

## NATULAR SURVEY

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On behalf of the MVCAC IVM Committee and Nancy Voorhees of Clark Mosquito Control Products, we have received responses from California Natular (spinosad) users for the period of 2014-17. The premise for the survey was to determine and confirm the rotational uses by those districts who incorporate Natular as part of their larviciding program.

Nancy identified a total of 23 mosquito control districts who use Natular in varying formulations. Those formulations include:

- Natular XRT
- Natular G30
- Natular 2EC
- Natular G
- Natular T30
- Natular DT

Of the 23 districts, we received responses from 20. We requested the following information:

- Which Natular formulation is most used by each district
- Number of years each district has been using Natular
- What source type(s) is Natular most readily used
- Rotation schedule
- Other larvicide materials used in the rotation schedule on the same source type
- Any signs of resistance reported from the field

Attached are the results from the survey. District List provided per Region.

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# **SACRAMENTO VALLEY REGION**

## NATULAR "USE" SURVEY

<b>DISTRICT</b>	<b>FORMULATION(S)</b>	<b>YEARS OF USE</b>	<b>SOURCE TYPE</b>	<b>ROTATION SCHEDULE</b>	<b>ROTATION PRODUCT</b>	<b>SIGNS OF RESISTANCE</b>
Butte County	Natular XRT	2	Storm Drains	Every 3 years	VectoMax and/or Atlosid	BTI resistance KDR confirmed

**SUPPLEMENTAL COMMENTS TO TABLE:**

**Natular is a great rotational product. Would love for the single brood granule to be more cost competitive to be able to use!**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Lake County VCD	Natular G30	2013-present (6 years)	Organic irrigated pasture	None	None	None
Lake County VCD	Natular XRT	2013-present (6 years)	Organic irrigated pasture	None	None	None

### **SUPPLEMENTAL COMMENTS TO TABLE:**

We use Natular for *Aedes nigromaculis* and *Aedes melanimon* control in an organic irrigated pasture. Before the pasture was organic, we applied Altosid Pellets for more than 10 years with no indication of resistance.

## NATULAR “USE” SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Placer MVCD	Natular 2EC	1	Log decks – Cx pipiens source – high organic content	Every 3 months	Altosid SR20	N/A
	Natular XRT	7	Catch basins	Every 3 months	Altosid XR briquets	N/A
	Natular T30	5	Catch basins with tiny openings – too small for XRT briquets	No – we are not using a lot of tablets per year	N/A	N/A
	Natular G	4	Low areas (spring flooded areas)	After a few treatments	VectoBac G; VectoMax	N/A
	Natular DT*	1 <sup>st</sup> yr	Tree holes	N/A	N/A	N/A

### SUPPLEMENTAL COMMENTS TO TABLE:

- \*Natular DT : First year we are using it in tree holes. We are evaluating if we will continue to use it in tree holes. Did not decide about rotation schedule and/or rotation products.
- No signs of resistance so far in our different source types. At least based on visual observations in the field. No larval bioassays performed in the lab so far to confirm any level of resistance.
- Natular G : Employees like the high density granules that penetrate better heavy canopy and also can be sprayed to a further distance even when it is windy.
- Like the quick kill of the product, especially the 2EC.

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Sacramento-Yolo Mosquito and Vector Control	<b>Natular XRT</b>	Since 2009	Catch Basins	Product rotated every 4th treatment, no less then every 3rd treatment.	VectoMax Methoprene	Population of concern

