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研究论文

AMMI模型在旱地春小麦稳定性分析中的应用

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摘要 基因型与环境的互作(GEI)决定了作物在多变环境下性状的稳定性。AMMI模型是一种将方差分析和主成分分析结合于一体，能更有效分析GEI、进而评价基因型稳定性和环境对基因型差异分辨力的有力工具。利用AMMI模型对10个品种(系)、13个试点组成的全国旱地春小麦区域试验产量资料分析表明，试点间平均产量变幅为396.6～4050.2 kg•hm^{-2}，现代品种间的平均产量变幅为1318.6～2315.6 kg•hm^{-2}；基因型间、环境间和GEI引起的产量变异达到极显著水平，三者的变异平方和分别占总处理平方和的6.2%、70.3%、23.5%，表明环境和GEI对产量变化的影响远大于基因型。用前3个代表了90.8% GEI信息的显著主成分计算基因型稳定性参(Di)和试点分辨力(Dj)，基因型间Di最大相差达3倍、而试点间Dj最大相差19倍；属于高产、稳产的品种有：定西35、西旱1号、定丰889，而在这两方面均表现最差的品种为蒙麦35号。有些品种对某些试点有特殊适应性，局部推广价值也大。

关键词

AMMI模型；区域试验；基因型×环境交互作用；旱地；春小麦

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Application of AMMI Model in the stability analysis of spring wheat in rainfed areas

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Abstract Genotype stability of agronomic traits is a direct measure of the effect of genotype × environment interactions (GEI). The additive main effects and multiplicative interaction model (AMMI) combine analysis of variance and principal component analyses that has been proved to be an effective tool in understanding complex GEI and evaluating genotypes stability and environmental discrimination to genotype diversity. The grain yield data of 10 spring wheat genotypes grown in a regional trial of China at 13 sites of the rainfed areas were used for AMMI analysis. The average grain yield across the 13 sites ranged from 396.6 kg•hm^{-2} to 4050.2 kg•hm^{-2}, of which the grain yields of newly released, modern genotypes ranged from 1318.6 kg•hm^{-2} to 2315.6 kg•hm^{-2}. Highly significant variations were observed among genotypes, environments and GEI, with the three variances accounting for 6.2%, 70.3% and 23.5% of total variance, respectively. The environment and the GEI had greater effects on grain yield than genotypes. The three first principal component axes (IPCA) with significant interaction represented 90.8% of total GEI variance. Using the three first IPCA, genotype stability parameter (Di) and site discrimination parameter (Dj) were calculated, where the difference of Di among the genotypes was up to 3 times, while that of Dj among the sites was up to 19 times; Genotypes Dingxi 35, Xihan No.1 and Dingfeng 889 had highest yields and best yield stability across different environments. The genotype Mengmai 35 was the worst in both yield and stability. Some genotypes performed best at some specific sites and can be recommended for those specific environments.

Key words AMMI model _ regional trial _ genotype-environment interaction _ rain fed areas _ spring wheat

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