ABSTRACT: Farm production diversity is associated with greater household dietary diversity in Malawi: findings from nationally representative data

Objectives: Farm production diversity has the potential to influence the diversity of household diets, an important nutrition outcome associated with the nutrient adequacy of diets and the nutritional status of individuals. Yet, little empirical research has assessed the relationship between farm diversity and diet diversity or the plausible causal mechanisms that may operate between these two constructs. The objectives of this paper are to determine the relationship between farm production diversity and household dietary diversity, and to identify determinants of this relationship.

Methods: We examined cross-sectional data from the Malawi Third Integrated Household Survey (IHS3), a nationally representative sample of farming households in Malawi, implemented from March 2010 – March 2011 as part of the World Bank Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA). Two indicators of dietary diversity, a modified Household Dietary Diversity Score (HDDS) using 7-day recall data, and the Food Consumption Score (FCS), were calculated along with three indicators of farm production diversity including the Simpson's Index, a metric accounting for both species richness and evenness. We conducted multivariate regression analyses, adjusting standard errors for the complex survey design of the IHS3 and controlling for the effects of several covariates on household dietary diversity.

Key findings: Farm production diversity was consistently positively associated with dietary diversity ($P<0.0001$). Greater farm diversity was especially strongly associated with consumption of legumes, vegetables and fruits. The effect of increased farm diversity was significantly greater in woman-headed households compared to those headed by men (HDDS: $P=0.008$; FCS: $P=0.076$). Farm diversity also had a larger positive effect on dietary diversity in wealthier households ($P<0.05$). Wealthier households were more likely to consume a greater number of different food items within food groups and to consume food groups with greater frequency. These households raised more livestock, cropped larger total areas, practiced less intercropping, and were more likely to devote a greater proportion of cultivated land to legumes, as well as tobacco, a market crop. Households dedicating a larger share of cultivated land to market-oriented crops demonstrated greater dietary diversity as measured by the modified HDDS ($P<0.001$). However, few households were strongly engaged in market-oriented agricultural production at all. Therefore, this relationship may only describe the relative extent of

subsistence production. Both diversity in farm production and diversity in the orientation of farm production then, may be beneficial for the diversity of household diets.

Conclusions & policy recommendations: While advances in agricultural technologies have tended to emphasize only increases in yields and incomes, agriculture may also be important for shaping nutrition outcomes. More diverse production systems, which have been shown to have multiple environmental benefits, may also contribute to more diverse household diets that in turn could positively influence the nutritional status of household members. Yet, this relationship is complex—it may be influenced by gender, wealth, control of household decisions, the relative market-orientation of a household's agricultural production, and the specific nature of farm diversity.

The Government of Malawi's support of increased staple food crop productivity through its Agricultural Input Subsidy Program is important for maintaining production and stabilizing food prices. Yet, too narrow a focus on a single crop, or targeting a single market, may leave smallholder farms and farming families vulnerable. Cultivating resilience may be an especially important goal for the Malawian food system, similar to many such systems across the globe, that face increasingly volatile climatic conditions and market prices for agricultural inputs and commodities. Without the capacity to respond to external shocks, agricultural output may suffer, but even more concerning, the health and nutrition of families that depend on that production for livelihood may be at risk. A diversified agricultural "portfolio", therefore, may be an important component of supporting diversified diets.

More research is required to clearly elucidate these relationships, especially with regard to identifying trade-offs and win-wins for agriculture's multiple ends. The pathways leading from agriculture to improved nutrition are not all straightforward and may have unintended consequences. Diversifying production, for example, may raise labor requirements. If this added labor falls disproportionately on women, it may have deleterious impacts on nutrition. Ensuring adequate access to markets is another important consideration if diversification leads to greater commercialized production. Therefore, policies that seek to cultivate food system resilience for improved nutrition, must explicitly consider nutritional outcomes and safeguards in policy formulation. Doing so may help to ensure that agricultural policies achieve multiple wins.