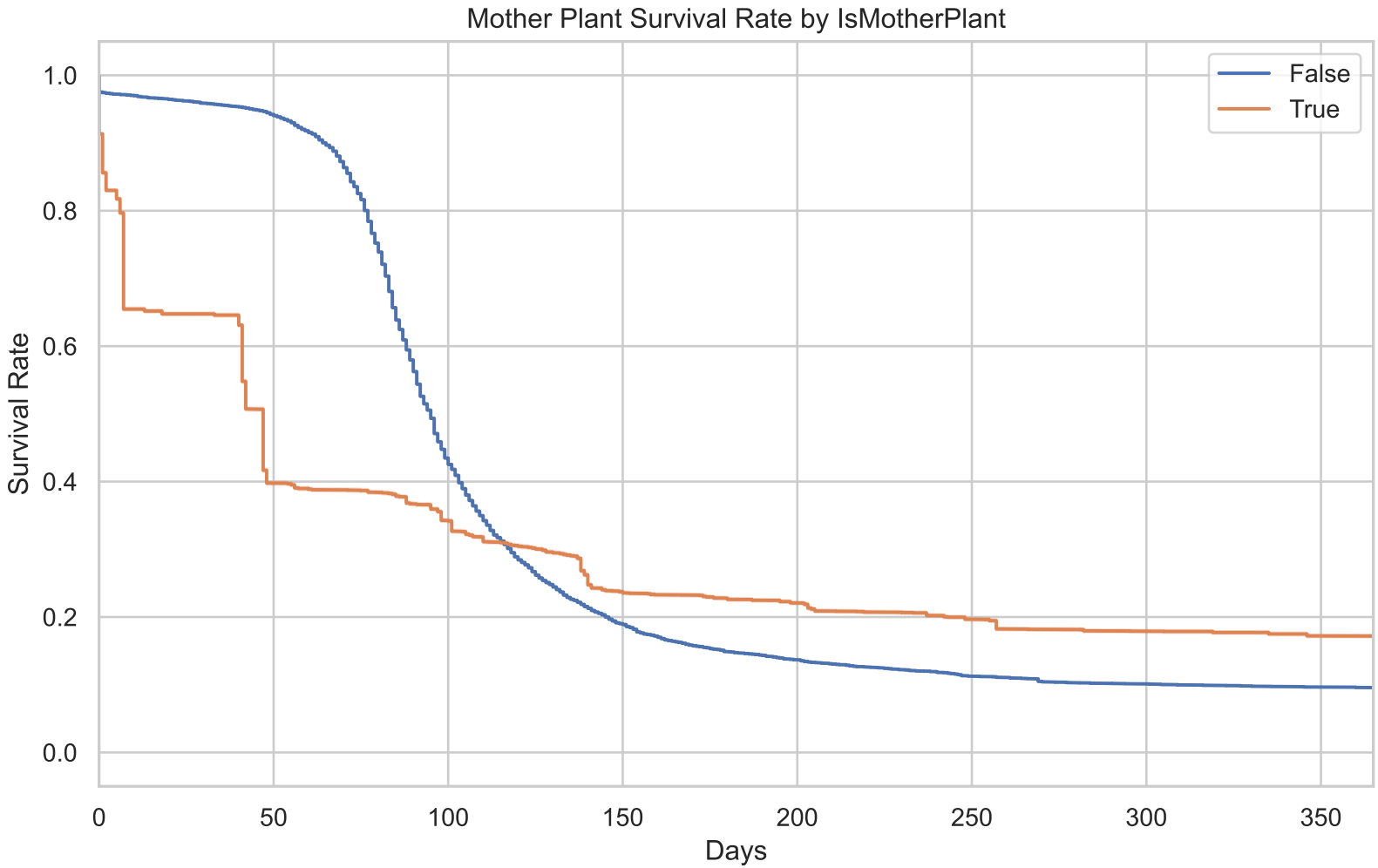

Plant Destruction Reasons
Other
47.1%
TooMuchWater
TooLittleWater
0.7%
1.8%
Contamination
3.8%
Mites
4.5%
42.1%
PlantDied

