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Minimum C Inputs and Sustainability of Biomass Harvest.

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There is expanding interest in harvesting crop biomass for energy. There are potential benefits for using recently fixed C for renewable energy compared to using fossil fuels; however, there are environmental risks that must be addressed as the biomass industry develops. The primary roles of crop biomass are to protect the soil from erosion, provide C inputs to support the belowground ecosystem and build and maintain soil organic matter (SOM)/soil organic carbon (SOC). The big question is how much biomass must stay on the field to provide these ecosystem services. The literature provides initial estimates of minimum source C (MSC) inputs required to maintain SOC. Grain production and harvest index make it possible to estimate aboveground biomass production from the NASS national yield database. The estimates of aboveground source C (ESC) production can be compared to MSC. Aboveground MSC input averaged 2.5 ± 1.0 Mg C ha^{-1} yr^{-1} (n=13) in moldboard plow sites and 1.8 ± 0.44 Mg C ha^{-1} yr^{-1} (n=5) in no-till and chisel plow sites, which is equivalent to 6.25 and 4.5 Mg stover ha^{-1} yr^{-1}, respectively. A MSC of (1.8 ± 0.44 Mg C ha^{-1} yr^{-1}) and a stover yield of 10 Mg stover ha^{-1} yr^{-1} suggest a little more than half the stover could be harvested. These MSC values included only aboveground source C; thus, underestimating the total MSC (including root and rhizodeposition) and cropland net C production. Current grain yields and measured MSC predict continued SOC loss associated with soybean and some wheat production management unless less intensive tillage is used and ESC is increased. The adequacies of ESC to maintain SOC has direct implications for estimating crop residue that can be harvested and yet maintain SOC and associated ecosystems service.

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