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MEMORANDUM

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916-445-2090

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SUBJECT: GEOGRAPHIC INFORMATION SYSTEM MAPPING AND PRELIMINARY
DATA ANALYSIS FOR THIOBENCARB USE IN CALIFORNIA, 2003-2009

ABSTRACT

This memorandum summarizes and maps thiobencarb used in rice fields of Sacramento Valley during 2003-2009. Preliminary data analysis was conducted to characterize the potential change on the spatial pattern of thiobencarb use. I investigated the potential causes of the increased detections and levels of thiobencarb concentrations in the Sacramento River during recent two years of 2008-2009. Please note that at this time, only draft and incomplete data for thiobencarb use in 2009 were available. Revisions in the data could partially modify the data analysis results.

INTRODUCTION

Based on thiobencarb monitoring data from the Rice Pesticide Program, thiobencarb concentrations in Sacramento River measured in 2008 and 2009 are higher than those from 2003 through 2007. No significant changes, however, are observed for Rice Pesticide Program management practices, weather conditions, and river flows between the two periods (Moran, 2009). In 2007, both the U.S. Environmental Protection Agency and the Department of Pesticide Regulation approved a slightly reformulated version of the thiobencarb Bolero product called "Bolero Ultramax." This product became available for use in the 2008 rice growing season, and partially replaced "Bolero 15G" that was used as the major thiobencarb products from 2003 through 2007. Therefore, the change in formulation and associated change in use pattern are considered to be potential causes of thiobencarb concentration increases in 2008-2009.

In this study, thiobencarb uses in Sacramento Valley during 2003-2009 are retrieved from Pesticide Use Reporting (PUR) database maintained by the Department of Pesticide Regulation. Use trends and patterns are investigated by mapping the annual use amount. Finally, preliminary data analyses are conducted to characterize the temporal trend and spatial variability of thiobencarb use in the study area.



THIOBENCARB USE DATA QUERY AND AGGREGATION

The PUR data queries are performed for three categories of thiobencarb products as shown in Table 1. Retrieved data covers thiobencarb use for rice fields (SITE_CODE=28072) in California during 2003-2009. Spatially, thiobencarb use data is summarized at section level for the convenience of GIS mapping. Temporally, annual uses are summarized at the following three time frames: (1) annual average use during 2003-2007; (2) annual total use in 2008; and (3) incompletely reported use in 2009. Annual average use for each section for 2003-2007 was calculated as the total thiobencarb use during 2003-2007, divided by the number of years with thiobencarb application.

Table 1. Thiobencarb products in PUR database

| Category | Product Number (PRODNO) |
|--------------------------------|--------------------------------|
| “Bolero 15G” | 46655 |
| “Bolero Ultramax” | 57157 AND 55765 |
| All other thiobencarb products | 28048, 28049, 28287, 57229 |

GEOGRAPHIC INFORMATION SYSTEM MAPPING

Section-level thiobencarb use data (in pounds AI) are geo-referenced via ESRI ArcGIS. Relevant spatial information is also provided, such as the county boundaries, monitoring sites, and rivers. Five maps are generated as follows (Figures 1-5). Same ranges of thiobencarb use rate, i.e., < 500 pounds (AI) per section, 500-1000, 1000-1500, and >1500, are used for all maps.

