Bluefield Seeding Solutions Inc.

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Cost/Benefit Analysis of Press Wheel & Seed Sensing Technology

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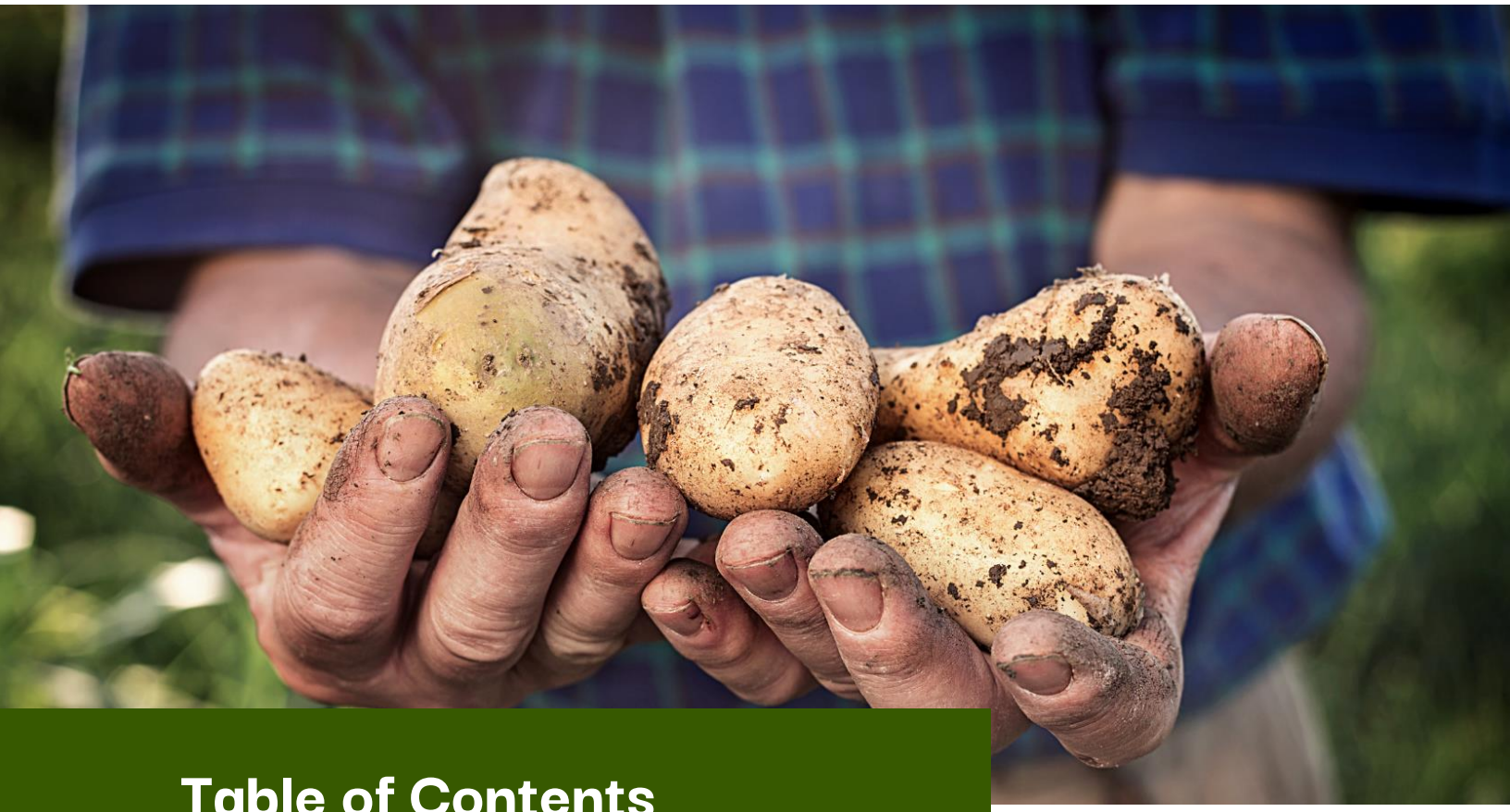

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EXECUTIVE SUMMARY

Today's potato producers see innovation and efficiency as important strategies to combat rising input costs, high interest rates, unpredictable weather patterns and other factors detrimental to their success.