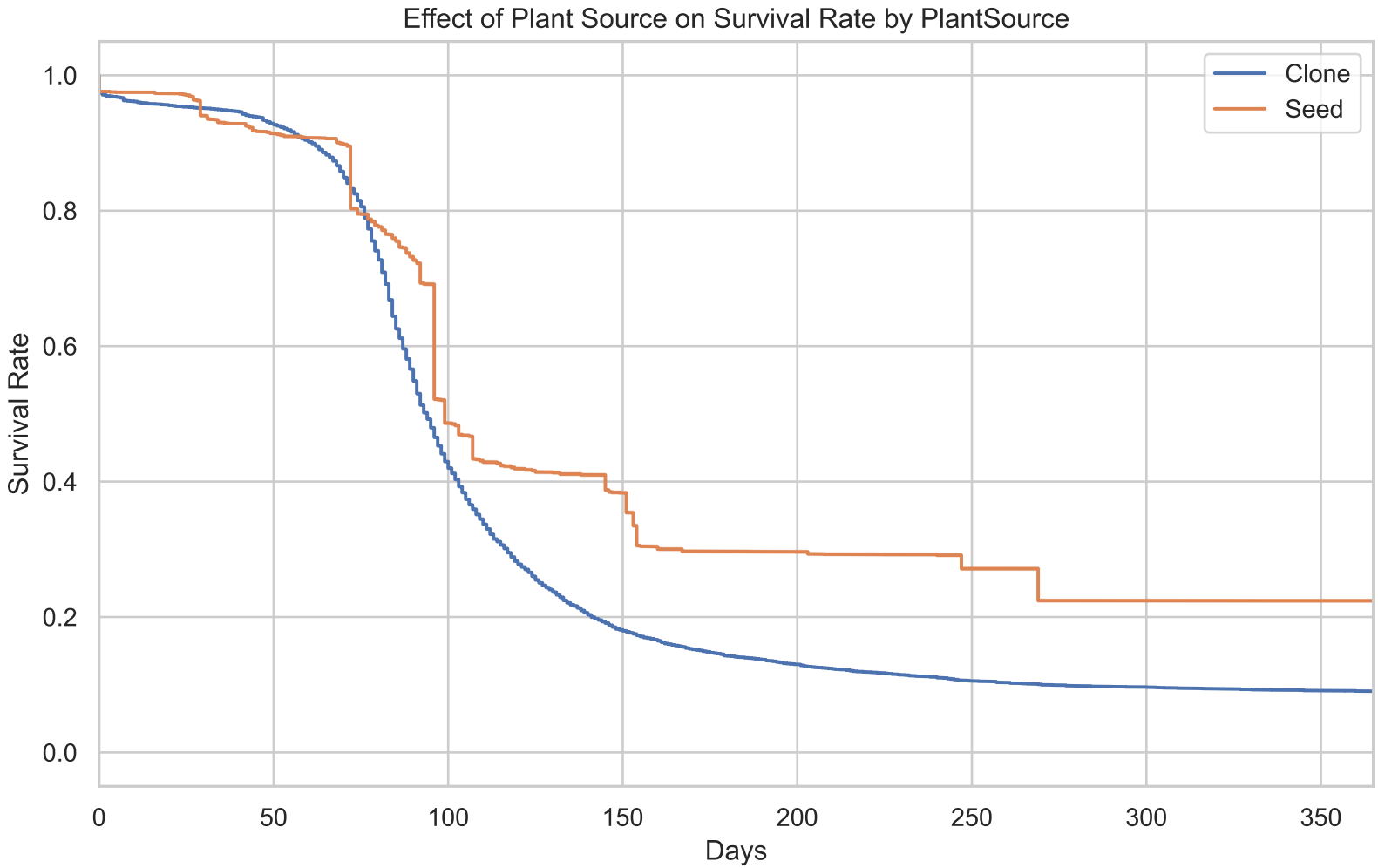

Number of Plants Harvested and Destroyed by Week
Harvested
Destroyed
Number of Plants
200000
150000
100000
50000
0
10
20
30
40
50
Week of the Year


Overall Plant Survival Rate
KM_estimate
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days


Survival Rate by Year Planted
2022
2023
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days