Bolero 15g (Thiobencarb) Use in Pounds, Annual Average 2003-2007

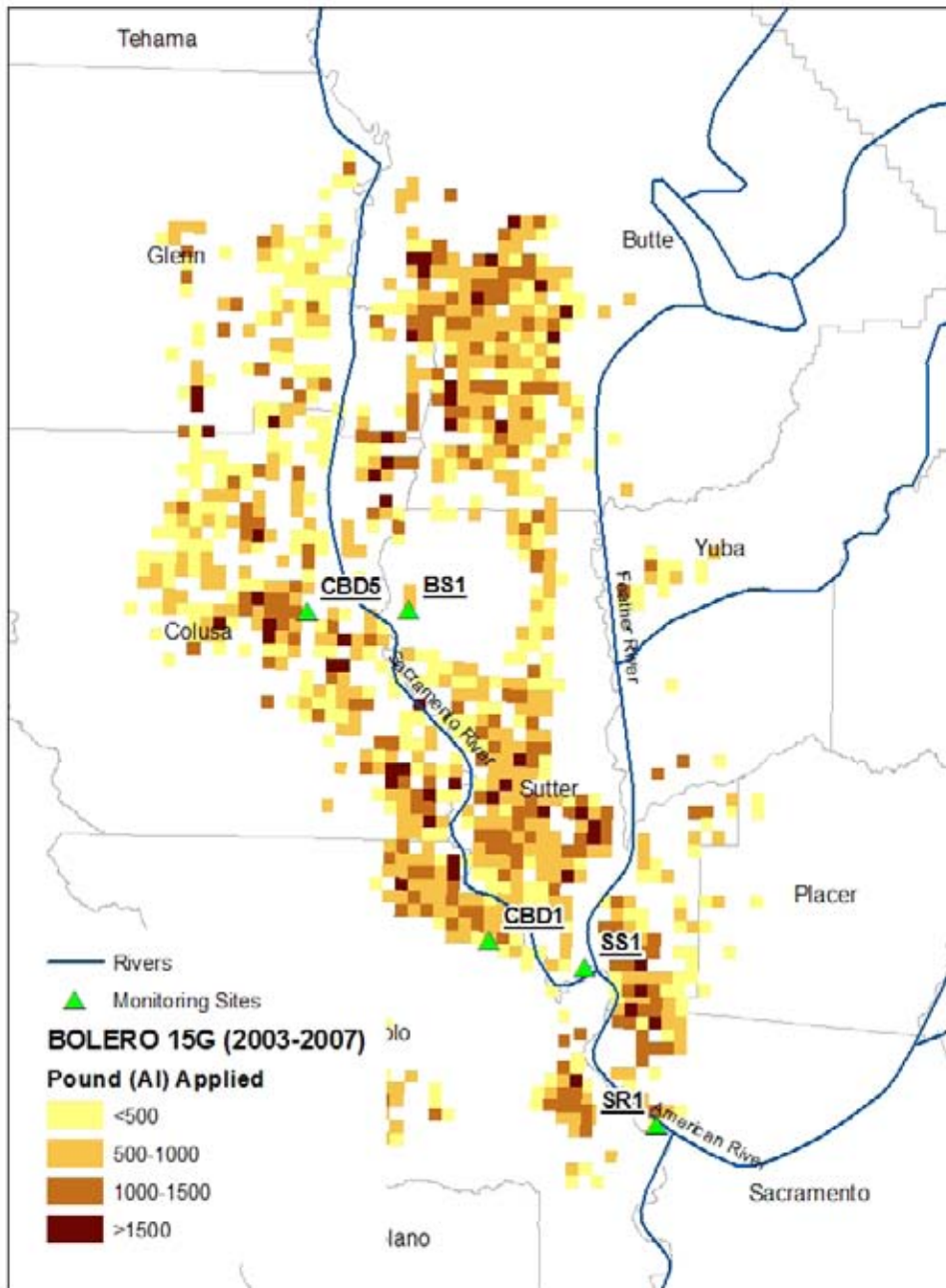


Figure 1. Annual average use of “Bolero 15G” during 2003-2007