Press Wheel (PW) technology was developed in 2018 by Craig McCloskey of Bluefield Seeding Solutions Incorporated (BSSI). The technology has allowed potato farmers to achieve more accurate seed placement and, in many cases, permitted faster ground speeds with planting equipment.

Press Wheel technology has proven to be an important innovation for potato growers in North America. To offer more value for growers, BSSI has recently enhanced its PW with Seed Sensing Technology (SST) which provides operators with real-time information on planter performance. Operators can then make immediate adjustments and mitigate on-going inefficiencies. In fact, SpudSmart Magazine included SST as a Top Ten Innovative Product of the Potato Industry in 2023.

Proven Benefits of PW and SST:

- Fewer gaps in the row
- Time savings in many cases
- Improved seed planting accuracy
- Higher quality potato crops
- Better usage of inputs

PW and SST Benefits under Investigation:

- Higher yields
- Environmental advantages
- ***Economic benefits, as examined in this report***

Whereas the PW provides consistent seed placement and spacing, on its own it does not give the operator any information on planting accuracy. The SST advantage alerts the

operator to seeding issues in real time, allowing instant modifications to improve accuracy, ultimately reducing gaps resulting from seed potatoes not being optimally placed. The operator can then assess if those modifications were successful and can track planter performance over time with records provided by SST.

The purpose of this report is to quantify and compile the input costs related to missing plants or gaps that exist in the absence of SST, and to demonstrate economic benefits of SST in the context of a 1,000-acre processing potato grower.

Results

Two years of trials conducted by Contour Consulting showed that when compared to SST, conventional planting equipment resulted in 47.5 acres of bare, unproductive land over a 1,000-acre potato farm. Each acre costs farmers approximately $3,400 for the variable inputs involved in growing potatoes; meaning, farmers spent an estimated $160,000 on bare ground. Using SST reduces these gaps culminating in a **total net economic benefit of over $107,000.**[1]

Further considerations are the positive environmental impacts of SST that could result from more complete vegetative cover. While these are out of scope for this report, they may include reduced off-target fertilizer and crop protectant applications, increased carbon sequestration, better utilization of energy, etc. Given that these additional potential benefits could improve a farm's carbon footprint, they warrant future study.

[1] Taking into account the equipment cost for a 6-row potato planter.

Photo Credit: Getty Images

BACKGROUND

When potato planter accuracy is suboptimal, the result can be gaps in the potato row where seed pieces have not been dropped or have bounced aside. Negative economic consequences accompany this bare ground because input costs remain the same. For example, fertilizer and crop protectants have already been applied or will be applied over this bare ground. Labour and machinery costs are also constant across these gaps. These gaps accumulate into significant total acres of bare ground when considered over commercial-scale acreage.

To quantify the improved performance of adopting SST on potato planting equipment, BSSI contracted Contour Consulting to capture drone imagery and calculate canopy cover. This two-year study involved comparing SST to conventional planters over ten fields (fifty-seven acres) and showed the following benefits:

- 2.9% fewer planter misses
- An average of 421.7 fewer gaps per acre[2]

When the results of that applied research were extrapolated to a 1,000-acre potato farm, the amount of ground currently left bare totals roughly 47.5 acres. That is a substantial quantity of land and could equate to upward of 1.5 million pounds (or 15,000 cwt)[3] of potato production going unfulfilled each year. On a potato farm achieving higher than average potato yields, the production loss is proportionately greater than this estimate.