Sacramento-Yolo Mosquito and Vector Control	<b>Natular G30</b>	Since 2010	Pastures, Hayfields, Rangeland low areas, Roadside Ditches, Freshwater marshes, Catch Basins	Every other treatment product is rotated. No more than 2 uses in a row	BTI VectoMax Methoprene	None
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Sacramento-Yolo Mosquito and Vector Control	<b>Natular 2EC</b>	Since 2012	Pastures, Hayfields, Rangeland low areas, Roadside Ditches, Freshwater marshes	No more then 2 uses in a row on a site.	BTI Methoprene	None
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Sacramento-Yolo Mosquito and Vector Control	<b>Natular G</b>	2013 to 2016	low areas, Sewage Lagoons	No more then 2 uses in a row on a site.	BTI Methoprene	None
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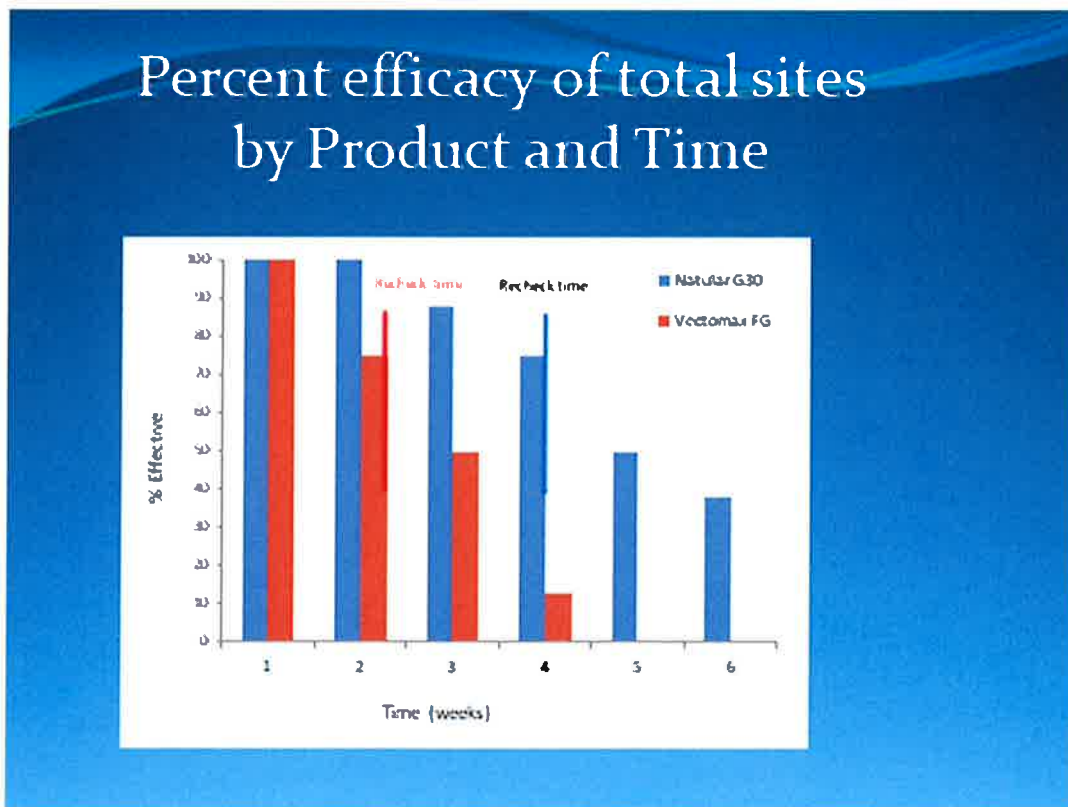
### **SUPPLEMENTAL COMMENTS TO TABLE:**

As presented at the annual meeting, there are some Catch Basins in Yolo County that experienced product failure with G30. More data is currently being collected to explain this.

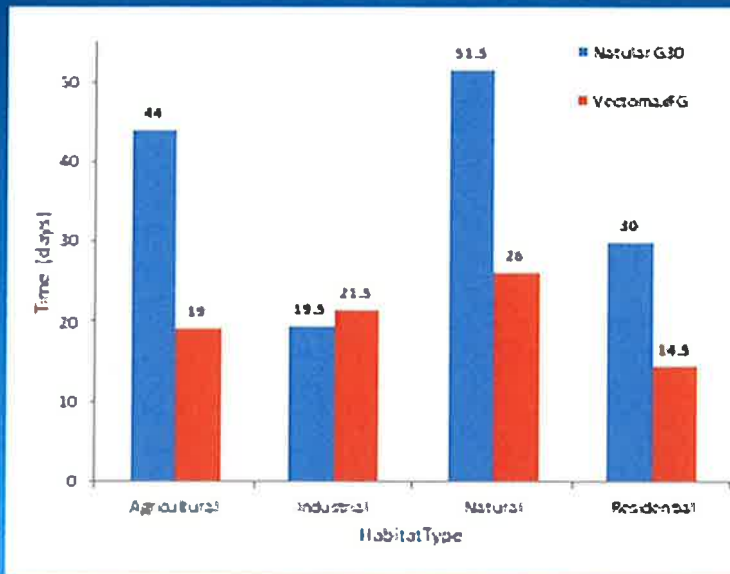
## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Shasta Mosquito and Vector Control District	Natular G30 (most used)	7 (since 2011)	All kinds of standing water including clear and organic ponds, ditches, swamps, storm drains, and natural and artificial containers except waters of sensitive environments.	Various, based on the type of sources and time of the year	VectoMax FG VectoBac G Altosid pellets MetaLarv S-PT Fourstar Briquets – 180 d	No
	Natular XRT	7	catch basins ponds puddles ditches containers Swimming pools	No fixed schedule.	Altosid XR MetaLarv S-PT	No