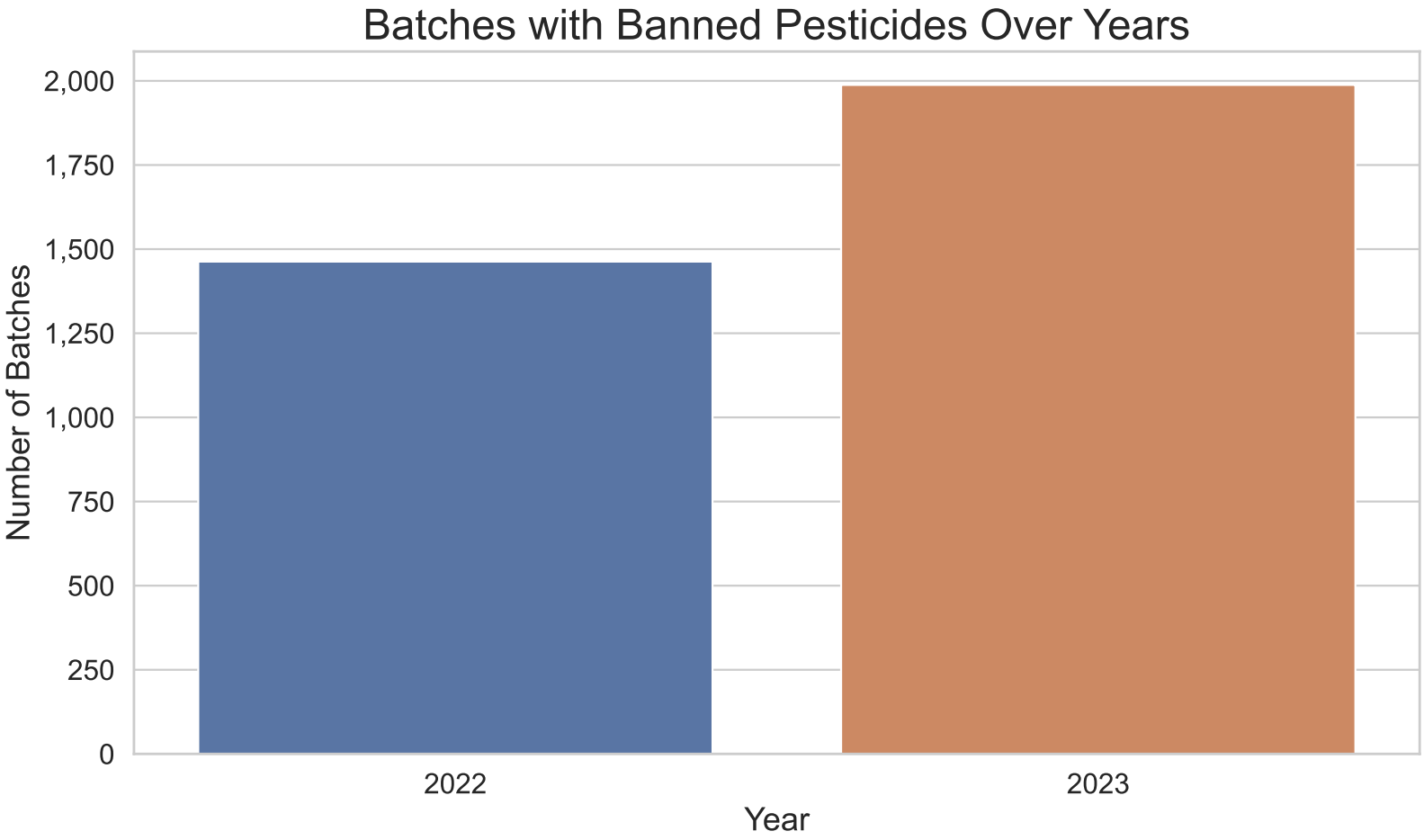

Survival Rate by Month Planted
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days
Month
January
February
March
April
May
June
July
August
September
October
November
December

