Predicting the yield of varieties of maize in a target environment using regression analysis

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ABSTRACT

Previous analyses on variety yield have usually focused on regression coefficients as an indicator to measure the stability and adaptation of a specific variety under experimental conditions. Due to the huge differences between experimental plots and farm fields, the model results from experimental plots can hardly be applied to farm fields. In this study, a regression analysis was conducted between the variety yield and an on-trial environment index (the mean yield of all varieties in the same test site). Then, using the average proportional coefficient between the on-trial environment index and the on-farm environment index (the statistical maize production yield of the growing county containing the test site) as a bridge, the on-farm environment index was converted to the corresponding on-trial environment index, which was then applied to the regression model generated from the on-trial plot-scale data. This procedure ensured the homogeneity of the model parameters and successfully predicted the yield of maize varieties under a target environment. The procedure also produced the 95% confidence interval predicted yield, making the results more practically significant. By introducing the proportional coefficient and confidence interval, the new approach provides a feasible solution for studying the performance of varieties under on-farm conditions. Finally, we used the maize variety NH1101 as an example to illustrate the modeling procedures. The results indicated that the model produced promising results. The new method provides direct support for variety recommendation, and facilitates the identification of better-adapted varieties.

1. Introduction

With more and more new maize varieties emerging, targeting and recommending an appropriate maize variety for growing environments is a serious problem faced by variety breeders, extension workers, variety managers, and others. To realize this, predicting the yield of a specific maize variety in a specific target environment could have considerable value, and could facilitate objective identification of better-adapted varieties for farmers.

Regression analysis is a simple statistical method, which is widely used in yield prediction issues. Regression of yields of varieties upon means of sets of varieties in the same trials (over diverse environments) is often used to give measures of stability and adaptability [1]. Their use goes back to Yates and Cochran [2], followed by Finlay and Wilkinson [3], widely popularized by Eberhart and Russell [4], Perkins and Jinks [5], and Tai [6]; later, a proposed modification to the limitations of conventional regression analysis was suggested by Verma et al. [7]. Gonçalves et al. used regression analysis on hevea progeny girth growth, rubber yield, bark thickness, and plant height [8]. Although there has been a lot of literature about this, it all focuses on the analysis of the variety–environment interaction, using regression coefficients as an aid to recognizing range of adaptation (or performance) of varieties rather than the yield per se. Hartz and Moore provided a multiple linear

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