


NOV 11-13, 2019

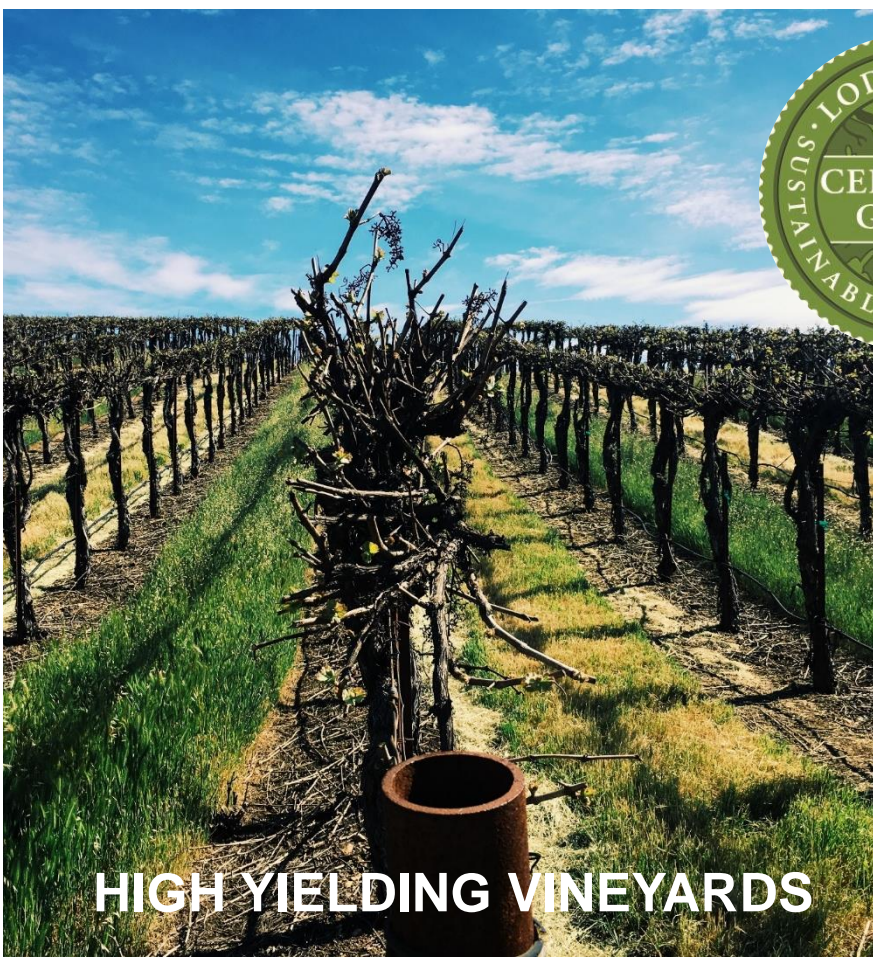
**SUSTAINABLE AG EXPO**  
&  
**INTERNATIONAL SUSTAINABLE  
WINEGROWING SUMMIT**