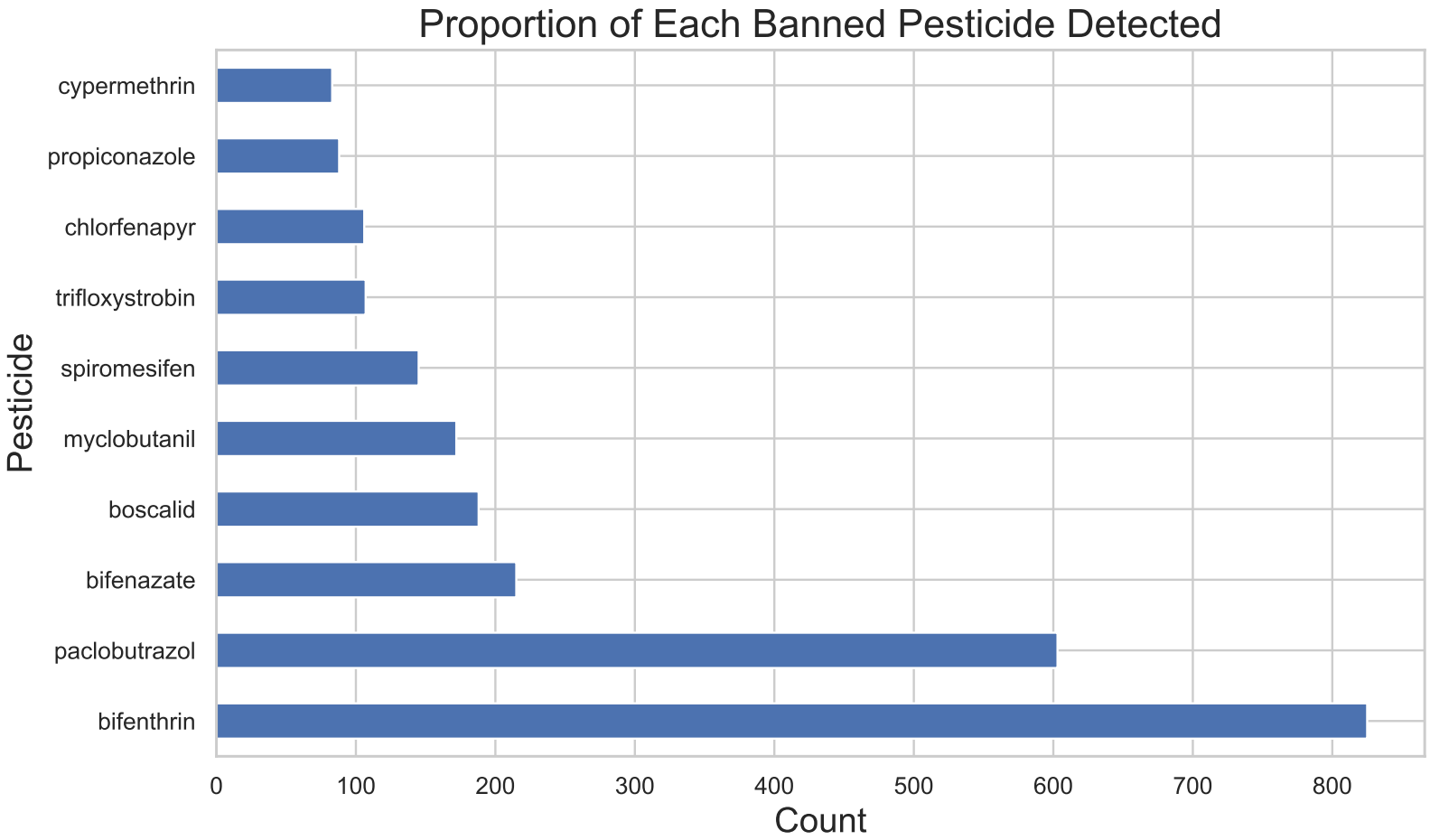

Mother Plant Survival Rate by IsMotherPlant
False
True
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days

