Quantification of Fruit Losses at Different Harvesting Time on Picking Efficiency of Wild Blueberry Harvesting

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INTRODUCTION

- Wild blueberry (Vaccinium angustifolium Ait.) is an important horticultural crop native to Northeastern North America.
- In last two decades, significant increase in fruit yield approximately 9 to 101.40 million kg in Canada and 8 to 47.37 million kg in Maine, USA is observed.
- Generally, wild blueberry producers harvest their crop from early to mid-August by ignoring proper ripening and timing of harvest and ends in first week of September.
- Wild blueberry industry is facing increased harvesting losses (15-25%) due to changes in crop characteristics and improper time of harvesting with existing commercial wild blueberry harvester.
- Therefore, this study is designed to quantify fruit losses with adequate knowledge of fruit ripening and timing of harvest on picking efficiency of harvester during wild blueberry harvesting.

Figure 1. Wild Blueberry Harvester

MATERIAL AND METHODS

- Eight wild blueberry fields were selected in Atlantic Provinces of Canada to evaluate the impact of harvesting time in combination with machine operating parameters on berry losses during mechanical harvesting.
- The pre-harvest and after harvest fruit losses were collected from randomly selected plot (0.91 x 3 m) within each field during harvesting.
- Split plot factorial experiment will be designed with three levels of ground speed (1.2, 1.6 and 2.0 km h^{-1}) and header revolutions (26, 28 and 30 rpm), and three levels of harvesting time (early, middle and late), and year will be considered as a blocking factor.
- The data collected by precision agriculture research team during last three years will also be utilized to examine the impact of harvesting time on fruit losses during harvesting.
- The treatment combinations were assigned randomly within whole and sub plots and fruit yield was used as covariate.

Figure 2. Collection of harvesting losses

RESULTS AND DISCUSSION

- Results of multiple means comparison revealed that losses were significantly higher in late season compared to early and middle season harvesting.

Table 1. Results o multiple means comparison of three-way interaction effect on fruit losses.

Treatments	Time of harvesting(season)	Speed (km h^{-1})	RPM	Loss (%)
1	Late	2.0	30	22.61 a
2	Late	2.0	28	21.66 ab
3	Middle	2.0	30	20.83 bc
4	Late	1.6	30	19.51 cd
5	Late	2.0	26	19.07 d
6	Middle	2.0	28	18.88 d
7	Middle	1.6	30	18.36 de
8	Late	1.6	28	17.06 ef
9	Early	2.0	30	16.84 f
10	Middle	2.0	26	16.77 fg
11	Early	2.0	28	15.31 gh
12	Late	1.2	30	15.10 h
13	Early	2.0	26	14.94 hi
14	Middle	1.6	28	14.92 hij
15	Middle	1.6	26	14.45 hijk
16	Early	1.6	30	14.43 hijk
17	Late	1.6	26	13.88 hijkl
18	Early	1.6	28	13.44 ijkl
19	Middle	1.2	30	13.42 jkl
20	Early	1.6	26	13.05 kl
21	Late	1.2	28	13.01 kl
22	Early	1.2	30	12.98 kl
23	Late	1.2	26	12.96 kl
24	Middle	1.2	28	12.72 l
25	Early	1.2	28	12.54 l
26	Middle	1.2	26	10.38 m
27	Early	1.2	26	9.14 m

Means with no letter shared are significantly different at p = 0.05

- The treatments 1, 2 and 3 were given the highest losses, while treatment combination 26 and 27 were found to induce least losses.
- The results also suggested that higher ground speed and faster rpm generated more fruit losses, whatever the time of harvesting but these losses were more prominent in late season compared to early and middle season harvesting.

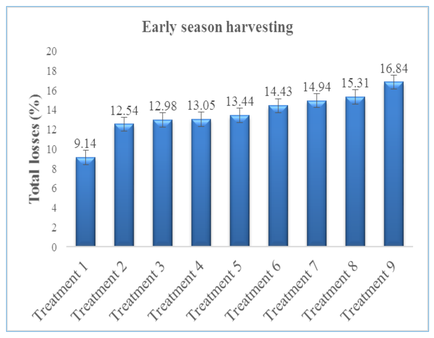

Figure 3. MMC of total fruit losses at different treatments in early season harvesting.

