RICE CRC

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. . . of growing importance

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Sustainability of Natural Resources

Using of EM surveys to identify seepage sites in on-farm channels and drains

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Introduction

EM-31 surveys were used to characterise soil differences along channel and drainage lines and the apparent electrical conductivity (ECa) values were compared with direct seepage measurements using an Idaho Seepage Meter. This method proved successful in identifying actual seepage sites. ECa values obtained from the EM-31 surveys provided an insight into the most likely locations to have high seepage rates. The EM-31 method was shown to be an important initial predictive tool.

EM-based methodologies have been developed to target rice soil suitability assessment. This study aimed at examining the use of the EM-31 technology to predict channel and drain locations with high seepage rates.

Method

Seepage investigations were carried out on 9 rice growing farms in the Murrumbidgee Irrigation Areas (MIA) and Coleambally Irrigation Area (CIA). The channels considered in this study were constructed in the last 2-30 years.

The methodology regarding the Idaho seepage meter measurements has been reported in Measurement of losses from on-farm channel and Drains. Three seepage measurements were taken at each sampling location. The 3 measurements were classified as the left bank, centre and right bank of the channel line.

Geonics EM-31instrument surveys were undertaken on both sides of all channels and drains on each farm. ECa survey results were mapped by SURFER (Golden Software 1999) using the approach of Beecher and Hume (1996).

EM data was recorded for each seepage meter sampling location and used in relation to the 3 sampling points at each location.

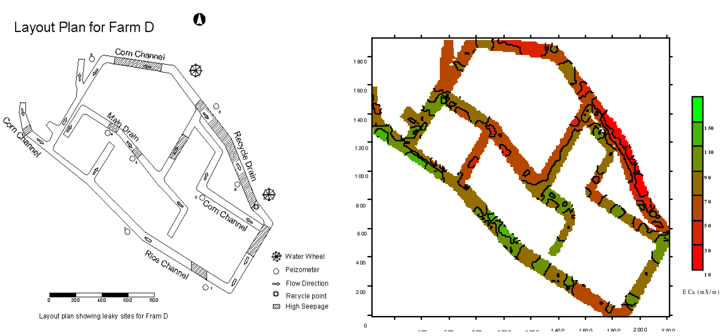

Fig 1. EM-31 Survey along channels and drains of Farm D.

Statistical Analysis

Initially the relationship between apparent electrical conductivity (ECa) values from the EM-31 and seepage rate measurements was examined for each farm by regression analysis. The relationships developed were poor.

The data for each channel was then considered as a two-dimensional array, classified by the sampling location (using the distance along the channel) and the position in the channel (left, middle or right). All analyses were performed in ASREML (Gilmour et al, 1999).

Results

Significant variation in ECa values was recorded along the length of the on-farm channels and drains (Fig 1.). From these survey maps, sites with a history of seepage problems were confirmed in discussion with landholders.

Graphs of the seepage rate verse ECa value for two farms are shown in Fig. 2a and 2b. Most of the higher seepage rate sites occurred where the low EM-31 readings were found.

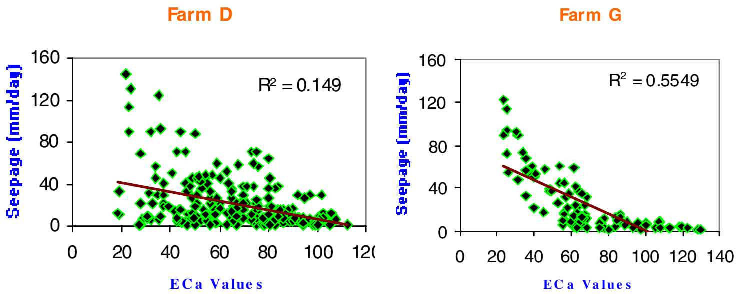

Fig 2a and 2b. Seepage rate verse EM-31 values for all channels on two representative farms.

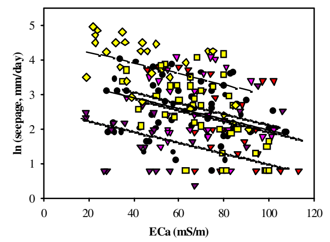

Figure 3. Plot of ln (seepage) verse ECa for Farm D showing linear relationships between seepage and EM-31 for different channels/drains.

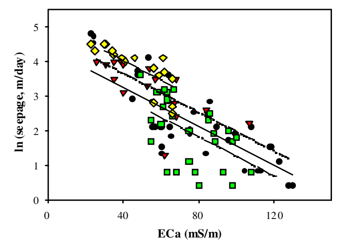

Figure 4. Plot of ln (seepage) verse ECa for Farm G showing linear relationships between seepage and EM-31 for different channels/drains.

In Figs.3 and 4, the relationship between ln (seepage) and ECa values along several channels / drains on each farm are shown.

Highest seepage rates were found where ECa values were low.

In some areas seepage rates were found to be low despite low ECa values at these locations. These anomalies were attributed to various factors which included compaction of substrate, clay layers below channel bed, sodicity, biological activity and sediment deposition.

The effect of ECa on ln (seepage) was highly significant for all farms.

Conclusion

Combining the seepage-monitoring program with the EM-31 electromagnetic survey method proved to be highly effective in detailing the nature and extent of the problem. Despite, limitations in interpretation of the ECa values in some locations, the EM-31 method is considered to be an important predictive tool in the first stage of seepage loss assessment.

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