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PRECISION FARMING FOR SITE-SPECIFIC CROP AND RESOURCE MANAGEMENT
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Site-specific crop management (SSCM) is the management of a crop at a spatial and temporal scale appropriate to that crop's own inherent variability. Precision agriculture has been defined as the application of modern information technologies to achieve SSCM. Concepts of precision agriculture have primarily been developed for application to large-scale production systems characteristic of Europe and North America, and have focused on the spatial dimension. Development of SSCM techniques in tropical regions has focused on the time dimension. Future research should permit these two approaches to be synthesized to a system that uses spatial relationships to optimize the efficiency of collecting information and that optimizes production in each year. An important question is whether concepts of SSCM and precision agriculture can be used to improve farming practices in areas with a lower level of mechanization, and whether methods developed for small farmers to improve the precision with which they manage their crops can provide guidance in the development of SSCM strategies for large fields in high technology systems. The objective of this paper is to consider these questions in the context of rice production. The overriding theme of the paper is that SSCM involves both a spatial and a temporal component, and that the most successful implementation of SSCM will be one that integrates these two components effectively.

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SPATIAL AND TEMPORAL ANALYSIS OF RICE YIELD VARIABILITY IN CALIFORNIA
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Most farmers recognize that spatial variability in yield exists when they harvest. However, this knowledge is generally of an informal, anecdotal nature, which must be made more precise if it is to be used effectively in precision agriculture. Currently, we know little about the spatial structure neither of these yields patterns, nor of the consistency of these patterns from year to year. The consistency of the spatial and temporal structure of crop yield across the field needs to be investigated before implementing any management strategy. The stability of the spatial structure over time will indicate whether the same physical and ecological processes are controlling yield from year to year. In this project we describe yield spatial and temporal structure of two rice fields in California. Yield spatial structure is assumed to consist of a large-scale deterministic structure or trend and a small-scale stochastic structure. Large-scale deterministic structure was determined for each year using median polish. Trend surface spatial behaviors were different each year, indicating a lack of temporal stability in this structure. The small-scale stochastic spatial structure was determined by computing variograms of the yield residuals after subtracting the trends. Variograms showed strong spatial structure of yield residuals. Temporal variability was determined by two different approaches: 1) computing the variance among years; and 2) by using cluster analysis of the standardized trend yield values. Cluster analysis reduced the considerable complexity in a sequence of yields maps of these fields to a few general patterns of among year's variations with a given spatial distribution.

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FACTORS UNDERLYING YIELD SPATIOTEMPORAL VARIABILITY IN TWO CALIFORNIA RICE FIELDS
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In this study several approaches were used to determine the factors that cause the spatial and/or temporal variability of two rice fields in California. These approaches include a) classical inferential statistics like Pearson's correlation coefficients and stepwise multiple linear regression, b) non parametric statistics like CART, Mantel and partial Mantel tests and c) geostatistical analysis like variograms and cross-variograms. For Field 1, none of the soil physical or chemical variables that were measured presented a consistent relationship with yield performance in the four years. In Field 2, there were four soil variables consistently related with yield performance from 1998 to 2000. Organic matter was significantly positively correlated with yield, while K, Clay and Soil compaction were significantly negatively correlated with yield performance during these years. Examination of the variograms showed that the range of spatial autocorrelation varied among soil properties and yield in different years. When the partial Mantel test was used to test if the correlations found by the simple Mantel tests are still significant when the spatial correlation is accounted, the results showed that these relationship indeed remain statistically significant when spatial effects were held constant, with the exception of Soil Compaction and Yield in the year 2000. There is no single approach or statistical analysis that is capable to completely explain the causes of yield spatial variability. Each method provides different information, and only by integrating classical inferential statistics, non parametric statistics and geostatistical analyses it is possible to conform a better understanding of causes of yield spatial variability.
Keywords: Precision farming, Spatial analysis, Classification and regression trees, Variograms, Cross-Variograms, Mantel statistics.

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ESTABLISHING A SYSTEM OF GEOGRAPHICAL INFORMATION WHITH A PROFILE APPLICABLE TO RACE AREAS.
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In the frame of the Proyect of Technological Innovation P.D.T. Nº S/INI/01/044, Conicyt (M.E.C) a methodology for compilation and headling of geographical information is developed.
Its aim is to generate a tool for the groundwork and planning of those agricultural systems which involve resourses geographicaly distributed and which require suitable planning and effective monitoring and control. Starting from the periodic load of information for its analysis in the taking of decisions and based on the technology of the sistems of geographical Information.
The implementation is in the watering system in "India Muerta" administrated by Comisaco S.A. and its coverage is approximately 180.000 Hás. in the province of Rocha.
The differencial contribution with regard to the existing developments in our country, at both state and private level, is in the working scale in the complete level of accuracy in the geographical elements and in the fact that it provides the necessary conditions for the management of the system in real time. This implies to evacuate historical condition of use management and performance for farm, and the needs in the water supply or potential of reload of the system, monitoring of the distribution nets, improvement in the eficiency of the use of the water resourse and other activities.
Technology of GPS, Digital Photogrammetry and software GIS specialized programmed for our clients were used for the development of the system.
The final product is the model of the zone at an adecuated and modernistic scale linked together with the variable time which makes possible to work in past, present or future situations.
Keywords: GIS, GPS, Digital Photogrammetry, Watering Use Administration, Comisaco S.A.