AGRICULTURAL PRACTICE EFFECTIVENESS FOR **REDUCING NUTRIENTS** IN THE RED RIVER BASIN OF THE NORTH

BENEFICIAL MANAGEMENT PRACTICES

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JANUARY 2021

Recent research suggests the effectiveness of many agricultural beneficial management practices (BMPs) differs in cold climates such as the Red River Basin of the North (RRB) from warmer areas where much of the body of knowledge has been developed. In order to reduce nutrient runoff and improve the water quality in the Red River and ultimately, Lake Winnipeg, agricultural BMP adoption is critical, however, reaching scientific consensus on effectiveness and suitability is an important first step prior to Basin-wide engagement with the agricultural community about BMPs and their adoption.

In an effort to address this need, a diverse group of university researchers and extension staff, state/provincial and federal government researchers and water resource managers, and industry professionals came together for a workshop in the spring of 2019 to examine the available research on the effectiveness of nutrient reduction BMPs in cold climates.

At the workshop, attendees discussed BMPs for both nitrogen and phosphorus load reduction and determined whether practices were highly effective in reducing N and/or P, not effective (in that the implementation of the standalone BMP has not been shown to reduce P and/or N) or where more research is needed to determine effectiveness. BMPs were organized based on the following categories:

- Nutrient Management Practices
- Erosion Control Practices
- Vegetative Management Practices
- Structural Management Practices

The practices displayed in the table on the following pages are those BMPs workshop participants broadly agreed were highly effective in reducing N and/or P loading. Those BMPs where there was not broad agreement among workshop attendees or those that are not currently known to be highly effective in reducing N and/or P are omitted in the table below but can be found in the full workshop report. (e.g. Conservation tillage for P, etc.)

Throughout the workshop presentations and discussion, participants noted the numerous and considerable challenges in determining nutrient load reduction BMP effectiveness and suitability in the RRB. Due to the multitude of small sources contributing to nutrient loads, numerous and varied measures must be undertaken across the Basin to mitigate the problem. Additionally, factors such as lack of research and understanding in cold climate environments, geographic variability across the Basin, scale applicability, and trade-offs between N loading and P loading further complicate BMP implementation. Some of the major limitations discussed at the workshop are also noted in the summary table.

Despite the challenges, progress can be achieved through implementation of those practices listed below which are known to be highly effective. That said, employing adaptive management will be important to respond to future conditions, including changing climate and weather, state, provincial and federal policies, economics, and the evolution of the agricultural management system.

More information on the workshop, workshop presentations and discussion, and the agricultural BMPs broadly agreed to be effective in cold climates can be found in the full workshop report, which can be located at **www.redriverbasincommission.org/rrbc-projects.**

BENEFICIAL MANAGEMENT PRACTICE (BMP)	LIMITATIONS AND RESEARCH GAPS
NUTRIENT MANAGEMENT PRACTICES	
FOR NITROGEN	
Nutrient Management	N rate cannot be reduced below agronomic crop requirements without reducing crop yield. Science-based thresholds for residual soil N should be established.
Soil/Manure Testing to Determine Application Rates	
Incorporation/Injection/Banding	Limited applicability in no-till systems.
FOR PHOSPHORUS	
Nutrient Management	Specifics on implementation (e.g., sufficiency application, maintain low levels of soil P and apply to crop requirements) and relationship to reduced losses at edge of field.
Soil/Manure Testing to Determine Application Rates	Soil testing 0-1.97 in (0-5 cm vs. standard 0-5.9 in (0-15 cm) warrants additional research due to near-surface P stratification.
Incorporation/Injection/Banding	
FOR NITROGEN AND PHOSPHORUS	
Spring Nutrient Application (instead of fall)	Addressing limitations in cropping systems and some areas or years which have a small spring operation windows.
Manure Application on Non-frozen Ground	Jurisdictional regulations may be required to change practice in US; may require costly storage upgrades.
EROSION CONTROL PRACTICES	
FOR NITROGEN	
Conservation Tillage	Presents challenges in fine and very fine textured soils.
Riparian Grazing Management (manage grazing timing and stocking rates in riparian areas)	Effective in eroded or unstable sites.
Feedlot Siting/Relocation	Impact on N losses uncertain.
FOR PHOSPHORUS	
Riparian Grazing Management (manage grazing timing and stocking rates in riparian areas)	Ungrazed vegetation can be a source of soluble P in snowmelt runoff.
Streambank and Shoreline Protection	May be effective in eroded or unstable sites.
Feedlot Siting/Relocation	

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BENEFICIAL MANAGEMENT PRACTICE (BMP)	LIMITATIONS AND RESEARCH GAPS
VEGETATIVE MANAGEMENT PRACTICES	
FOR NITROGEN	
Cover Crop	Establishment of cover crop is a challenge if planted after harvest in October or November. Seeding cover crops into an established crop needs more research.
FOR PHOSPHORUS	
Vegetation Removal (buffer areas, ditches, cover crop)	More research is required to determine appropriate approaches; equipment limitations for harvesting in challenging landscape areas.
STRUCTURAL MANAGEMENT PRACTICES	
FOR NITROGEN	
Culvert Resizing	Impacts on taking land out of production during wet periods; siting is critical. Tools to identify optimal locations should be evaluated in RRB.
Wetland Restoration (depression/ponded)	Siting tools and cost-benefit needs more investigation in RRB.
Wetland Restoration (riparian/floodplain)	Siting tools and cost-benefit needs more investigation in RRB.
Water and Sediment Control Basin	Lack of permanent storage may limit efficacy.
FOR PHOSPHORUS	
Culvert Resizing	Impacts on taking land out of production during wet periods, siting is critical. Tools to identify optimal locations should be evaluated in RRB.
Wetland Restoration (depression/ponded)	Siting tools and cost-benefit needs more investigation in RRB; may require complex design.
Wetland Restoration (riparian/floodplain	Siting tools and cost-benefit needs more investigation in RRB; buildup of P-rich sediment may be a concern; may require complex design.
Water and Sediment Control Basin	May be effective if particulate P is the dominant form. Lack of permanent storage may limit efficacy.
FOR NITROGEN AND PHOSPHORUS	
Drainage Water Recycling	Site limitations (favourable soil-landscape conditions); other water quality concerns (e.g., salts); requires means of irrigation or sub-irrigation.
Small Dams/Ponds/Reservoirs	Siting tools and cost-benefit needs more investigation in RRB; sedimentation can limit effectiveness and lifespan.
Wastewater and Feedlot Runoff Control	

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