PROMOTING SOIL HEALTH
through extension and incentives

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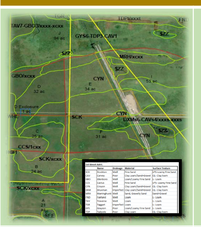
Manitoba Agriculture & Resource Development has long advocated for the adoption of agronomic principles and practices that, directly or indirectly, maintain or improve soil health. The table below features six soil health BMPs currently promoted via incentive funding (up to 50% cost share) through Ag Action Manitoba, a program of the Canadian Agricultural Partnership. Far from exhaustive, the table does cite representative publications supporting the scientific basis of each practice.

The Practice	What constitutes the practice? What are the links to soil health?	Evidence of Benefits
 **Resource Management Planning**	**Comprehensive, integrated planning of the management of a farm's resources to mitigate risks to air, land and water while optimizing production.** • Integrating soil, water and nutrient management planning enables a farmer to **face complex, linked production limitations** that also pose **environmental risks**, including soil degradation. • Full examination of diverse challenges and opportunities, supported by the right **expertise** and **data**, can reduce soil health risks (e.g. salinity, erosion, compaction) and boost soil health benefits (e.g. aggregation, organic matter formation, nutrient cycling).	**D.D. Bochtis et al.** Field traffic planning for reduced soil compaction. XXXIV CIOSTA CIGR V Conference 2011. "The resulting optimal traffic pattern consists of sequences of field-work tracks that do not follow any pre-determined standard motif." **P. Smith.** Water Stewardship Actions under Environmental Farm Plans. 47th Central Canadian Symposium on Water Quality Research (2011). "95% of farmers reported environmental improvements…:74% saw improvements to soil quality…"
 **Cover Cropping**	**Establishing a living crop on a field when normally little to nothing is growing.** • Increased **carbon input** to the soil. • Reduced soil erosion risk. • Reduced risk of runoff and nutrient loss. • **Transpiration** of excess soil moisture, **lowered water table** to mitigate salinity, **earlier** field access. • Reduced reliance on nitrogen fertilizer when using legume cover crops.	**C. Poeplau, A. Don.** Carbon sequestration in agricultural soils via cultivation of cover crops – A meta-analysis. Agriculture, Ecosystems and Environment 200 (2015) 33–41. "In total, the cover crop treatments had significantly higher soil organic carbon stocks than the reference croplands." **H. Cicek, et al.** Late-season catch crops reduce nitrate leaching risk after grazed green manures but release N slower than wheat demand. Agriculture, Ecosystems and Environment 202 (2015) 31-41. "Catch crops were able to reduce soil NO_3-N loading up to 120 cm depth…"
 **Intercropping**	**Growing two or more crop types together.** • Higher **resource-use efficiency**, leading to higher yields compared to mono-cropping. • Increased **carbon input** to the soil. • Reduced reliance on nitrogen fertilizer when adding a legume to the crop mix. • Increased **weed suppression** and **resilience** against crop pests and diseases. • Increased **adaptability** of a cropping system **to adverse weather** conditions. • Reduced risk of nutrient loss.	**L. Mao et al.** Yield advantage and water saving in maize/pea intercrop. Field Crops Research 138 (2012) 11-20. "…intercropping maize and pea enhances land use efficiency compared to growing them as sole crops." **P. Orrell, A.E. Bennet.** How can we exploit above-belowground interactions to assist in addressing the challenges of food security? Frontiers in Plant Science (2013) 4(432):432. "Finally, intercropping has been shown to reduce pest (both microbial and arthropod) attack."
 **Perennials in Rotation**	**Including perennials in crop rotations.** • Increased **carbon input** from season-long photosynthesis. • Increased or maintained soil organic matter due to **reduced tillage**, **aggregate formation** and **deep rooting**. • Improved **soil structure** leading to more **water infiltration** and **storage**. • Reduced soil erosion risk. • **Increased biodiversity**, wildlife habitat and sustenance for pollinators. • Reduced salinity impacts due to **transpiration of excess soil moisture**.	**A. King, J. Blesh.** Crop rotations for increased soil carbon: perenniality as a guiding principle. Ecological Applications 28 (2017). "…diverse crop rotations have the potential to provide a broad suite of ecosystem services…including increasing SOC." **Russelle et al.** Reconsidering integrated crop-livestock systems in North America. Agronomy Journal 99 (2007) 325-334. "Multiple agronomic and environmental benefits can be realized when land is converted from annual cropping to rotations that include perennial forages."
 **Perennial Cover on Sensitive Land**	**Establishing perennial crop on ecologically vulnerable land.** • Increased **carbon input** to the soil. • **Reduced soil erosion** risk. • Reduced salinity impacts due to transpiration of excess soil moisture. • Reduced risk of runoff and nutrient loss. • Increased biodiversity, **wildlife habitat** and sustenance for pollinators.	**AGRI-FACTS.** Vegetative control of saline seep recharge. Agdex 518-18 (2007). "Ensuring that available precipitation is used for productive crop growth rather than contributing to runoff or ground water buildup is one of the most practical and cost effective control strategies for contact or slope-change salinity." **A.W. Bailey et al.** Management of Canadian Prairie Rangeland. AAFC (2010). "The maintenance or reclamation of natural prairie grasslands contributes to the replenishment of oxygen, nitrogen, nitrogen fixation, carbon sequestration, reduces greenhouse gases, minimizes soil erosion, filters sediment and chemicals from water, and detoxifies certain contaminants."
 **Improved Pasture Management**	**Increasing productivity through changes to livestock grazing, or by other means address limitations such as fertility and invasive species.** • Increased carbon input to the soil due to **increased growth** of pasture plants. • Reduced runoff due to **increased transpiration, infiltration and water holding capacity**. • Increased soil microbial activity and **nutrient cycling**.	**Teague et al.** Grazing management impacts on vegetation, soil biota and soil chemical, physical and hydrological properties in tall grass prairie. Agriculture, Ecosyst. and Environment 141 (2011) 310-322. "Soil organic matter and CEC were higher with [multi-paddock grazing] and [ungrazed areas] than both [light continuous] and [heavy continuous] grazing. **Reeder et al.** Impact of grazing management strategies on carbon sequestration in a semi-arid Rangland, USA. Proceedings of the XIX International Grassland Congress (2001) 211-213. "Grazing at an appropriate stocking rate had beneficial effects on plant composition, forage production, and soil C seq."

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