SAN LUIS OBISPO, CALIFORNIA

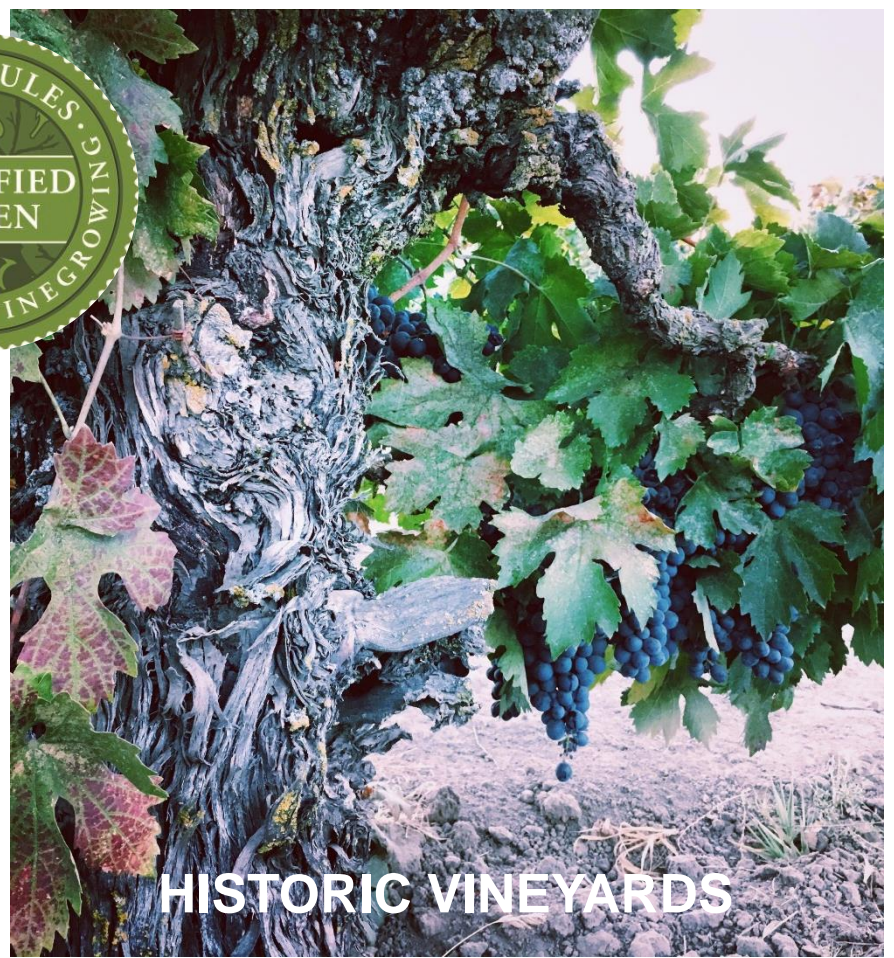


**Grapevine Virus Management in LODI:  
A Collaborative Research &  
Integrated Outreach Effort to Help  
Solve a Statewide Challenge**

**Stephanie Bolton, PhD**  
**Lodi Winegrape Commission**



**HIGH YIELDING VINEYARDS**



**HISTORIC VINEYARDS**





**850,000 tons**  
**110,000 acres**



x 750



# LODI GRAPEVINE VIRUS RESEARCH FOCUS GROUP



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**Our overall objective is to learn how to best manage and prevent grapevine virus disease in the 110,000 acres of Crush District 11, providing outreach tools and strategies to be shared with other regions across California.**

- Learn from BOTH scientists & growers from around the world
- Develop and deliver timely, relevant educational materials & approachable outreach for best virus management practices for growers
- Long-term:
  - A management plan for economically feasible & impactful virus control strategies in Lodi and California
  - Prioritize future grapevine virus research projects

# Virus-Induced 7 Stages of Grief

(Modified Kubler-Ross Model)

## Shock\*

- Initial paralysis at hearing the bad news.

## Denial

- Trying to avoid the inevitable.

## Anger

- Frustrated outpouring of bottled-up emotion.

## Bargaining

- Seeking in vain for a way out.

## Depression

- Final realization of the inevitable.

## Testing\*

- Seeking realistic solutions.

## Acceptance

- Finally finding the way forward.

\*This model is extended slightly from the original Kubler-Ross model, which does not explicitly include the Shock and Testing stages. These stages however are often useful to understand and to facilitate change.

[betterhelp.com/advice/grief/understanding-the-stages-of-grief/](https://betterhelp.com/advice/grief/understanding-the-stages-of-grief/)



TELL ME, I FORGET.

SHOW ME, I REMEMBER.

INVOLVE ME, I UNDERSTAND.

ANCIENT CHINESE PROVERB

# NO ONE IS IN CHARGE



# We can't beat these viruses alone.



## **Growers**

Education, vector management, and lowering the amount of virus inoculum on each farm.



## **Nurseries**

Providing growers with reliably clean rootstock and scion material.



## **FPS**

Providing nurseries with reliably clean propagation material.



## **CDFA**

Administering an effective Grapevine Certification & Registration Program.



## **Academia**

Scientific research to validate & improve management strategies and new technologies for virus detection & management.



## **Virus Testing Labs**

Providing reliably accurate, efficient, and economical virus testing for plant material.



## **Wineries**

Education and teamwork with growers to beat the virus challenge.



## **Extension**

Virus education outreach and connection to resources needed.



## **IPM Companies**

Vector control that keeps the natural enemies of vine mealybug doing their job.