Bolero 15g (Thiobencarb) Use in Pounds, 2008

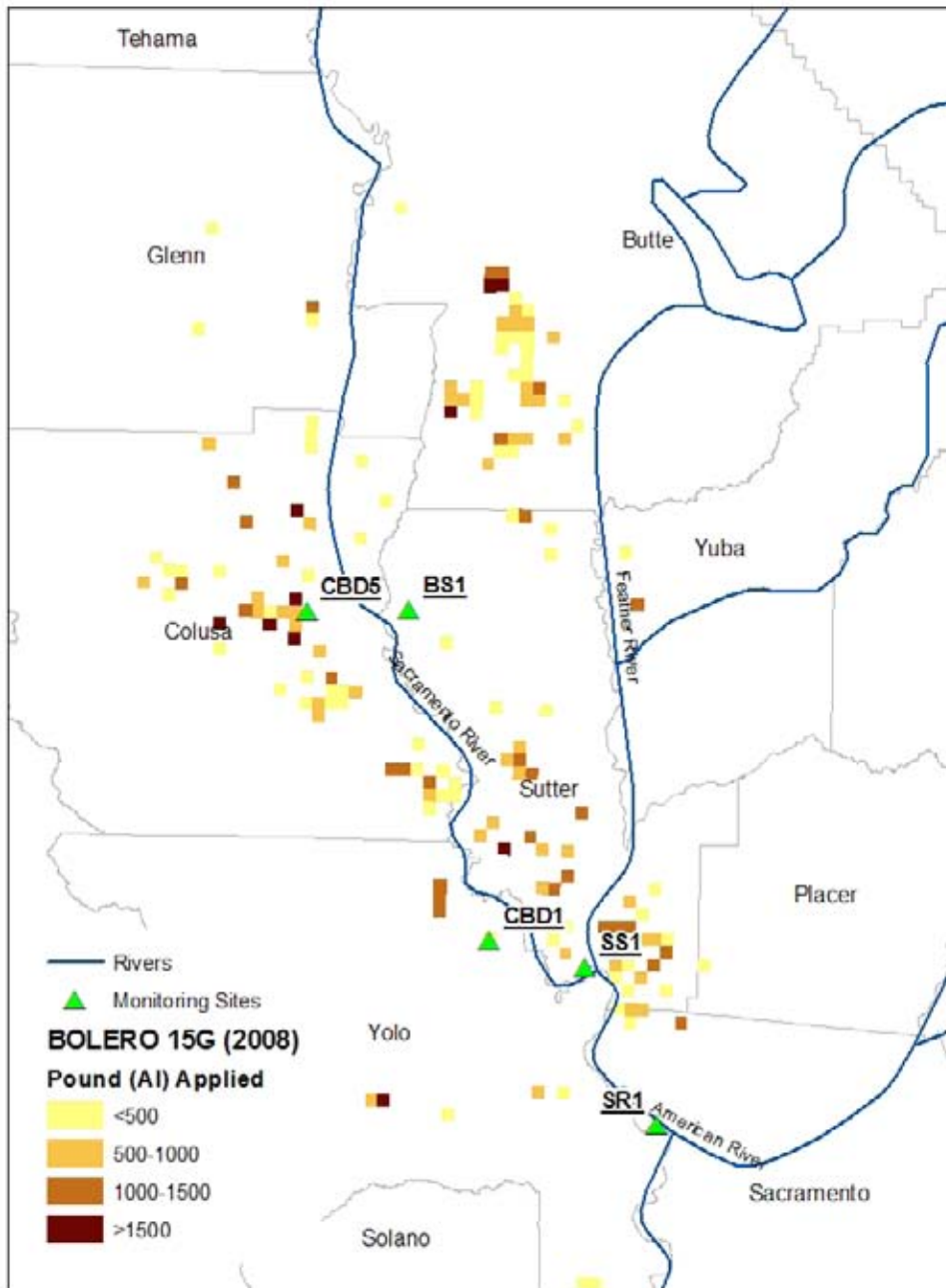
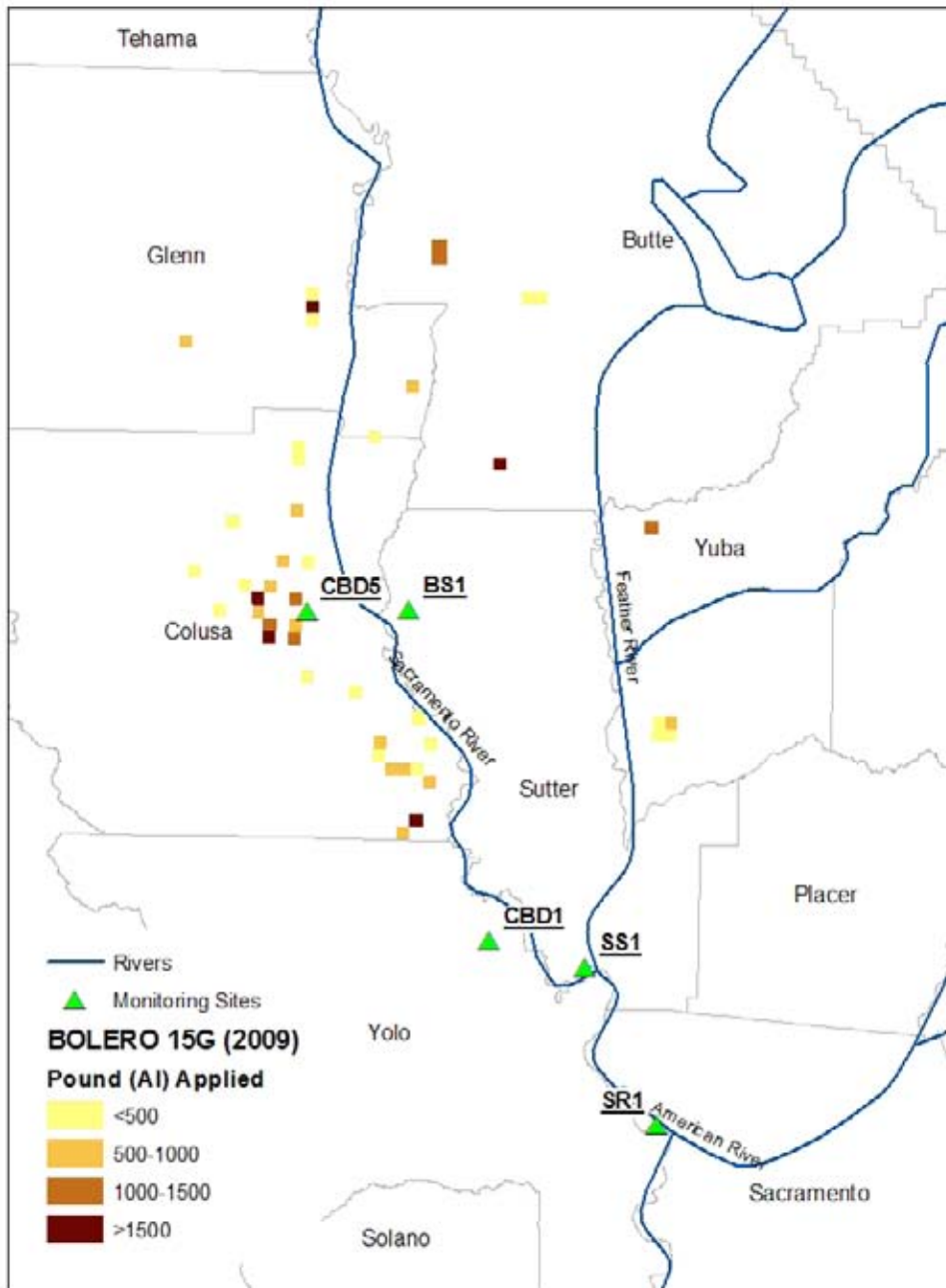


