World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:13, No:09, 2019

Optimal Tetra-Allele Cross Designs Including Specific Combining Ability Effects

Authors : Mohd Harun, Cini Varghese, Eldho Varghese, Seema Jaggi

Abstract : Hybridization crosses find a vital role in breeding experiments to evaluate the combining abilities of individual parental lines or crosses for creation of lines with desirable qualities. There are various ways of obtaining progenies and further studying the combining ability effects of the lines taken in a breeding programme. Some of the most common methods are diallel or two-way cross, triallel or three-way cross, tetra-allele or four-way cross. These techniques help the breeders to improve the quantitative traits which are of economical as well as nutritional importance in crops and animals. Amongst these methods, tetra-allele cross provides extra information in terms of the higher specific combining ability (sca) effects and the hybrids thus produced exhibit individual as well as population buffering mechanism because of the broad genetic base. Most of the common commercial hybrids in corn are either three-way or four-way cross hybrids. Tetra-allele cross came out as the most practical and acceptable scheme for the production of slaughter pigs having fast growth rate, good feed efficiency, and carcass quality. Tetra-allele crosses are mostly used for exploitation of heterosis in case of commercial silkworm production. Experimental designs involving tetra-allele crosses have been studied extensively in literature. Optimality of designs has also been considered as a researchable issue. In practical situations, it is advisable to include sca effects in the model as this information is needed by the breeder to improve economically and nutritionally important quantitative traits. Thus, a model that provides information regarding the specific traits by utilizing sca effects along with general combining ability (gca) effects may help the breeders to deal with the problem of various stresses. In this paper, a model for experimental designs involving tetra-allele crosses that incorporates both gca and sca has been defined. Optimality aspects of such designs have been discussed incorporating sca effects in the model. Orthogonality conditions have been derived for block designs ensuring estimation of contrasts among the gca effects, after eliminating the nuisance factors, independently from sca effects. User friendly SAS macro and web solution (webPTC) have been developed for the generation and analysis of such designs.

Keywords : general combining ability, optimality, specific combining ability, tetra-allele cross, webPTC
Conference Title : ICASA 2019 : International Conference on Applied Statistics and Analysis
Conference Location : Vancouver, Canada
Conference Dates : September 24-25, 2019