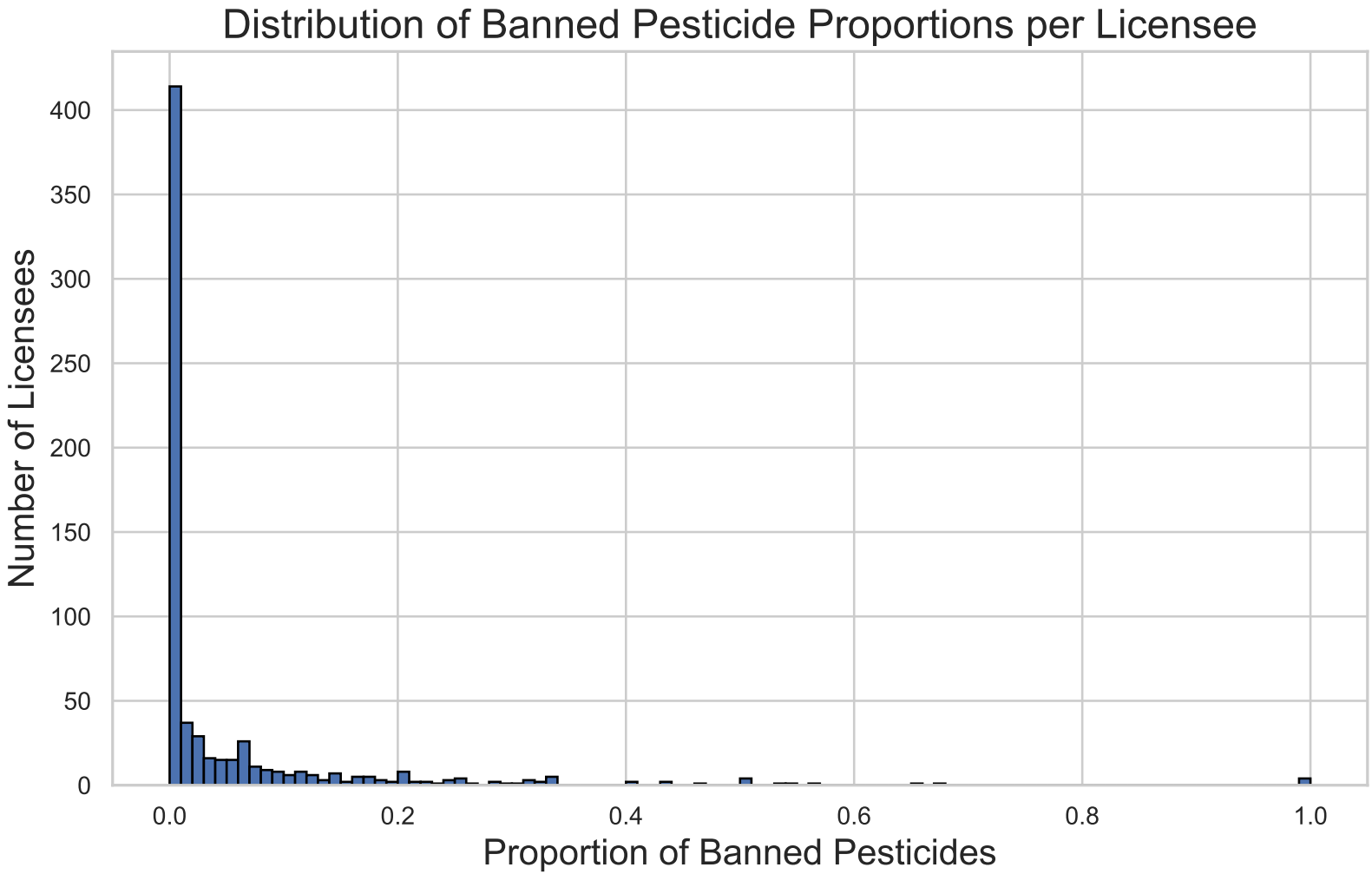

Effect of Plant Source on Survival Rate by PlantSource
Clone
Seed
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days

