DEFINING QUALITY TARGETS FOR ROBUSTA BREEDING

Testing an innovative approach to classifying coffees by quality segment

THE PROBLEM

Genetic improvement is one of the most efficient ways to increase and stabilize coffee yields, improve the plant's tolerance to abiotic and biotic stresses such as drought and diseases, and improve cup quality. The latter is an especially important goal for C. canephora, also called Robusta, which has long been associated with inferior cup quality but which has agronomic performance traits that are increasingly needed by farmers (namely, disease resistance and heat tolerance). Globally, the share of Robusta production has steadily increased compared with Arabica over the last 50 years. Additionally, as the effects of climate change to the production and quality of Robusta's higher-quality cousin, C. arabica, become increasingly detrimental, there is a renewed interest in the opportunity to diversify production of some lower altitude Arabica coffee zones with Robusta coffee. The problem with using Robusta coffee in Arabica replacement programs is that the increasing market demand for premium and specialty coffees requires higher baseline quality than Robusta coffees currently have a potential to provide.

However, "quality" is not objectively defined in coffee. In order for breeders to truly incorporate the improvement of Robusta cup quality into their agenda, as WCR aims to do, it is necessary to define objective targets for quality. Defining "quality" descriptively isn't easy—there is disagreement in the industry about terms related to quality. Moreover, different buyers of coffee will have different definitions of what quality means for them.

THE SOLUTION

In order to locate relevant breeding targets for improving quality, it's necessary to link objective sensory descriptive properties (e.g., the flavors, aromas, and other sensory properties of a given sample) to quality perception by the industry, and to examine the results to determine if there are chemical/molecular precursors associated with the perception of quality. For example, it may be that a certain intensity of bitterness or astringency (as measured by sensory experts using the World Coffee Research Sensory Lexicon) is predictive of when a coffee will shift a coffee from a medium quality category to a low quality category. Or that a certain threshold of acidity or sweetness predicts a shift from medium to high. Similarly, there may be specific volatile organic compounds associated with highly rated coffee samples but not lower quality ones.

The main objective of this work is to identify volatile compounds that may predict quality perception in Robusta coffee. WCR aims to identify these precursor molecules and, through genome-wide association (GWAS) approaches, incorporate quality-relevant genetic targets into regional advanced breeding programs. Utilizing such predictive markers could dramatically shorten the time and cost associated with breeding new varieties that place quality at the forefront.

IMPACT

Relatively little research has been undertaken to improve Robusta cup quality; in general this indicates that there is high potential for improvement. Where it has been done, most breeding for Robusta coffee has focused on agronomic performance and not quality attributes. There is significant untapped genetic material in coffee genebank collections. Having a methodology for testing previously unused genetic material (including noncommercial varieties, or even wild relatives of arabica and robusta) to determine its quality potential for breeding has the potential to significantly shift Robusta breeding and change the underlying assumption that Robusta coffees are necessarily lower quality.

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