



# Reply to Remans et al.: Strengthening markets is key to promote sustainable agricultural and food systems

In their letter, Remans et al. (1) argue that our study (2) on the relationship between farm production diversity and household dietary diversity confirms earlier research but lacks discussion of scale and environmental aspects. Indeed, our findings are largely consistent with recent case studies from particular settings, but they challenge some widely held beliefs in the public and policy debate. Using data from various countries and diverse conditions, we were able to draw some broader conceptual and empirical lessons that go beyond case-study evidence.

Concerning the points raised by Remans et al. (1) on landscape diversity and multifunctionality of diversity, these were not the main focus of our article, so we only addressed them briefly in the discussion section. This is also why we stressed that “additional research is needed to better understand how agriculture and food systems can be made more nutrition-sensitive in particular situations” (2). However, we do not see how more explicit consideration of landscape diversity and multifunctionality would change our result that improved smallholder market access has positive effects for dietary quality and nutrition. Of course, monocultures and food deserts, as observed in some parts of the world, are undesirable phenomena. However, these are not the result of well-functioning markets but of biased agricultural and food policies (3). For a long time, many governments have subsidized a limited number of crops through commodity support programs. Similarly, a narrow range of grains and oilseeds were prioritized in agricultural research.

Farmers reacted to these policy incentives, and this has contributed to reduced production and consumption diversity at local and global scales.

Markets are the transmission mechanism, not the root cause of biased incentives. Hence, rather than restricting markets, policies that disincentivize diverse production and consumption need to be rectified. Markets and their functioning need to be strengthened to provide economic incentives to produce and consume more diverse foods and thus also promote landscape diversity. This has to include markets for nonstaple foods and perishable commodities, which are often poorly developed in low-income countries. Without sufficient economic incentives, agricultural systems will hardly become more sustainable. Well-functioning markets are also conducive to implement payments for ecosystem services. Payments for ecosystem services schemes are important in situations where private and social costs and benefits of environmental conservation diverge (4).

Remans et al. (1) mention that in remote settings of Africa, strengthening market access is difficult. This is true, but limited market access is one of the main reasons for high rates of poverty and undernutrition in remote settings, so improving market infrastructure should, nonetheless, have high priority. Even in remote settings, foods purchased in the market play an important role for household dietary diversity (5), a role that cannot easily be replaced through more diverse subsistence production (2, 6). We fully agree that other measures, such as strengthening extension

services, are also important to promote sustainable food systems, and that the mix of interventions needs to be targeted to specific contexts. However, as Remans et al. (1) also stress, supporting market integration and improving extension services are highly complementary approaches.

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**1** Remans R, DeClerck FAJ, Kennedy G, Fanzo J (2015) Expanding the view on the production and dietary diversity link: Scale, function, and change over time. *Proc Natl Acad Sci USA* 112:E6082.

**2** Sibhatu KT, Krishna VV, Qaim M (2015) Production diversity and dietary diversity in smallholder farm households. *Proc Natl Acad Sci USA* 112(34):10657–10662.

**3** Bowman MS, Zilberman D (2013) Economic factors affecting diversified farming systems. *Ecol Soc* 18(1):33.

**4** Krishna VV, Drucker AG, Pascual U, Raghu PT, Israel Oliver King ED (2013) Estimating compensation payments for on-farm conservation of agricultural biodiversity in developing countries. *Ecol Econ* 87(1): 110–123.

**5** Lockett BG, DeClerck FA, Fanzo J, Mundorf AR, Rose D (2015) Application of the Nutrition Functional Diversity indicator to assess food system contributions to dietary diversity and sustainable diets of Malawian households. *Public Health Nutr* 18(13):2479–2487.

**6** Sibhatu KT, Krishna VV, Qaim M (2015) Reply to Berti: Relationship between production and consumption diversity remains small also with modified diversity measures. *Proc Natl Acad Sci USA* 112(42): E5657.

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