

A comprehensive evaluation of regional experimental proso millet (*Panicum miliaceum* L.) varieties based on GYT biplot analysis

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Abstract: 【Objective】 To scientifically evaluate the adaptability, high yield, and stable yield of proso millet varieties tested in national regions, so as to provide a theoretical basis for the rational distribution of varieties and regional planning. **【Methods】** Correlation analysis and GYT biplot technique were used to comprehensively evaluate the agronomic traits and yield of 20 varieties of 15 pilot millet varieties in the national regional experiment from 2019 to 2020, including growth periods, plant height, node numbers, main spike length, grain weight per ear, thousand-grain weight. **【Results】** The correlation analysis showed that yield of non-waxy proso millet was positively correlated with the number of growing periods ($P < 0.001$), negatively correlated with the number of node numbers ($P < 0.05$), and negatively correlated with the main spike length ($P < 0.001$). Plant height was positively correlated with growth periods and main spike length ($P < 0.01$), and the number of node numbers and thousand-grain weight were significantly positively correlated ($P < 0.001$). In waxy proso millet, the yield was significantly positively correlated with growth periods and thousand-grain weight ($P < 0.001$), and significantly negatively correlated with main spike length ($P < 0.001$). Plant height was significantly positively correlated with growing periods, main spike length and thousand-grain weight ($P < 0.05$), and growing periods were significantly positively correlated with plant height and thousand-grain weight ($P < 0.05$). In the correlation analysis between yield and trait combination, all combination traits were significantly positively correlated ($P < 0.05$). The GT biplot of non-waxy and waxy proso millet explained 61.81% and 69.96% of the interaction effect, and the correlation of agronomic traits was basically consistent with the correlation heat map. The GYT biplot technique was used to analyze the correlation between yield and trait combination of the tested varieties, and all the combination traits was significantly positively correlated ($P < 0.05$). According to the ideal index evaluation of the tested varieties, Yi 11-02-92-4, 0515-2-2, Gu 19-63, Yi 11-03-3-2-2, and Yi 8430-2-3-3 were excellent varieties with yield and character combinations. The comprehensive performance of Chimi 3, Xinong 2018-N02, Xinong 2018-N10, Y1660, Gu 15-173, and Xinong 18-W06 was poor. Compared with other tested varieties,

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Yi 11-02-92-4 and 0515-2-2 have more extensive adaptability and better yield in different growing areas, showing absolute regional yield advantage, and having broad promotion prospects. **【Conclusion】** GYT biplot is an effective method for the scientific evaluation of glutinous millet varieties because of its high reliability. The no-waxy proso millet with better performance was Yi 11-02-92-4, suitable for planting in the spring proso millet area of Northeast China and the spring and summer proso millet area of Loess Plateau. The waxy proso millet variety with better overall performance is 0515-2-2, which is suitable for planting in the spring proso millet area of northern China and the spring and summer proso millet area of Loess Plateau.