[2] *Bluefield Seeding Solutions Seed Sensing Technology Evaluation*. Contour Consulting.
[3] Using the 2023 PEI average potato yield of 311 cwt/acre

METHODOLOGY & ANALYSIS

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Large Scale Trials, 2022 & 2023

Using the values arrived at above, it is assumed that by using SST, the accumulated gaps making up the 47.5 acres of bare land would produce at least one potato plant per gap, would utilize the inputs applied, and wouldnot be bare ground. Therefore, the objective was to arrive at a per acre cost of inputsapplied, so that the economic benefits of SST over conventional planting equipment can becalculated. Users of conventional potato planting equipment can then relate to theexpenditures laid out without any financial return.

With permission of the PEI Potato Board, data from the *2023 Processing Potato Cost of Production*[4] was analyzed. A list of variable input costs spent on an acre of potatoes (whether a plant was produced or not) was compiled. Using a conservative approach, a rationale was developed for the inclusion/exclusion of the list of accepted input costs. This list was shared with BSSI who then approved it for use in calculations. **The objective was to arrive at a value representing the total direct input costs of planting one acre of potatoes.** This cost would be incurred whether 100% canopy cover was achieved, or if there were roughly 400 gaps/bare ground on that one acre.

Employing a cautious approach, the criteria for including specific variable input costs were that these expenditures had to be:

- directly related to the number of acres planted (i.e. seed[5], fuel, fertilizer, and agronomy services); or
- used as a proxy for undetermined costs (i.e. custom work as a proxy for machinery operation).

Several variable input costs were excluded from the calculations because:

- They are unrelated to the potato crop year (i.e. cover crops, land improvements);

[4] Prepared by BDO Canada LLP and published in March 2024.
[5] See Appendix C for Author's Note about the inclusion of seed potatoes as a variable cost.

- They are proportionate to the quantity of production (i.e. trucking and levies); or
- Bare ground versus full canopy cover would have negligible impact on the cost (i.e. small tools, advertising and promotion)

The agreed upon variable direct input cost relevant to planting potatoes was **$3,357 per acre**. This number was applied to the number of acres of bare ground determined by Contour Consulting.

Over 2022 and 2023, an average of approximately 422 fewer gaps per acre vs. conventional planting equipment was observed. Using the average size of gaps and row width allowed a conversion from number of gaps to square feet, then to acres. The resulting bare ground from 422 gaps is 47.5 acres.

Therefore, the cost of 47.5 acres of potatoes—whether a crop is produced or not—is **$159,457.50** [47.5 X $3,357].

Now considering the one-time equipment cost of installing the complete SST package on a six-row planter,[6] **$52,351**, we arrive at a **net economic benefit of $107,106.50** for a 1,000-acre potato producer to adopt SST in the very first year of implementation. Put another way, **SST will pay for itself more than three times over in year one**. It follows that yields will increase where gaps are replaced by potato plants, and economic benefits will amplify as equipment costs are further offset by revenue increases.

Focused Trial, 2024

This season, preliminary results were shared by Contour Consulting from one farm conducting a focused trial. Variability resulting from equipment, operator practices, weather, variety and land factors were reduced significantly in this trial but not entirely eliminated. The trial is being conducted on one field planted with two varieties.

The gap analysis showed that results can fluctuate by potato variety. Although varieties were not identified, only one of the two showed a difference in gaps, where the SST had approximately 170 fewer gaps per acre versus conventional planting equipment. This is roughly 40% fewer gaps; or 19 acres total on 1000 acres, 2024 vs 2022 and 2023.

While the advantage of SST in 2022 and 2023 was 47.5 acres compared to 19 acres for this season's preliminary findings, it is important to note that the potato planter traveled **34% faster** than the conventional planter.

[6] Most common potato planter size in Prince Edward Island

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SUMMARY AND FURTHER CONSIDERATIONS

Diligent potato producers are confronted with the realities of economic risk and production challenges, and they utilize operational efficiencies and technological innovations to progress their farm businesses.

