Prairie Agricultural Machinery Institute

DETERMINING OPTIONS TO LOWER MECHANICAL OVERLAP IN SINUOUS RIPARIAN AREAS

Multiple Interior Obstacles

By: Nathan Gregg and Patricia Lung, Project Leaders
Philip Leduc, Senior Manager

Introduction

Riparian areas and wetlands provide many benefits that work towards a balanced and healthy landscape, including water quality, biodiversity, reduced erosion, and wildlife habitat. Efficient agricultural crop production means effective use of time and resources to minimize overapplication of seed, pesticides, and fertilizers while also reducing fuel use. Environmental stewardship retains and properly manages riparian areas and wetlands in order to maintain their natural function.

Irregular shapes of a farmable area increase overlap (the amount of turning required during field operations) and can result in overapplication of seed, pesticides and fertilizers, increased fuel consumption (and thus emissions), and increased work time.

To aid professional staff and producers in selecting ways to minimize overlap without removing or reconfiguring critical natural elements, fact sheets were created. In this fact sheet, a production area with multiple interior obstacles is discussed and, to aid in overlap illustrations, a specific example is used.

Glossary of Terms

PERIMETER OVERLAP – Mechanical overlap experienced on the headlands of cropland.

OBSTACLE OVERLAP – Mechanical overlap experienced as an implement traverses around an obstacle in its pass of travel.

THEORETICAL OVERLAP – The best case scenario for mechanical overlap on a parcel of land by assuming "**no**" overlap is seen per pass traveled on the land, and all overlap is associated with perimeter (headland) overlap.

Site Description

The agricultural cropland was three quarter sections with multiple interior obstacles. The quarter represented in the upper left-hand corner of **Figure 1** is the quarter in discussion for this fact sheet.

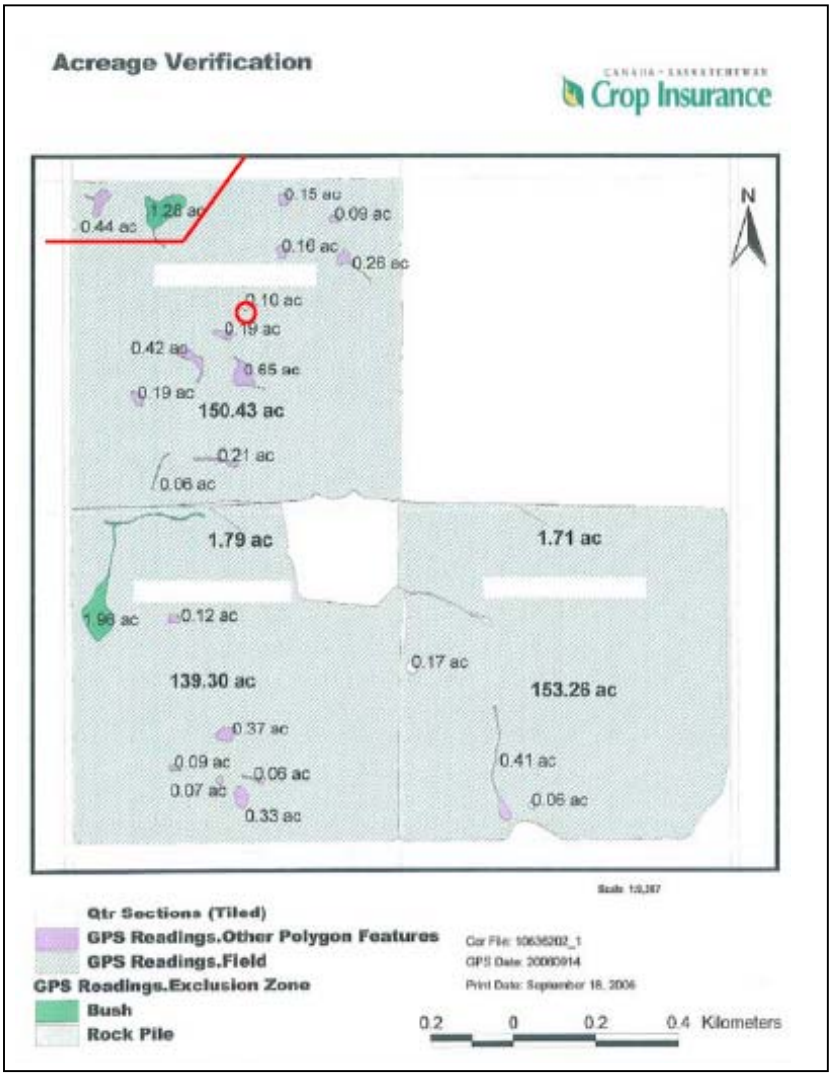

Figure 1. Multiple Interior Obstacles.