## **PCAs/Viticulturists**

Education, vector management, virus detection and management.



## **County Ag Commissioners**

Education, vector management, regional organization and leadership.



## **Regional Associations**

Education, vector management, regional organization and leadership.

# HOW MUCH ARE VIRUSES COSTING YOU?



# THE SNEAKY COST OF LIVING WITH VIRUSES



**CASE STUDY 001 in LODI, CALIFORNIA.** A 70-acre block of Malbec was planted in 2012. It was pulled out in 2018 due to leafroll virus infection, at a total loss (including revenues) of **at least \$2.5 million.**

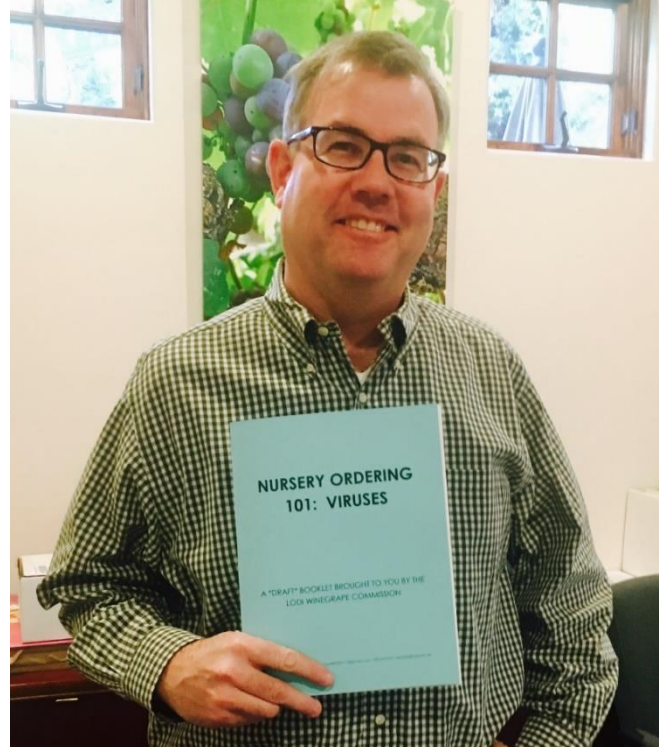
# CDFA CERTIFIED DOES NOT MEAN VIRUS FREE





## Questions to ask when ordering grapevines:

- Will these vines be CDFA-certified (both rootstock & scion)?
- What virus testing program does the nursery have in place, and does it apply to the vines I am buying?
- May I have a copy of the most recent virus tests (especially leafroll, red blotch, and fanleaf) for all source wood?
- Will the vines be hot water dipped for mealybugs? If not, what method(s) of mealybug & vector control are being used?



# GRAPEVINE VIRUS WORKBOOK

coming in April 2020

# VIRUS DIFFERENCES



# VIRUS TESTING



## GRAPEVINE VIRUS TESTING 101

the task is daunting.  
virus testing is expensive.  
you don't really know what to do or who to trust.  
the results will likely be depressing...