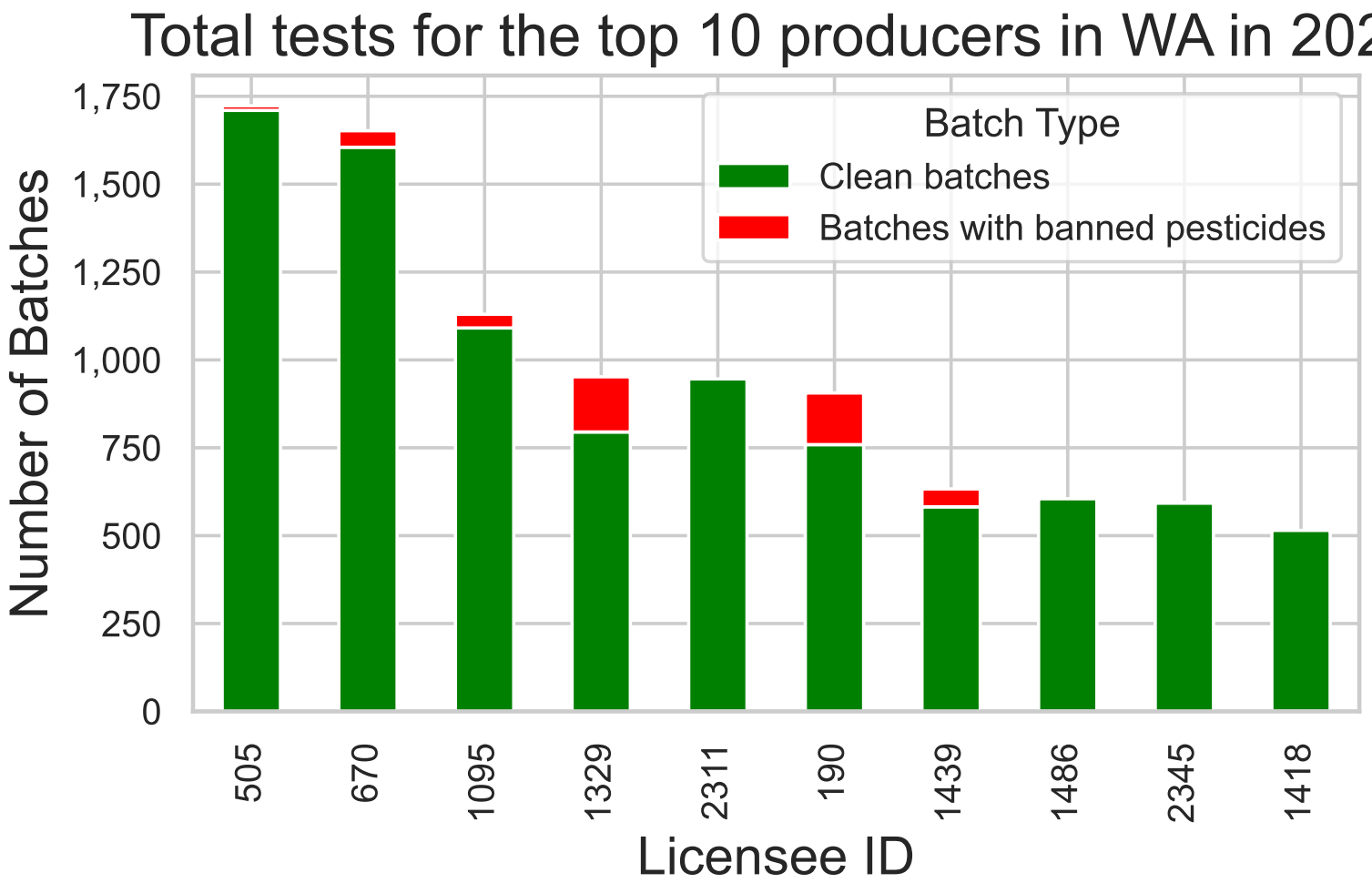
Research Question

Do licensees who have had a banned pesticide detected in their produts have a lower or greater survival rate than other licensees?

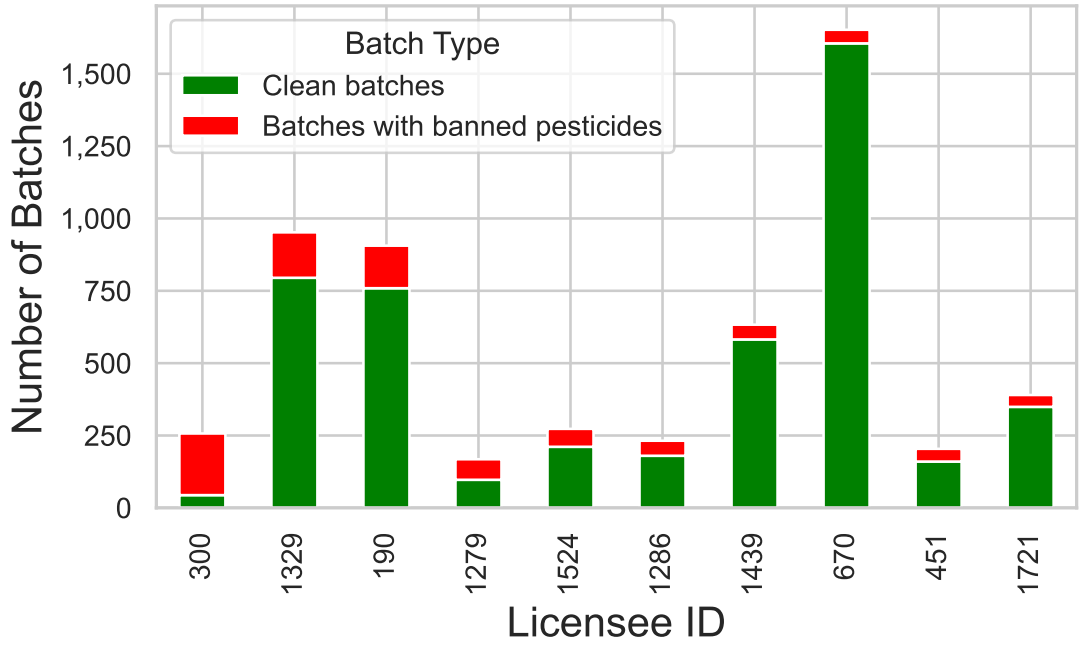

Batches with Banned Pesticides Over Years
Number of Batches
2,000
1,750
1,500
1,250
1,000
750
500
250
0
2022
2023
Year