**SUPPLEMENTAL COMMENTS TO TABLE:** Our field tests have shown that Natular G30 has 100% control of mosquito larvae for 3 weeks and effective control (80%) for 4 weeks, with an average of 36.2 days. Our field tests also have shown that Natualr G 30 lasts the longest (51.5 days) in natural sources, followed by residential sources (lasted 30 days), and the least (19.2 days) in industrial sources. We recheck Natular treated sources monthly.



# 2017 Field Efficacy Test Results by Habitats





## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Sutter-Yuba	Natular XRT	Approx. 10 years	Catch basins	2 to 3 years	Altosid XR Briquets	None
	Natular G30	Approx. 10 years	Pastures Tires	2 to 3 years	Altosid Pellets	Looking into some efficacy issues with a particular lot of G30.*

### SUPPLEMENTAL COMMENTS TO TABLE:

\*Will be performing a bio assay on G30 with wild *pipiens* larvae in house, as well as providing product in question for Clarke to examine.

**NORTHERN SAN JOAQUIN VALLEY  
REGION**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
San Joaquin County MVCD	Natular G30	5	Pasture	Rotate 1-3 different active ingredients between G30 treatments	Methoprene, Bti, Larviciding Oil.	None Observed
	Natular XRT	5	Catch Basins, Fish Ponds	Every Other Year	Altosid XRT, Vectomax WSP	*Observed some areas of failure within 60 days in heavily organic sump style basins in a few areas.

**SUPPLEMENTAL COMMENTS TO TABLE:**

**\*previous years evaluations had shown much longer residual in those areas. Product samples sent to manufacturer for testing.**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Turlock MAD	Natular XRT Natular G30 Natular 2EC	3	ALL	Generally use rotationally throughout the season	We use Natular as a rotational product, primarily for Altosid or Vectolex	Our latest applications using Natular XRT to catch basins/storm drains we did see issues with some catch basins showing no control (100's per dip)

**SUPPLEMENTAL COMMENTS TO TABLE:**

Overall, good product, technicians like the immediate kill effects. Concerned about it's overuse by districts in California. Also, a bit concerned about the lack of effectiveness from some of the applications using Natular XRT in catch basins...about 7-10% of the post-inspections are showing lack of control. In the past, these same sites were treated with a single briquet of Altosid successfully. I'm not too concerned about the "spinosad" but more that to achieve the 180-day time length, the product maybe releasing too slowly, especially in polluted/organic situations.

# **COASTAL REGION**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Contra Costa Mosquito & Vector Control District	Natular 2EC	7	Primarily swimming pools and rain water sources. As labeled all source types	Natular products are rotated every application. No back to back applications	Vectomax, Vectolex, Altosid, Vectobac, and BVA oil	No signs of resistance.
	Natular G30  Most Used Product	6	As Labeled all source types		Vectomax, Vectolex, Altosid, Vectobac, and BVA oil	No signs of resistance.
	Natular XRT  New for Catch Basin use	1st year	Catch Basin, Artificial Containers		Vectomax, Vectolex, Altosid, Vectobac, and BVA oil	No signs of resistance.
	Natular DT	2	Catch Basins, Artificial containers		Vectomax, Vectolex, Altosid, Vectobac, and BVA oil	No signs of resistance.

### SUPPLEMENTAL COMMENTS TO TABLE:

-First batch of Natular 2EC we experienced problems with the product crystallizing in the container. This concern was quickly addressed by the manufacturer.

-No lab processed post samples, will be doing this year with XRT catch basin use. Field observations very positive for swimming pools, one negative review of XRT use in a 6'x6' vault (3 XRTs used) failed, where Altosid products work.

-2EC requires agitation, which not all equipment has.