### WHY WOULD YOU TEST FOR VIRUSES?

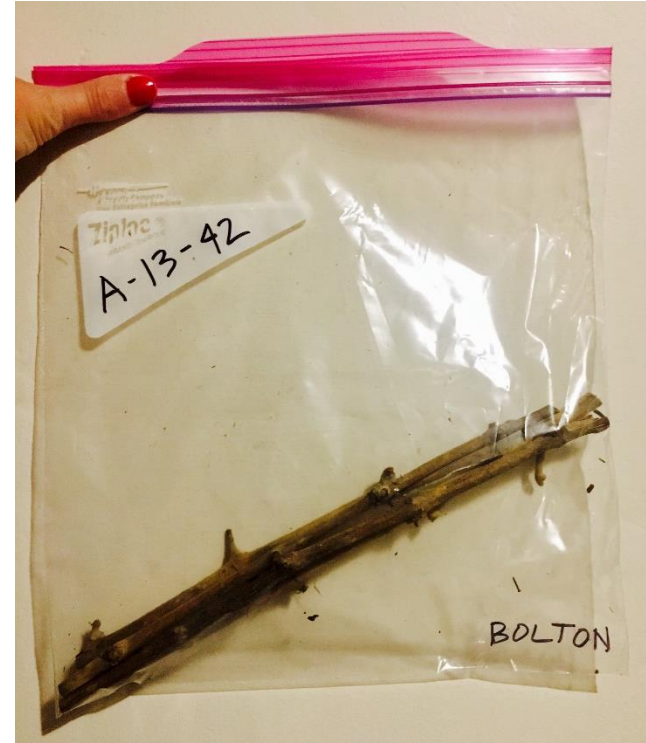
1. Knowledge is money-saving power when it comes to viruses – once you know what you're dealing with, you can make decisions that may save you lots of money over time.
2. Visual symptoms and ripening delays provide clues that a grapevine is infected with a virus, but they cannot be relied upon alone for detection in California. Testing by a trusted laboratory is crucial for an accurate diagnosis if you think you may have a virus infection.
3. Not all viruses affect a vineyard in the same way – for example, leafroll virus, red blotch virus, fanleaf virus, and vitiviruses (or co-infections of these viruses) each have their own management strategies, mostly due to the way they can spread to healthy vines. It's important for the grower to understand which, if any, viruses they may be dealing with.
4. If your vines are infected with viruses, they are sources of inoculum which could infect healthy vines in your vineyard, in your neighbor's vineyard, and in other vineyards across your region.



Notice how the leafroll virus infection is spreading from the vines on the bottom left corner to the younger vines above.

5. If only some of your vines or a portion of your vineyard is infected, you can act now to reduce the spread.
6. If you have leafroll virus in your vineyard, there can be a carryover infection into the next vineyard planting on the same ground – something you will want to know in order to determine what to plant in that ground next.
7. Ignoring virus infections for even one year can cost the grower a lot of money due to the fast rate of spread (especially with leafroll virus).
8. Testing new plants before propagation reduces the possibility of planting vines carrying a virus infection.
9. It's wise to know the virus status of any wood before you plan to top-work a vineyard or provide wood for bench-grafting.

2019 • LODI WINEGRAPE COMMISSION • GRAPEVINE VIRUS RESEARCH FOCUS GROUP • stephanie@lodiwine.com



# MEALYBUG MANAGEMENT



## VINE MEALYBUGS BY THE NUMBERS



BY: THE LODI WINEGRAPE COMMISSION

In the LODI AVA, our vine mealybugs have 5-7 generations per growing season.  
On average, the females lay 300 eggs each, with about half of those eggs being female.

### 1TH GENERATION

1 female +  
1 male mealybug

### 2ND GENERATION

1 female x 300 eggs  
= 300 mealybugs  
150 females

### 3RD GENERATION

150 females x 300 eggs  
= 45,000 mealybugs  
22,500 females

### 4TH GENERATION

22,500 females x 300 eggs  
= 6,750,000 mealybugs  
3,375,000 females

### 5TH GENERATION

3,375,000 females x 300 eggs  
= 1,012,500,000 mealybugs  
506,250,000 females

### 6TH GENERATION

506,250,000 females x 300 eggs  
= 151,875,000,000 mealybugs  
75,937,500,000 females

### 7TH GENERATION

by the 7th generation, those 2 original mealybugs are now  
**75,937,500,000** females x **300** eggs =

**22,781,250,000,000** mealybugs

which then overwinter under the bark and in the roots - helped by ants - until the Spring



## LODI VINE MEALYBUG SCOUTING CARD

<< best used in conjunction with hands-on training • train all workers >>

Vine mealybugs can be seen with the naked eye or a hand lens.

Look for females, crawlers, and white cottony egg sacs. Mark hotspots with mealybug flagging tape.



## BENEFICIAL INSECT SCOUTING

*Anagrus* wasps and *Cryptolaemus* beetles are on our team since they kill vine mealybugs.

***Anagrus* wasp activity:** look for female vine mealybugs with a black dot on their body (the exit hole).

***Cryptolaemus* beetles:** look for fake shaggy "mealybugs" hanging out around vine mealybug colonies.



**Anagrus wasp activity:**  
parasitized mealybugs

***Cryptolaemus* beetles: a  
wolf in sheep's clothing**



## AN IMPORTANT FIRST STEP IN BIOCONTROL: DON'T KILL THE GOOD INSECTS!

Our CD11 Mealybug Biocontrol Research Focus Group has put together this regionally-specific chart, based on the UC-IPM Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees Table, available online at [ipm.ucanr.edu/PMG/r302900111.html](http://ipm.ucanr.edu/PMG/r302900111.html), and years of real-world experience.