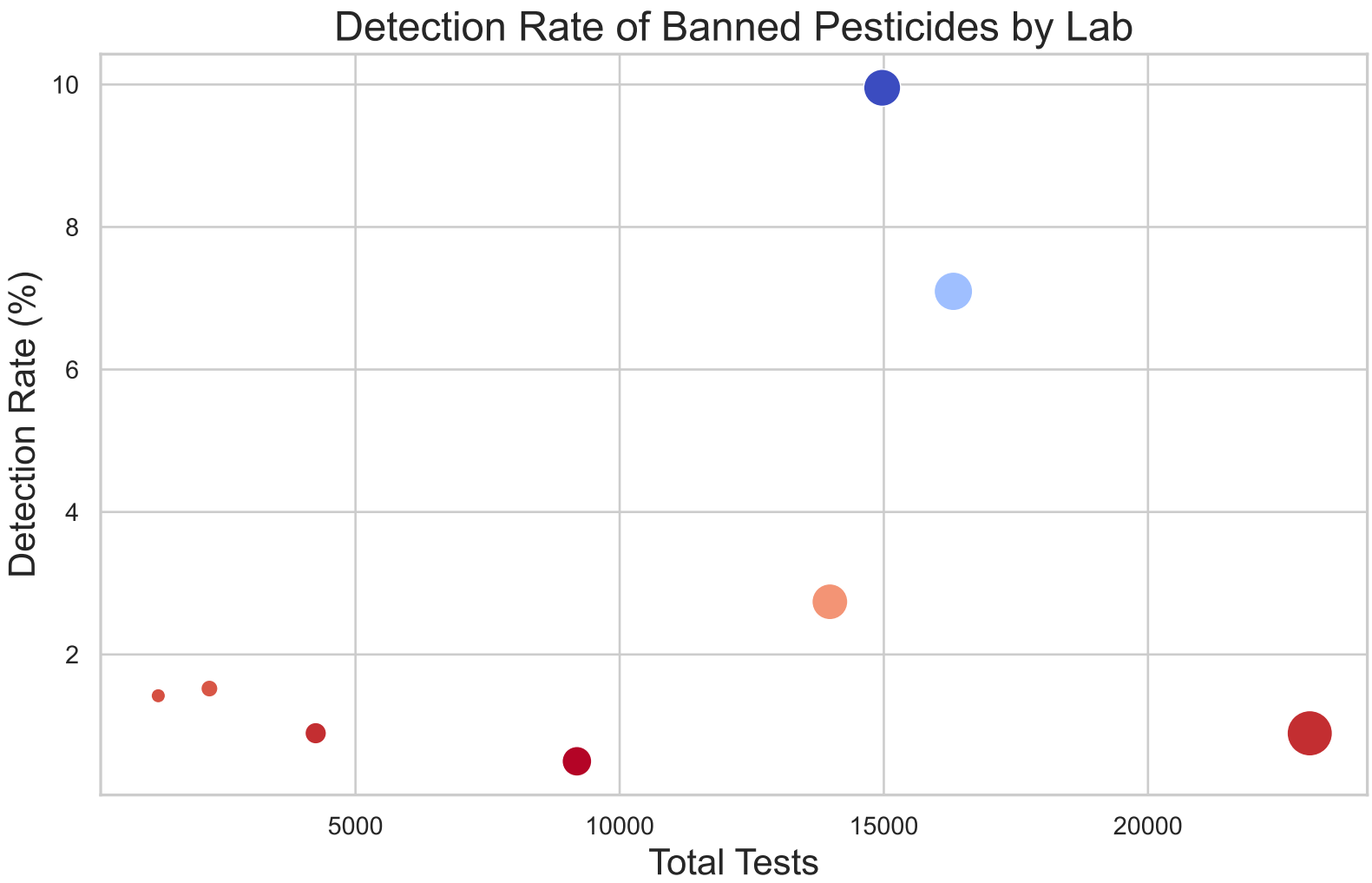

Proportion of Each Banned Pesticide Detected
Pesticide
cypermethrin
propiconazole
chlorfenapyr
trifloxystrobin
spiromesifen
myclobutanil
boscalid
bifenazate
paclobutrazol
bifenthrin
0
100
200
300
400
500
600
700
800
Count

