BAYESIAN ESTIMATION OF THE ADDITIVE MAIN EFFECTS AND MULTIPLICATIVE INTERACTION (AMMI) MODEL

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Linear-bilinear models such as the Additive Main effect and Multiplicative Interaction (AMMI) are used for studying genotype × environment interaction (GE). These linear-bilinear models are parsimonious because the interaction parameters are estimated from a subset of components of the singular value decomposition of the GE matrix. For plant breeders, the use of linear-bilinear models offer more opportunities for modeling GE than the simple regression of genotypes on the site mean. A Bayesian method for estimation of parameters in the AMMI model using Markov Chain Monte Carlo (MCMC) approach through Gibbs sampling with embedded Metropolis-Hastings random walks has previously been proposed. This Bayesian approach for estimating AMMI model parameters provides an easy method for dealing with unbalanced data and heterogeneity of variances, and it produces, for noninformative prior distributions, shrinkage estimates similar to those computed by the usual mixed models. Some practical and theoretical issues have been resolved by the Bayes-AMMI approach to be presented, such that a set of conditional distributions for AMMI model parameters was developed such that solutions are obtained by a straightforward Gibbs sampler without the previously necessary computer-intensive ,Metropolis-Hastings steps, This reduces the computing time required for sampling from the posterior distribution and makes the algorithm more stable with a convergence rate that sufficiently rapid so make its use practical. The main objective of this research was to implement this Bayesian methodology to estimate the bilinear GE interaction parameters in AMMI models. Parameters for linear (additive) effects were estimated as usually done in Bayesian mixed model methodology with the inclusion of blocks within sites as random effects. For unbalanced data set, the imputation data methodology based on a Gibbs sampler was used. We show the use of informative and noninformative prior distributions for both balanced and unbalanced data sets.