Help the good insects (beneficials, predators, parasites) help you!  
What GOOD insects are we trying to keep ALIVE, anyways?

The *Anagrus* wasps, *Cryptolaemus* beetles, and Lacewings who attack mealybugs.

The predatory mites, six-spotted thrips, and minute pirate bugs who attack mites.

The *Anagrus* wasps and green lacewings who attack leafhoppers.

The parasitic wasps and flies who attack caterpillars and omnivorous leafrollers.

Western predatory  
mite attacking  
spider mite egg



UC IPM Online

Trade Name	Common name	MOA	Good insects stay alive	May reduce good insects	Good insects are killed	Notes
Acramite	bifenazate	20D				



**PARABUG**



# ANTS ARE FARMERS TOO



# Leafroll virus.

(spread by propagation & vectors)

**Reducing any points  
on this triangle lowers  
your odds of a leafroll  
virus infection**

decreases yield  
causes poor fruit quality & color  
causes delayed ripening  
lowers Brix  
decreases vineyard lifespan

farm mealybugs for  
honeydew  
move mealybugs  
fight off natural enemies

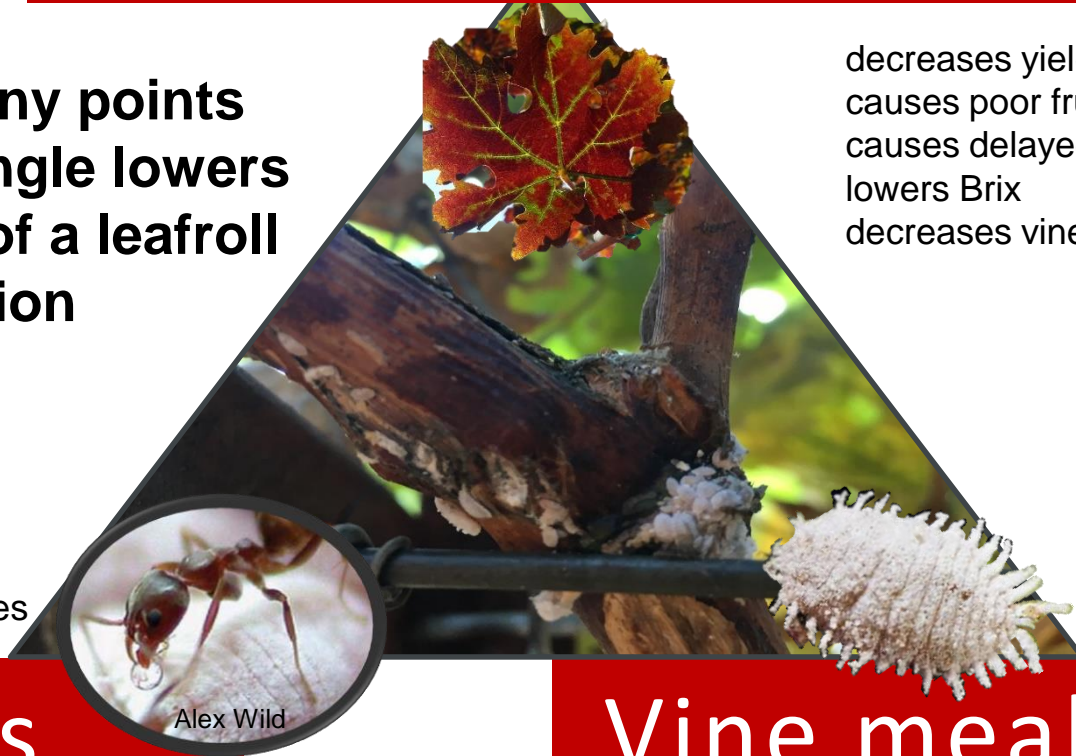
spread leafroll virus  
reproduce at an alarming  
rate

## Ants.

(vector assistant)

## Vine mealybugs.

(leafroll virus vector)



Alex Wild





An ant carrying a mouthful of vine mealybug eggs along a drip irrigation line.

