

Title Regional analyses of constraints affecting rice production systems in California: Grain milling quality at harvest and evolution of herbicide resistant *Echinochloa* spp.

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Abstract

Rice systems in California, despite being highly developed and efficient, present constraints at different levels in its production system when an agro ecological viewpoint is formulated. Though analyses at the plot or field level have denoted significance for science resulting in important technologic progress, a wider perspective is required nowadays to improve systems efficiency in a faster approach. Moreover, regional studies have provided the opportunity to combine more disciplines, taking into account time and space in an integrative analysis, thus facilitating the comprehension of natural phenomena.

Grain milling quality is one important issue in current California rice systems, especially related to variations in weather pre-harvest that could result on low head rice percent and also worse final returns. A regional analysis approach was carried out using statistical interpolation methods (through geographic information systems) to evaluate the mentioned association and to estimate the optimum harvest time relative to obtaining maximum head rice percent. Obtained results will aid farmers and industry decisions towards preparation of harvest and storage facilities to improve the system efficiency.

Evolution of herbicide resistance in *Echinochloa* spp. (*E. phyllopogon*, *E. oryzoides* and *E. crus-galli*) towards various herbicides currently in use in California rice (thiobencarb, bispyribac-sodium and fenoxaprop-ethyl) was associated with landscape, crop and weed management variables using a geographic information system and multivariate analysis (classification and regression trees, CART). Diverse outcomes were obtained for each species, denoting their different genetics and ecology; the regional integrative analysis conducted allowed for in-depth evaluation of dissimilar information that could be incorporated simultaneously into the analysis. The information thus obtained will be useful to define best strategies for mitigating further evolution and spread of herbicide resistance in *Echinochloa* spp. throughout rice fields of the Sacramento and San Joaquin valleys.

This dissertation exemplifies how a complex problematic can be visualized and addressed from a regional perspective, integrating all kinds of available information, to provide guidelines for action at various levels scaling from field to farm and finally to an entire region.