Figure 2. Use of “Bolero 15G” in 2008

Bolero 15g (Thiobencarb) Use in Pounds, 2009



Note: Use data for 2009 is draft and incomplete

Figure 3. Use of “Bolero 15G” in 2009

Bolero Ultramax (Thiobencarb) Use in Pounds, 2008

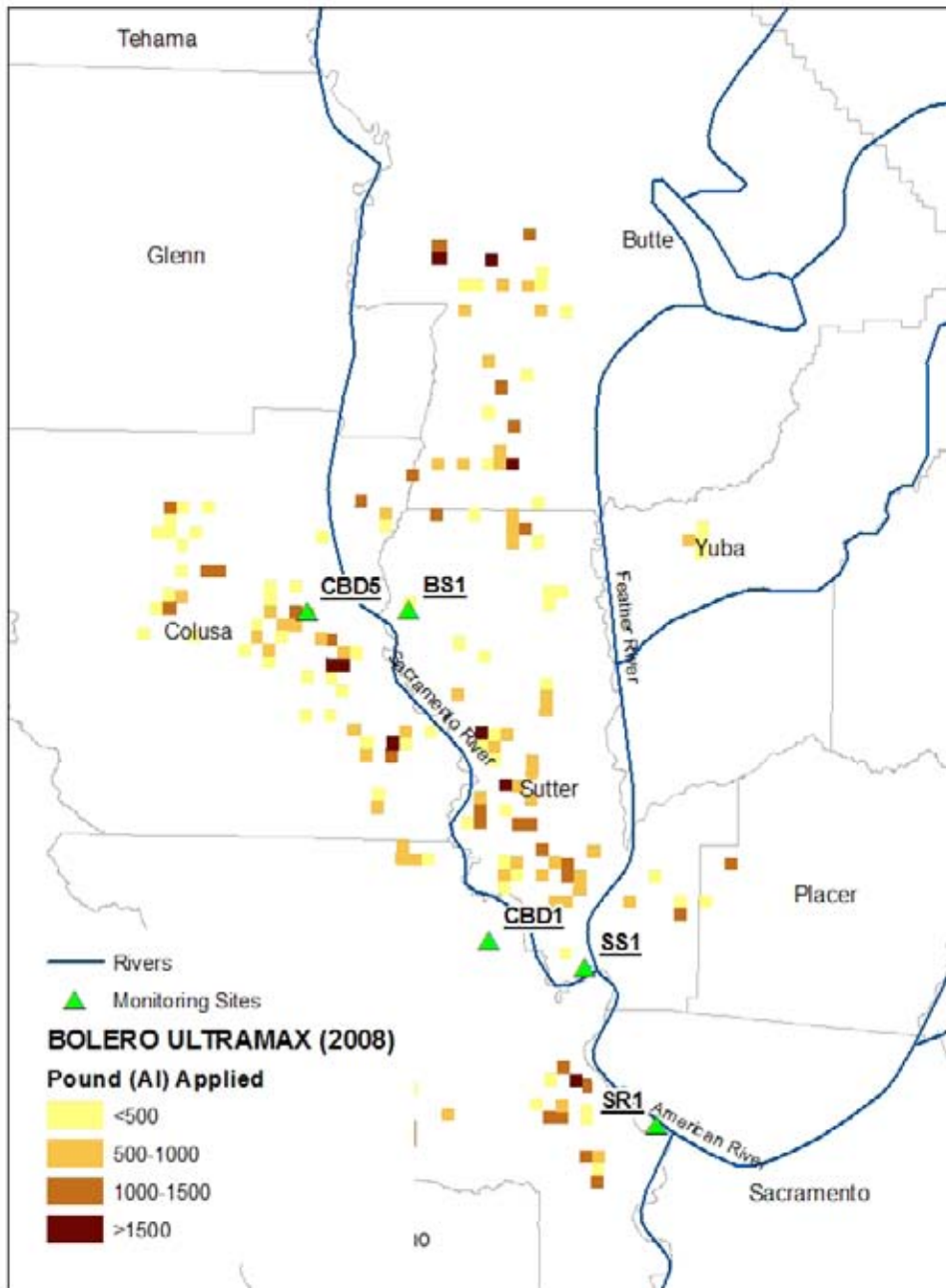
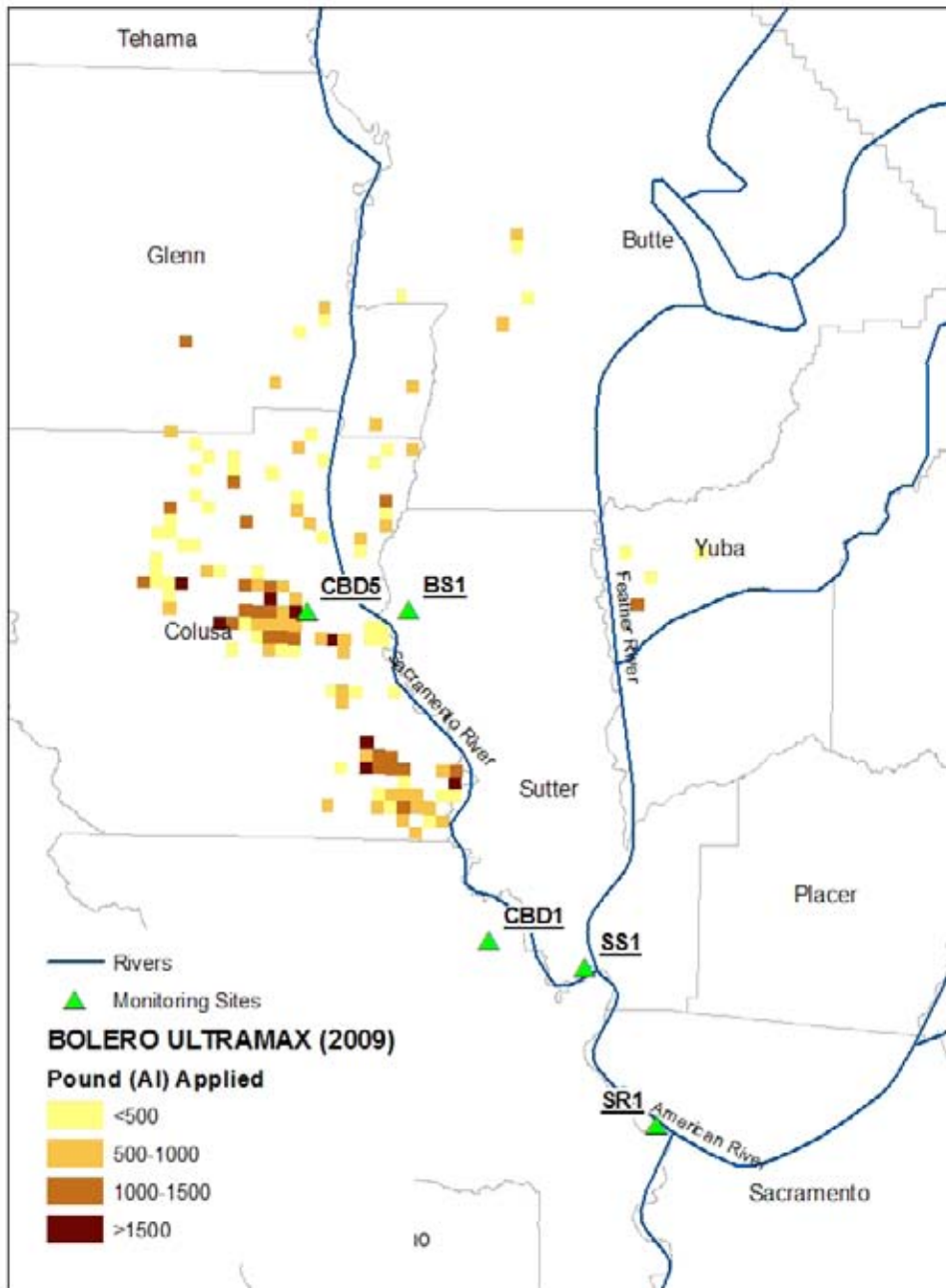


