Survey of Incidence of Rice Diseases in the Sacramento Valley of California

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Objective: Document the incidence of rice diseases in the rice growing area of the Sacramento Valley.

Methods

Eight Sacramento Valley counties where rice is grown were selected for the survey (Table 1). Rice acreage in these counties represents 99% of the rice acreage in California. In each county, rice fields were randomly selected for inspection, trying to distribute the fields geographically to include most of the rice area in a county (Fig. 1). The number of fields surveyed in each county varied with the size of rice acreage. Ten, five or two fields were surveyed in large, medium and small rice counties, respectively. The survey was conducted between September 8 and September 23, 2014.

Table 1. Counties surveyed, their rice acreage and number of fields sampled.

County	Rice acreage*	% of statewide acreage	Number of fields sampled
Butte	103,000	18	10
Colusa	163,000	29	10
Glenn	79,500	14	10
Sutter	116,000	21	10
Yolo	32,400	6	5
Yuba	37,000	7	5
Placer	13,500	2	2
Sacramento	12,630	2	2
Total	557,030	99	54

* 2013 growing season, National Agricultural Statistics Service and County Crop Reports

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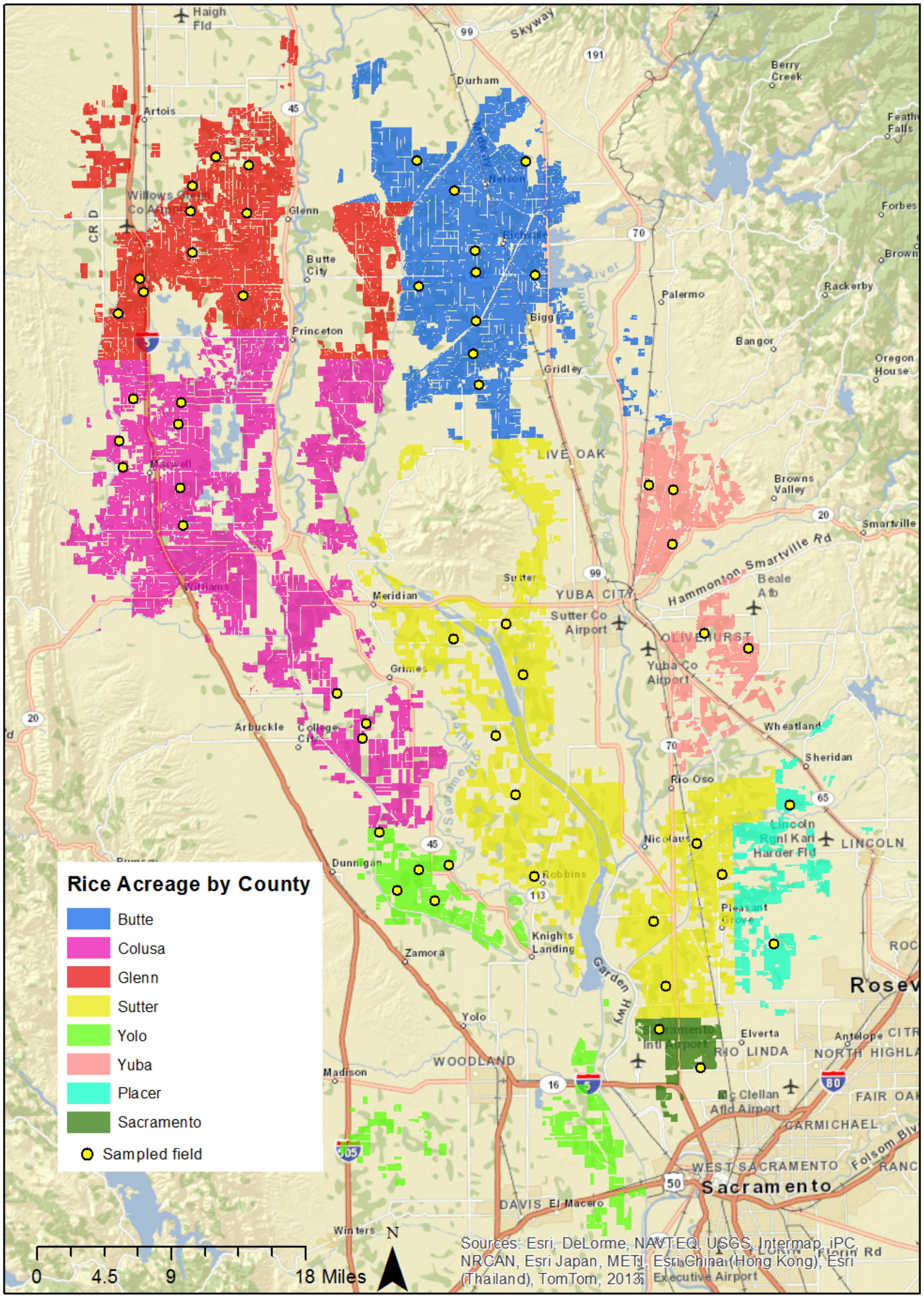

Fig. 1. Rice acreage and sampled fields in selected counties in the Sacramento Valley. Rice acreage from Land Use Survey, Department of Water Resources.

