We built two model, one is a statistic model to help us compare significant difference of the effect between different pesticide and our product. We measure three variable migration rate, mortality and gnawing rate to understanding pesticide effect. Another is an epidemic model which is a ODE model to predict each statement's s dynamics and understanding the sensitivity of each argument.

First beginning with the statistic model. You will ask what is the input ,what is the data. In simulating room we deal with cockroach with these pesticide and measure migration rate, mortality and gnawing rate to get data.

Then you will ask how to use our data to reach the goal –to modify our design. We use Levene's test to make sure whether the variances of groups are same. If variances are same, we can use T-test to understand the significant difference of three variable in four groups. Then we can get the feedback of products comparing to modify our design.

The statistic model have some assumptions , we can design experiment to make groups are pairwise independent. And if groups follow the null hypothesis of Levene's test , T - test is fit in our model.

Next, you will ask does the results follow the null hypothesis of Levene's test. Let's watch our result, we will find p-values are higher than 0.05 and we can use T-test.

So, what's the T- test result. Z are groups, number are t value which higher than 2.77 means higher significance,more red, lower than -2.77 means lower significance,more green.

From the output visualization , we get the feedback. Our product have terrible migration rate , best gnawing rate and delay several days to reach the mortality of other pesticide.

Second, let's focus on epidemic model. The data come from reference papers, government research and our experiment.

We use the data to built a ODE model to estimate LT time and analysis arguments sensitivity to estimate the impact of each factors then we can modify our design.

We have 8 assumption : We use Logistic function to estimate population growth. we Ignore natural death rate because the cockroach are strong. Infectious individuals can not recover, and ignore they give birth because of our experiment data.

We compare the natural condition with after control to estimate our epidemic effect . The ODE equations represent different statements of population growth.

We get the result through numerical simulation. In natural condition, population reach the top less than 5days . And after control 8days 50% cockroach dead ,15days is 80%. lt is better.

Then you will ask what argument is most important that we can control to modify our model. Because
we can't control r in obversely relevant way to modify our design. We just need measure(γ: mortality，
β: transmission rate)'s Senitivity to our outcome (LT50 and LT80)

From the output visualization, β : good approximation γ : increase mortality a little bite to modify LT50 is more sensitive than LT80 γ is more sensitive than β β & γ have low sensitivity. ln conclusion Setted parameters did not greatly affect the lethal time . Our parameters are well approximate.