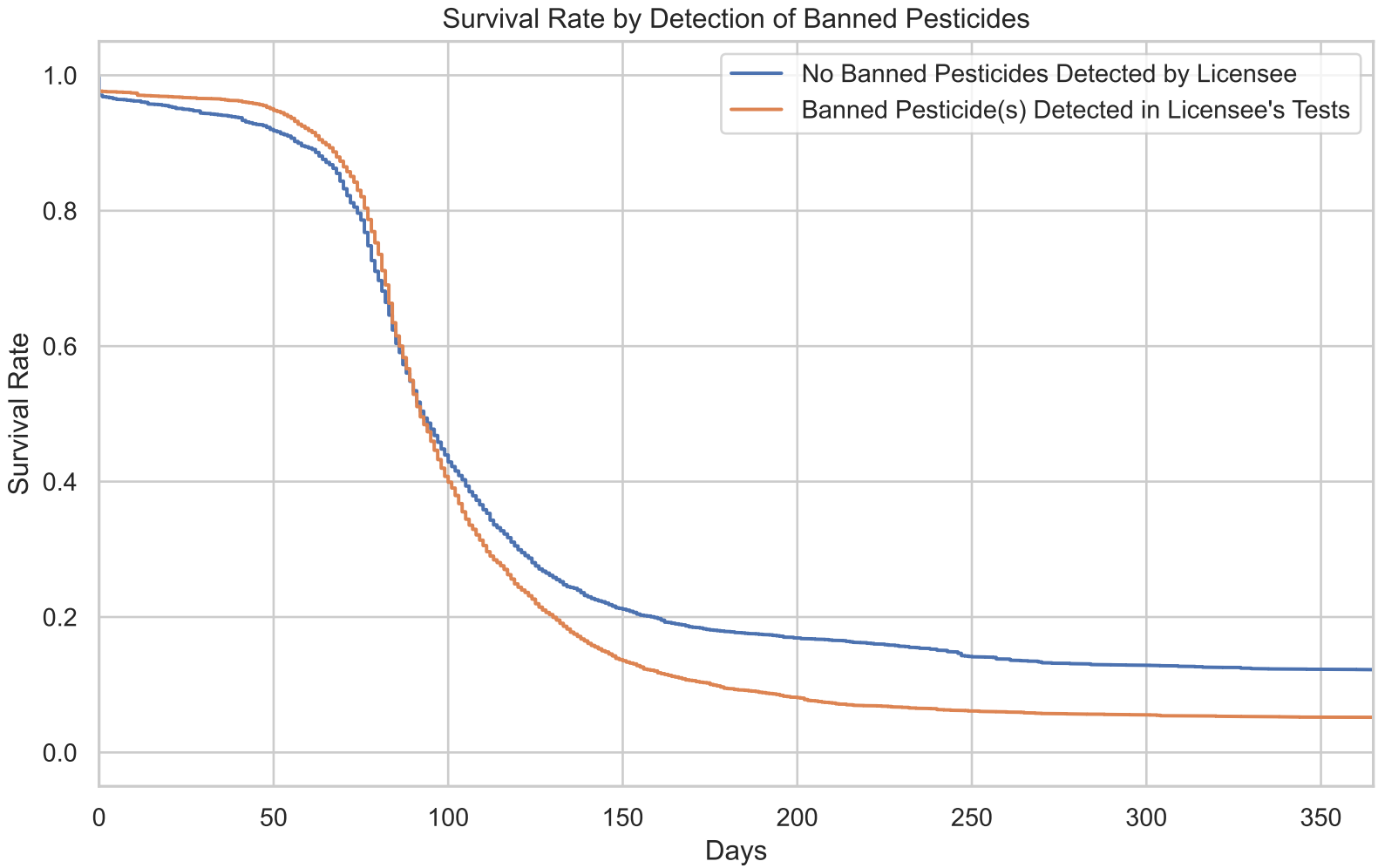

Distribution of Banned Pesticide Proportions per Licensee
Number of Licensees
400
350
300
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
Proportion of Banned Pesticides


Total tests for the top 10 producers in WA in 2023
Number of Batches
1,750
1,500
1,250
1,000
750
500
250
0
Batch Type
Clean batches
Batches with banned pesticides
505
670
1095
1329
2311
190
1439
1486
2345
1418
Licensee ID

Tests for licensees with the most banned pesticide detections in WA in 2023




Detection Rate of Banned Pesticides by Lab
Detection Rate (%)
10
8
6
4
2
5000
10000
15000
20000
Total Tests


Survival Rate by Detection of Banned Pesticides
No Banned Pesticides Detected by Licensee
Banned Pesticide(s) Detected in Licensee's Tests
Survival Rate
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
Days

The Benefit of Using Banned Pesticides

Given

- LTV_{plant} is the lifetime value of a plant.
- N_{plant} is the number of plants.
- $\Delta Pr(\text{survival})_{pesticides}$ is the change in the survival rate of plants when pesticides are applied.

The **benefit** to using banned pesticides is

$$LTV_{plant} \times N_{plant} \times \Delta Pr(\text{survival})_{pesticides}$$

The Cost of Using Banned Pesticides

Given

- $\text{Cost}_{pesticides}$ is the cost of banned pesticides.
- $\text{Cost}_{\text{enforcement}}$ is the cost when enforcement happens
- $Pr_{\text{enforcement}}$ is the probability of enforcement

The **cost** to using banned pesticides is

$$\text{Cost}_{pesticides} + Pr_{\text{enforcement}} \times \text{Cost}_{\text{enforcement}}$$

Why does this matter? The incentive to use pesticides

Cultivators will **not use** banned pesticides when*:

$$N_{plant} \times \Delta Pr(\text{s})_{pesticides} \leq Pr_{\text{enforcement}} \times \text{Cost}_{\text{enforcement}}$$

Likelihood of use <u>increases</u> when:

- $N_{plant} \uparrow$
- $\Delta Pr(\text{s})_{pesticides} \uparrow$

Likelihood of use <u>decreases</u> when:

- $Pr_{\text{enforcement}} \uparrow$
- $\text{Cost}_{\text{enforcement}} \uparrow$

* Assuming $\text{Cost}_{pesticides}$ is approximately 0 and $\text{Cost}_{enforcement}$ is normalized to LTV_{plant}.

Thank you for coming.

Lessons of the Day

- **Survive**, then thrive.