In each field, three basins were selected. In each basin, a scout performed 10 inspections every 15 feet. Five inspections were conducted walking towards the center of the basin, and the other five walking in the opposite direction, towards the basin's edge. Each inspection consisted of a 1-minute search at each stop during which the scout looked for disease symptoms in nearby plants and recorded their presence or absence. Diseases surveyed, their symptoms, and location in the plant are described in Table 2.

Table 2. Diseases surveyed, their symptoms and plant part inspected.

Disease	Symptoms	Plant part inspected
Stem rot	Stem lesions	Stems at the water line
Aggregate sheath spot	Stem lesions	Stems at the water line
Rice blast	Necrotic tissue	Foliage and panicles
Kernel smut	Infected panicles	Panicles

To summarize the data, each 1-minute inspection was considered a sample unit, and the percentage of inspections within a basin with disease symptoms was considered a sample. Data is presented as sample average per county.

Results and Discussion

Inspected fields were at the grain filling stage during the survey dates. During this stage, rice diseases presented in Table 2 can be easily identified.

Diseases not included in the survey were seedling disease and bakanae. Seedling disease affects rice during the first two weeks after planting, killing seeds before they germinate. Surveying this disease is difficult because it occurs before plant structures can be observed. Bakanae is a seedling disease that can be observed after plants have emerged through the water, 3 to 4 weeks after planting, or during grain development. However, the occurrence of this disease is minor and its effect on yield negligible at this time (Webster and Greer 2004). The widespread use of sodium hypochlorite during seed soaking has successfully limited the incidence of this disease.

A total of 162 samples, consisting of 1,620 sample units, were taken. The percentage of inspections in which disease symptoms were found was highly variable within counties. For instance, samples taken in Colusa County that had symptoms of stem rot ranged from 0 to 100%, whereas in Butte County samples ranged from 40 to 100%. This variability is due in part to differences in crop management. Several factors affect disease incidence: nitrogen and potassium fertility affect the development of stem rot and aggregate sheath spot (Williams and Goldman-Smith 2001, Maschmann et al. 2010); high plant density creates conditions that are favorable for stem rot development (Webster and Greer 2004); rice varieties differ in their susceptibility to stem rot, aggregate sheath spot and rice blast (Webster and Greer 2004); water management can have a strong influence on rice blast development (Greer and Webster 2001); straw management after harvest helps reduce the inoculum of diseases for next season (Webster et al. 1981, Cintas and Webster 2001). These and other factors make it difficult to generalize about the prevalence of a disease within a county.

Stem rot and aggregate sheath spot were found in all fields in all counties (Table 3). Kernel smut was found in all counties, except in Sacramento County. Rice blast was not found in any of the counties. On average, the incidence of stem rot and aggregate sheath spot was high. For all counties, 68% and 71% of inspections had symptoms of stem rot and aggregate sheath spot, respectively. The incidence of kernel smut was low, with only 12% of inspections having symptoms.

Table 3. Average percentage of inspections where disease symptoms were present.

County	Stem rot	Aggregate sheath spot	Kernel smut	Sample size
Butte	85	77	25	30
Colusa	61	74	11	30
Glenn	62	51	9	30
Sutter	67	83	9	30
Yolo	81	60	1	15
Yuba	67	68	25	15
Placer	45	72	2	6
Sacramento	53	88	0	6
All counties	68	71	12	162

Stem rot is a disease that has been present in California since the beginning of rice cultivation (Davis 1950) and can be easily found in rice fields. Aggregate sheath spot became a problem after the introduction of high-yielding, semidwarf varieties by the end of the 1960s (Gunnell and Webster 1984) and is also commonly found in rice fields. The severity of these two diseases is mostly dependent on crop management. Currently, fungicides are registered that will control or suppress both diseases.

Kernel smut is considered a minor rice disease in California (Webster and Greer 2004). The survey shows that it is present in almost all counties, but at a much lower incidence than stem rot or aggregate sheath spot. Medium and short grain rice varieties do not favor development of this disease.