PHOTO: Mario Salinas, a vineyard scout

October 17, 2019  
**LEAFROLL VIRUS TAILGATE TALK**



PHOTO: Akif Eskalen

SUSTAINABLE AG EXPO  
INTERNATIONAL SUSTAINABLE  
WINEGROWING SUMMIT

LODI WINEGRAPE COMMISSION  
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# MYSTERY/SUDDEN VINE COLLAPSE

June  
2013



May  
2017







# MYSTERY/SUDDEN VINE COLLAPSE WORKING HYPOTHESIS =

{ VIRUS-SENSITIVE ROOTSTOCK } + { LEAFROLL VIRUS } + { A VITIVIRUS } + { ? }



# LEAFROLL VIRUS DEMO VINEYARD

- Rootstock trial planted in January 2019
- Vines tested negative for viruses at time of planting
- Tested for viruses in October-November 2019: Already getting positive results for leafroll 3 virus and grapevine virus A (a vitivirus)



# USDA Tree Assistance Program







**Decrease vector populations.**



**Lower virus inoculum.**

**Why? The future of our industry depends on what we do today.**

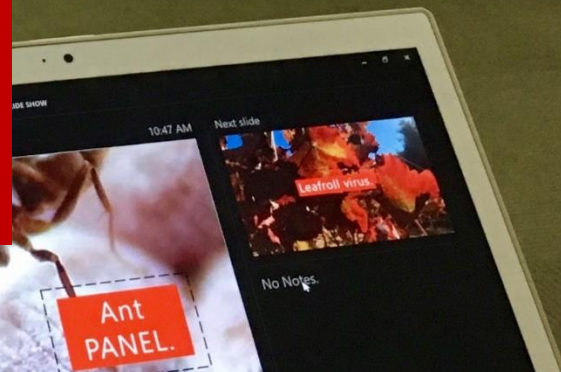


# MEALYBUG & VIRUS VIDEOS





**April 9th, 2020  
Mealybug & Virus  
Outreach Meeting  
Stockton Ag Center**



# THANK YOU

American Vineyard Foundation  
CDFA PD/GWSS Board  
Lodi Mealybug Biocontrol &  
Grapevine Virus  
Research Focus Groups

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LODI WINEGRAPE COMMISSION  
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lodigrowers.com/  
growereducation/viruses/



Be careful when you re-plant after a leafroll virus infected vineyard.



Report:	V0190	Positive Control	+	+	+	+	Sample Control	
Report date:	4/2/2018	Negative Control	-	-	-	-		
Lab ID	Sample ID	Variety	Row	GLRaV-1	GLRaV-2	GLRaV-3	GRBaV	Sample Control
V680-1	R1	Cab Sauv	1-5	-	-	+	-	Confirmed
V680-2	R2	Cab Sauv	1-5	-	-	+	-	Confirmed
V680-3	R3	Cab Sauv	1-5	-	-	+	-	Confirmed
V680-4	R4	Cab Sauv	1-5	-	-	+	-	Confirmed
V680-5	R5	Cab Sauv	1-5	-	-	+	-	Confirmed

# Vino Farms Ranch 8 Block 3 Clone/Rootstock Trial

**N Section** - Western ten vines of each row  
The list is repeated 3 times for a total of 30 rows

43/own roots  
4/SO4  
7/101-14  
7/1103P  
43/3309C  
7/110R  
685/RS3  
685/RS9  
685/GRN2  
7/039-16  
4/140R

N1 Replication  
 N2 Replication  
 N3 Replication

**M Section** - Approximately 1 and a half rows in the center section of block. The list goes from west to east. About one and a half rows were needed to repeat the list 3 times.

685/RS9  
4/120R  
4/SO4  
43/ own roots  
43/3309C  
685/RS3  
7/039-16  
7/110R  
7/1103P  
7/101-14  
685/GRN2

M1 Replication  
 M2 Replication  
 M3 Replication

**S Section** - Takes 3 partial rows in the south east corner of the map. The list goes from west to east. Each row is one repetition of the list.

685/GRN2  
7/039-16  
4/140R  
7/101-14  
7/110R  
4/SO4  
685/RS3  
43/own roots  
7/1103P  
685/RS9  
43/3309C

S1 Replication  
 S2 Replication  
 S3 Replication