To a 1000-acre potato producer, SST can provide a net economic benefit of $107,106.50 in the first year of implementation. In addition to this economic benefit, producers can plant potato crops in less time allowing them to move on to other field operations, and providing greater flexibility when poor weather conditions reduce optimal planting days.

The economic benefit of employing SST can be further enhanced when increased yields offset production costs. This is a suggested area of study, as it is a principle of agricultural production that a more consistently planted crop, which SST offers, produces greater yields.

Finally, the environmental benefits of SST are an additional area of interest to producers. Mitigating off-target pesticide and fertilizer applications, reducing soil run-off, increased carbon sequestration and reduced carbon footprint are just a sample of suggested areas for further study.

APPENDIX A: Cost/Benefit Analysis

Derived from 2023 PEI Processing Potato Cost of Production		
Variable Costs	**$/acre**	**Notes**
Seed potatoes	Confidential Data	Direct correlation to acres planted
Fertilizer		Direct correlation to acres planted
Lime		Direct correlation to acres planted
Freight-in		Assume this is cost of shipping seed, fertilizer, etc.
Crop scouting		Direct correlation to acres planted
Hired agronomy		Direct correlation to acres planted
Soil tests		Direct correlation to acres planted
Crop protectants		Direct correlation to acres planted
Labour		Direct correlation to acres planted
Fuel and lubricants		Direct correlation to acres planted
Repairs and maintenance		Direct correlation to acres planted
Custom work		Used as proxy for cost of tillage/planting/harvest
TOTAL VARIABLE COSTS	**$ 3,357**	CAD

	4-row	***6-row***	***8-row***
Potential acreage reduction	47.5	47.5	47.5
Potential savings in input costs	$ 159,457.50	$ 159,457.50	$ 159,457.50
LESS: One-time PW/SST cost (6-row)	-$ 43,175.00	-$ 52,351.00	-$65,600.00
First Year Economic Benefit	**$ 116,282.50**	**$ 107,106.50**	**$ 93,857.50**

Notes:

- Complete SST package cost is for a 6-row planter
- One time cost, but savings repeat annually
- Ability to increase planter ground speed reduces planting time
- Available for 4, 6 or 8 row planters,
- Cost per row goes down with larger planters
- Note that input costs may vary by planter size (fuel, labour)
- 34% increase in planter ground speed with SST

APPENDIX B: Excluded Costs & Rationale

Derived from 2023 PEI Processing Potato Cost of Production	
Variable Costs	**Notes**
Cover crops	Removing any costs not directly related to potato crop year
Rotation costs	Removing any costs not directly related to potato crop year
Less rotation crop revenue	Removing any costs not directly related to potato crop year
Small tools	Negligible impact from reducing acreage
Land improvements	Removing any costs not directly related to potato crop year
Custom trucking	Removing any costs that are calculated based on yield
Advertising and promotion	Negligible impact from reducing acreage
Dues, fees & levies	Removing any costs that are calculated based on yield
Operating interest	Negligible impact from reducing acreage

APPENDIX C: Inclusion of Seed Potatoes in Variable Costs

The inclusion of seed potatoes as a variable cost impacted by SST might be disputed. For the purposes of this analysis, we assume that the variable input cost of seed potatoes has been derived from conventional potato planting equipment.

Whereas SST can impact planter accuracy and generate more plants as opposed to gaps, we will use this as a constant input cost. It cannot be assumed that a gap in the row equates to a seed potato piece not dropping to the ground.

There are multiple explanations why a seed is not placed appropriately. For example, the seed piece may have bounced aside, making it a sunk but unnecessary cost that can be mitigated with SST.

Furthermore, In the case where the cut seed piece becomes attached to another seed piece in the planter cup, or in the case of an empty cup, Seed Sensing Technology can detect these issues and allow adjustments limiting these defects thereby greatly reducing those impact.

For that reason, while a gap in the row is considered to be preventable with the use of SST, the cost of potato seed per acre is considered constant in this assessment. What varies between the two regimes is % canopy cover.