Rice blast disease was not found in any of the fields surveyed. Rice blast was first identified in California in 1996. Since then, rice blast disease has been observed every year. The severity of rice blast disease varies with weather. In warmer locations such as Glenn and northern Colusa counties, the disease has become endemic and is observed every year. In cooler locations such as Yolo County, the disease is rarely found.

Blast infections are favored by long periods of leaf wetness, high relative humidity and mild temperatures (63^{o}F to 82^{o}F) (Greer and Webster 2001). During 2014, temperatures were higher than normal during the period of rice vegetative growth. For example, when comparing degree-day accumulation over 50^{o} F during 2014 with 2010, a year when blast incidence and severity was high, 2014 stands out as a warmer year (Fig. 2). Higher temperatures may have inhibited blast sporulation and slowed infection of plants and reduced overall incidence of this disease. Consultations with growers and pest control advisers from several areas confirmed that the disease was not seen in 2014, with only one grower reporting seeing blast in Glenn County.

Fungicide use in California rice has increased over the past several years (Fig. 3). The main disease targeted by fungicide applications is rice blast; however, these fungicides also have activity against the other rice diseases presented in this survey, and some growers have those in mind when doing a fungicide application. The results of this survey, together with fungicide use data, show that rice diseases are widespread among the Sacramento Valley and require active management by rice growers.

In conclusion, stem rot and aggregate sheath spot were commonly found during this survey. Kernel smut was found in most counties, but its incidence was low. Rice blast was not found during the survey. Most likely, rice blast low incidence was due to weather conditions that were not conducive to disease development.

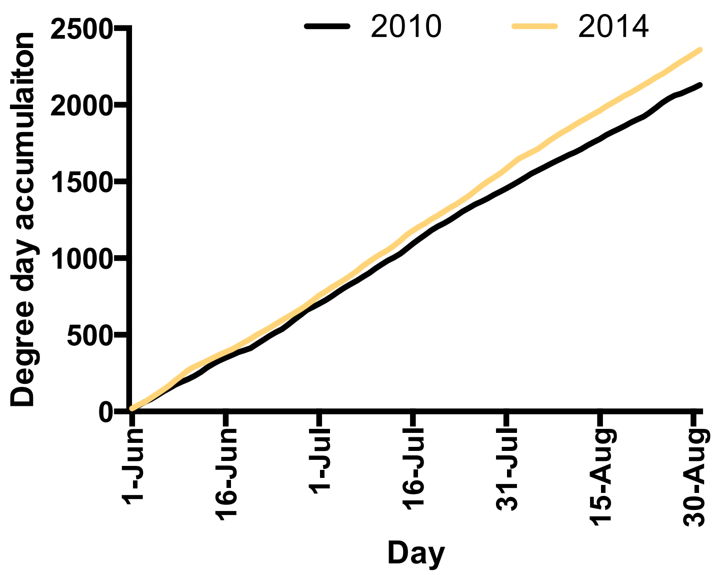

Fig. 2. Degree-day accumulation over 50° F during the months of rice vegetative growth for 2010 and 2014. Temperature data from California Irrigation Management Information System, station 32, Colusa.

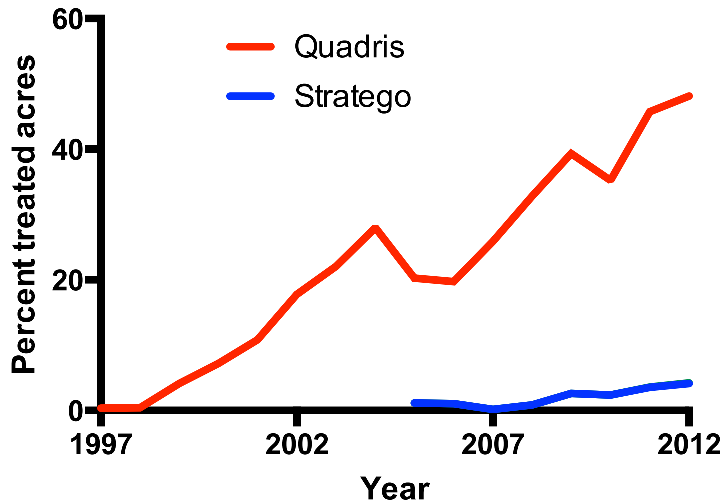

Fig. 3. Percentage or rice acres treated with fungicides. Pesticide Use Report data, Department of Pesticide Regulation.

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