-Works very well in cold temperatures

-Currently a VCI is monitoring a site to see if the XRT's live up to their 180 day claim.

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Northern Salinas MAD	DT, G, 2ec, XRT	6 Years	Salt marshes, drains	Only use in Saltmarshes in the Winter and drains every other year	BT, BTS, Metho,OIL	NO

### SUPPLEMENTAL COMMENTS TO TABLE:

**Natular is so effective it kills everything including beneficial bugs, so we refrain from using in spring and summer months. Winter usage is perfect for us in the salt marshes because the larvae are not biting on other types of product at that time.**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
SAN BENITO COUNTY	NATULAR XRT	OVER 5 YEARS	STORM DRAINS, POOLS	N/A	N/A	YES
SAN BENITO COUNTY	NATULAR G30	OVER 5 YEARS	POOLS, PONDS	N/A	OIL	NO

### **SUPPLEMENTAL COMMENTS TO TABLE:**

**Natular XRT is used for storm drains due to the 180 days of protection. No other product with BT offers 180 days of protection that we are aware of.**

**Natular G30 with 30 days of protection is used for immediate suppression of mosquito larvae. Oil is typically used in tandem with Natular G30 to help suppress larvae and pupae populations.**

**Some resistance has been observed with Natular XRT in treatments of pools with high organic matter or mud at the pool bottom. No sign of resistance has been observed with Natular G30 treatments.**

**Both Natular XRT and Natular G30 are effective products for larvacide applications in San Benito County.**



## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Santa Cruz County MVC	2EC, G, G30, XRT	7	Marshes, Artificial containers, intermittent ponding, street catch basins, ditches, septic ponds	Avoid consecutive treatments	BVA, Vectomax, Vectobac, Altosid	undetermined

### **SUPPLEMENTAL COMMENTS TO TABLE:**

XRT failed at times in street catch basins and ponds possibly due to: burial in sediment, high organic load, and water turn over.

Otherwise Natular seems to be one of our most effective products.

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
San Mateo MVCD	Natular 2EC	3	Ditches and Seasonal impounds	Every other treatment per site	Altosid SR20/Teknar HPD	N/A
	Natular XRT	5	Catch basins/Fish ponds	Every 4 months	Altosid XR briquets	N/A
	Natular T30	5	Small containers/catch basins/Fountains	We do rotate every 4-6 weeks but we haven't used this product as much the last 2 years	8.6 Altosid	N/A
	Natular G	4	Seasonal impounds/Marshes	After a few treatments	Altosid XRG; VectoMax	N/A
	Natular DT*	1	Small breeding sites	Every other tx	8.6 Altosid	N/A

### SUPPLEMENTAL COMMENTS TO TABLE:

- We like the XRT for their long lasting treatment and have seen up to six months of control
- No signs of resistance so far in our different source types.

**SOUTHERN SAN JOAQUIN VALLEY  
REGION**

## NATURAL "USE" SURVEY

<b>DISTRICT</b>	<b>FORMULATION(S)</b>	<b>YEARS OF USE</b>	<b>SOURCE TYPE</b>	<b>ROTATION SCHEDULE</b>	<b>ROTATION PRODUCT</b>	<b>SIGNS OF RESISTANCE</b>
Consolidated	G30,XRT, 2ec (high cost limits use)	Since Registration In CA	Pastures, riparian flood water, catch basins, Unmaintained pools	During season	Bti, methoprene	None

**SUPPLEMENTAL COMMENTS TO TABLE:**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Delta VCD	2EC , G 30	7	Labeled	As need	Bti, Bs	none

### SUPPLEMENTAL COMMENTS TO TABLE:

- Which Natular formulation is most used by your district.
  - A. Natular 2EC, roughly 3gallons per year.**
  - B. Natular G30, roughly 80lbs per year.**
  
- Number of years your district has been using Natular.
  - A. Delta VCD has been using Natular for seven years. First purchase was made in 2011.**
  
- What source type(s).
  - A. Main uses are on labeled Agricultural crops, but have also used in water retention basins and other areas.**
  
- Rotation schedule.
  - A. Natular was purchased to be used in area's showing Methoprene resistance, in rotation with Bti products.**
  
- Other larvicide materials used in the rotation schedule on the same source type.
  - A. Methoprene, Bti, Bs, and Suffocant oils depending on label restrictions to source type.**
  