- It is evident (Fig.3), total losses were dependent upon time of harvesting, ground speed and header rpm of the harvester. The treatment 1 (1.2 km h^{-1} and 26 rpm) was found to be best combination during early season harvesting with less than 10% berry losses compared to grower's treatment 5 (1.6 km h^{-1} and 28 rpm).
- The treatment 9 (2.0 km h^{-1} and 30 rpm) was caused the highest fruit losses (> 16 %) due to high ground speed and higher rpm.
- The treatment 7 and 8 were non-significant, while the treatment 7 and 9 were significantly different.

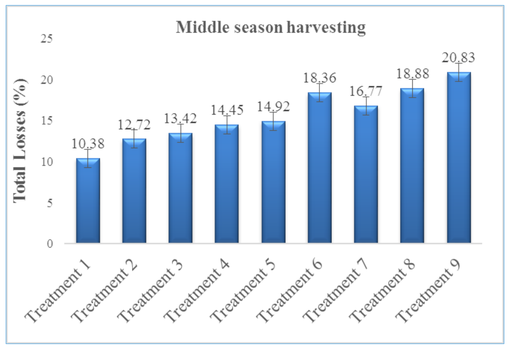

Figure 4. MC of fruit losses at different treatments in middle season harvesting

- The treatment 1.2 km h^{-1} and 26 rpm was found to be best combination having < 11% fruit losses during middle season harvesting (Fig. 4).
- Fruit losses were observed more than 1% in middle season as compare to early season harvesting at treatment 1.
- More than 4% fruit losses were observed, when compared treatment 1 with treatment 5 (grower's combination).
- The combination 2.0 km h^{-1} and 30 rpm was found to be the worst having fruit losses greater than 20%, suggesting the need to reduce the ground speed and header rpm for better berry recovery and picking efficiency in middle season harvesting.

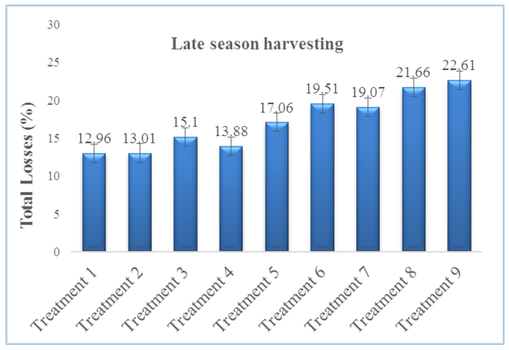

Figure 5. MC of fruit losses at different treatments in late season harvesting.

- There was a mixed trend of fruit losses (%) with machine operating parameters in late season harvesting.
- The treatment 1 was resulted more than 2 and 3% fruit losses in late season, when compared with middle and early season harvesting respectively.
- The grower's treatment combination (1.6 km h^{-1} and 28 rpm) was induced 4% and 2% more fruit losses in late harvesting as compare to same treatment in early and middle season harvesting respectively.
- The treatment 1 was non-significant to treatment 4 but significant to treatment 3, suggesting that not only higher speed caused more fruit losses, the faster rpm also resulted with more fruit losses.
- There were 2% and 6% more fruit losses with treatment 9 in late season, when compared with same treatment in middle and early season respectively.

CONCLUSION

- Based on the results of this study, it can be deduced that fruit losses during harvesting are not only a function of machine operating parameters (ground speed and header rpm) but also due to time of harvesting (season) in wild blueberry fields.
- Fruit losses were found to be higher in late season compared to early and middle season emphasizing that early and middle season harvesting could be fruitful in reducing fruit losses.
- Higher ground speed in concomitance with higher header rpm resulted in substantial increased fruit losses in each harvesting season.
- A treatment combination of 1.2 km h-1 and 26 rpm can serve better in minimizing berry losses.
- Selecting an appropriate combination of ground speed and header rpm in relation with harvesting time can minimize berry losses and improve farm profitability.

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