Figure 4. Use of “Bolero Ultramax” in 2008

Bolero Ultramax (Thiobencarb) Use in Pounds, 2009



Note: Use data for 2009 is draft and incomplete
Figure 5. Use of “Bolero Ultramax” in 2009

PRELIMINARY DATA ANALYSIS

Thiobencarb use in the five counties of Sacramento Valley, i.e., Butte, Colusa, Glenn, Sutter, and Yolo, are used in the preliminary data analysis. Maximum product use intensity is about 28 pounds per acre treated. No significant error was observed. There is a general decreasing trend in the total thiobencarb use (Figure 6). In addition, no significant change was observed for use intensity (pounds over acre treated). The mean use intensity is about 4 pounds (AI) per acre treated, or 26.6 pounds (product) per acre treated.

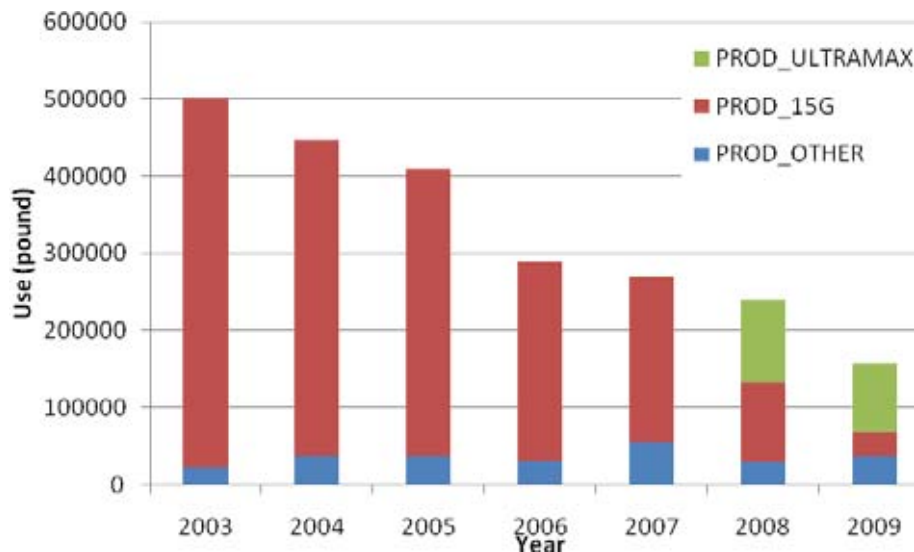


Figure 6. Annual use of thiobencarb in the five counties of Butte, Colusa, Glenn, Sutter, and Yolo (Note: Data for thiobencarb use in 2009 are draft and incomplete).