Factors to note when calculating overlap and respective information regarding this study:

Farmable acres — 150.43

Equipment — 33-foot air seeder

Operation — auto steer capability

Recorded acres traveled — 164

Overlap acres — 13.57 (9.02%)

Overlap-Reduction Options

1. Auto Steer

Due to the employment of auto steer technology on this quarter, the overlap reduction potential without the loss of seeded acres is limited. The theoretical overlap calculated on a quarter section of land with 13 interior obstacles averaging 0.33 acres each was 4.66%.

Achieving the theoretical overlap utilizing the existing application equipment would result in a reduction of 4.36% or 7.01 acres. Using an average production cost of $95/acre, an overlap reduction of 7.01 acres would result in a direct savings of $666 without loss of any seeded acres. Continued use and tuning of the current auto steer technology employed by this producer may allow the achievement of theoretical overlap numbers.

2. Equipment Size

The utilization of smaller equipment to reduce mechanical overlap, and as such reduce the overlap of seed, fertilizer, and chemical applications, introduces a time-management factor into the operation. The use of smaller equipment correlates to more time spent in the field; therefore, a balance is required between time, equipment cost, and potential variable cost savings associated with cropping the land.

The theoretical overlap anticipated with the use of auto steer technology on a quarter section of land with 13 interior obstacles utilizing various implements in width is shown in **Table 1**.

Table 1. Implement Width vs Theoretical Overlap of 13 Obstacles.

Implement Width (ft)	Theoretical Overlap (%)
33	4.66
22	3.02

The information in the table indicates that reducing the implement width by one third reduces the theoretical overlap over one third. Using a 22 foot wide implement would theoretically decrease overlap by 6.00% or 9.03 acres. An overlap reduction of 9.03 acres yields a direct savings of $858 without a loss of seeded acres using an average variable production cost of $95/acre.

3. Isolation of Obstacles

A third option to assist in overlap reduction would be to isolate the two obstacles (outlined in red) in the northwest corner of this quarter section and move the rock pile (circled in red) to this location as well. The isolation reduces the farmable area from 150.43 acres to 147.83 acres; however, it also reduces the number of obstacles in the field to ten. The theoretical overlap anticipated with the use of auto steer technology on a quarter section of land with ten interior obstacles utilizing an implement less than 33 feet in width is shown in **Table 2**.

Table 2. Implement Width vs Theoretical Overlap of Ten Obstacles.

Implement Width (ft)	Theoretical Overlap (%)
33	3.02
22	2.62

With the obstacle reduction, the theoretical overlap would be reduced to 4.02% on a quarter section with ten obstacles averaging 0.24 acres while using an implement 33 feet wide. The overlap percentage was calculated using the new farmable area of 147.83 acres. Therefore, the amount of acres overlapped equates to 5.94 as compared to the original 13.57, and the resulting overlap reduction would be 7.62 acres. As well, the loss of 2.6 acres of productive land must be taken into account. At an average production cost of $95/acre, an overlap reduction of 7.36 acres would result in a direct savings of $699, and the removal of 2.6 acres of productive land provides a further offset of $247 to go against the prospective income loss from the crop yield on the 2.6 acres.

Utilizing 22 foot wide equipment in this third scenario results in a theoretical overlap of 2.62% on a quarter section with ten obstacles averaging 0.24 acres. This equates to 3.87 acres as compared to the original 13.57 acres resulting in an overlap reduction of approximately 9.70 acres. However, the loss of 2.6 acres of productive land must again be considered. At an average production cost of $95/acre, an overlap reduction of 9.70 acres would result in a direct savings of $665, and the removal of 2.6 acres of productive

land provides a further offset of $247 to go against the prospective income loss from the crop yield on the 2.6 acres.

It was shared by the producer that this particular quarter section of land usually does not have the water obstacles at the time of seeding. However, because 2006 was an unusually wet year, the obstacles were still in the field.

Conclusion

Each producer will need to tailor these options to reduce overlap in his/her particular situation. However in this example, given the fact that under normal circumstances the water obstacles dissipate prior to seeding, the most cost-effective method to achieve the theoretical overlap on a quarter section with 13 interior obstacles would be to optimize the GPS tracking technology with the auto steer currently being used on the existing equipment for the following reasons:

- It allows for integration seamlessly into the existing business unit.
- It requires no investment into new cropping equipment by implementing a smaller equipment strategy.
- It is a technology investment that can be used on equipment at each stage of the cropping process so there is an option to compound its impact.
- It has the ability to assist in time management during each stage of the cropping process because field time can be extended if field conditions are favourable.
- It is a relatively low-cost investment as compared to alternatives.

To further reduce overlap in a sustainable and practical manner, the producer managing the agricultural cropland also has the option of isolating the northwest corner of the cropland that holds two of the larger obstacles and moving the rock pile into this northwest corner to reduce the number of obstacles in the productive area. The 3.5 acres isolated may provide a return on the land through alternative uses such as:

- Forage production.
- Tree production.
- Native fruit production.

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Saskatchewan Watershed Authority

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For more information contact:

Prairie Agricultural Machinery Institute, Box 1150, Humboldt SK S0K 2A0 Phone (306) 682-5033 Fax (306) 682-5080 www.pami.ca