- Any signs of resistance reported from the field?
  - A. Delta VCD has not seen any signs of possible resistance to Natular treated sites to this date.**

## NATULAR "USE" SURVEY

<b>DISTRICT</b>	<b>FORMULATION(S)</b>	<b>YEARS OF USE</b>	<b>SOURCE TYPE</b>	<b>ROTATION SCHEDULE</b>	<b>ROTATION PRODUCT</b>	<b>SIGNS OF RESISTANCE</b>
Fresno Mosquito VCD	Natular XRT	8 years	Catch basins, utility vaults	Yearly	Altosid XR Briquets	None
	Natular G30	3 years	Small containers, pastures	Yearly	Altosid XRG or Vectobac GS	None
	Natular 2EC	7 years	Catch basins, Sump/gutter	Yearly	Vectobac 12AS or Altosid Liquid Larvicide	None

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Kings MAD	2EC	8	Pastures, Orchards, Dairy Drains	1 to 3	Bti, Altosid, or Oil	None
	Natular G	8	Pastures, Sloughs, Orchards	1 to 3	Bti, Altosid, or Oil	None
	Natular G30	8	Pastures, Sloughs, Orchards,	1 to 3	Bti, Altosid, or Oil	None
	XRT Tablets	8	Swimming Pools, Catch Basins	1 application per season	Altosid, Vectolex, or Oil	None
	T30 Tablets	8	Catch Basins, Swimming Pools	1 application per season	Altosid, Vectolex, or Oil	None

### SUPPLEMENTAL COMMENTS TO TABLE:

Generally speaking, we avoid back to back Natular applications when possible. Our rotation products fluctuate depending on the specific conditions at the source at the time applications are necessary. This may include fluctuating water depths, expected time the source may exist, the cost of the application material, and the relative importance.

Special care is taken with residual products. We often limit application to 1 per year.

# **SOUTHERN CALIFORNIA**



## NATULAR "USE" SURVEY

<b>DISTRICT</b>	<b>FORMULATION(S)</b>	<b>YEARS OF USE</b>	<b>SOURCE TYPE</b>	<b>ROTATION SCHEDULE</b>	<b>ROTATION PRODUCT</b>	<b>SIGNS OF RESISTANCE</b>
Northwest MVCD	Natular G-30	3	Curb and Gutter, ditches, flood channels, etc	Every other trmt.	VectoBac G, Vectomax FG	None
Northwest MVCD	Natular 2EC	3	Retention ponds, cattail ponds	Every other trmt.	VectoBac 12AS	None
Northwest MVCD	Natular XRT	3	Swimming Pools	Every other trmt.	Altosid XR	None

**SUPPLEMENTAL COMMENTS TO TABLE:**

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
Orange County Mosquito And Vector Control District	Natular XRT Natular G30 Natular 2EC Natular T30	3	ALL	Used to rotate with Altosid products until trials at the district showed Altosid not working	We use Natular primary as a residual treatments	

**SUPPLEMENTAL COMMENTS TO TABLE:**

Good product, we have doubts the 180 day XRT's actually are effective that long. Used to rotate with Altosid products but tests at the district showed that Altosid products were not preventing larvae development.

## NATULAR "USE" SURVEY

DISTRICT	FORMULATION(S)	YEARS OF USE	SOURCE TYPE	ROTATION SCHEDULE	ROTATION PRODUCT	SIGNS OF RESISTANCE
SAN BENITO COUNTY	NATULAR XRT	OVER 5 YEARS	STORM DRAINS, POOLS	N/A	N/A	YES
SAN BENITO COUNTY	NATULAR G30	OVER 5 YEARS	POOLS, PONDS	N/A	OIL	NO

### **SUPPLEMENTAL COMMENTS TO TABLE:**

**Natular XRT is used for storm drains due to the 180 days of protection. No other product with BT offers 180 days of protection that we are aware of.**

**Natular G30 with 30 days of protection is used for immediate suppression of mosquito larvae. Oil is typically used in tandem with Natular G30 to help suppress larvae and pupae populations.**

**Some resistance has been observed with Natular XRT in treatments of pools with high organic matter or mud at the pool bottom. No sign of resistance has been observed with Natular G30 treatments.**

**Both Natular XRT and Natular G30 are effective products for larvacide applications in San Benito County.**