Percent use of thiobencarb in counties of Colusa, Sutter, and Yolo (Yolo only uses a small fraction of total thiobencarb) increased from ~70% during 2003-2007 to 80% in 2008 and 90% in 2009 (Figure 7). Consequently, the total thiobencarb use in those counties remains steady, while total use in the Sacramento Valley decreased significantly. This finding suggested that application of thiobencarb is moving to the south portion of the Sacramento Valley.

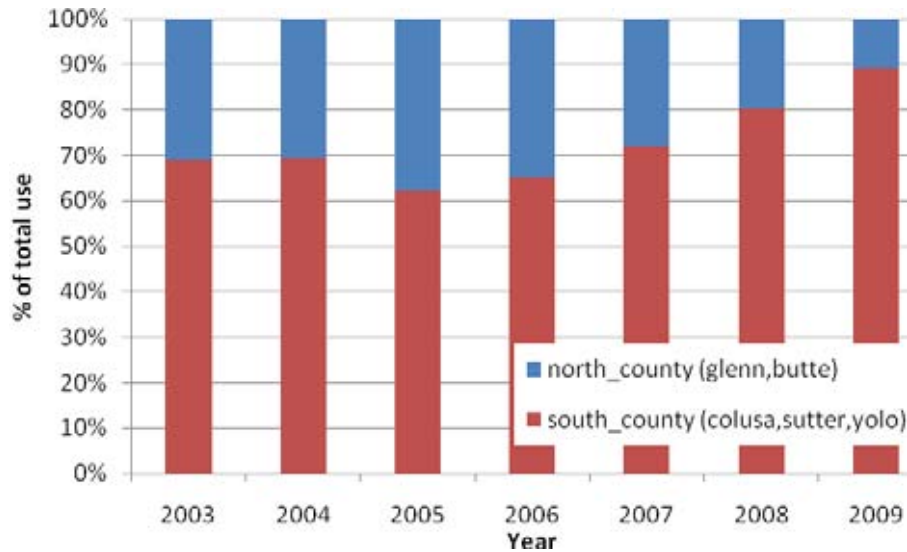


Figure 7. Annual use of thiobencarb, comparing use in northern counties (Glenn and Butte) and southern counties (Colusa, Sutter, and Yolo) (Note: Data for thiobencarb use in 2009 are draft and incomplete).

In addition, there is an increasing trend of “Bolero Ultramax” product use in the southern counties, 68.2 thousand pounds (AI) in 2008 and 82.4 thousand pounds (AI) in 2009. At the same time, the “Bolero Ultramax” product use in the Valley has decreased from 106.8 K to 89.1 K pounds (AI). Consequently, majority of “Bolero Ultramax” products are applied in the southern counties, accounting for 64% and 92% of total “Bolero Ultramax” use in the Valley in 2008 and 2009, respectively. This might explain the increased concentration in Sacramento River during 2008 and 2009 (Table 2).

Table 2. Summary of temporal trend and spatial variability on thiobencarb use in California rice fields, 2003-2009

| Product | Sacramento Valley | Southern Counties |
|-----------------------------------|-------------------|-------------------|
| Total thiobencarb use (2003-2009) | Decreased | Steady since 2006 |
| “Bolero Ultramax” use (2008-2009) | Decreased | Increased |

Note: Data for thiobencarb use in 2009 are draft and incomplete.

SUMMARY

Total thiobencarb use in the Sacramento Valley decreased consistently during recent years from 2003 through 2009. However, thiobencarb use was steady (for total thiobencarb) or increasing (for “Bolero Ultramax”) in the three Counties of Colusa, Sutter, and Yolo. This finding suggests a potential change of thiobencarb use pattern between 2003-2007 and 2008-2009; however, we are still waiting for the completion of 2009 PUR to confirm this change. Treatment locations in three southern Counties (Colusa, Sutter, and Yolo) have relatively short transport distances to the monitoring stations, compared to the Counties of Glenn and Butte. Therefore, the use pattern change might be attributed to the increased thiobencarb concentrations measured in Sacramento River for 2008 and 2009.

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REFERENCE

Moran, K.D., 2009. Thiobencarb—evaluation of recent monitoring data, a memorandum to the Rice Pesticide Program, by TDC environmental, LLC, San Mateo, California.