CLIMATE CHANGE
ADAPTATION PROGRAM

Managing Extreme Heat with Reflective Tarps in the Blueberry Industry

Project Report

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Climate & Agriculture Initiative BC

Fraser Valley, British Columbia, 2021

Managing Extreme Heat with Reflective Tarps in the Blueberry Industry

Project Report

Fraser Valley — Managing Extreme Heat with Reflective Tarps in the Blueberry Industry: Project Report

Prepared by ***Integrated Crop Management Services Inc.***
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a program delivered by the ***Climate & Agriculture Initiative BC***.

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Disclaimer

Acknowledgments

This report was prepared for the BC Blueberry Council by ***Grant McMillan*** (Project Lead) of Integrated Crop Management Services Inc., in partnership with the Climate & Agriculture Initiative BC.

The Project Oversight Committee included:

- ***Anju Gill*** and ***Jason Smith,*** BC Blueberry Council
- ***Allen James***, BC Poultry Association
- ***Jesse MacDonald*** and ***Peter Toivonen***, Agriculture and Agri-Food Canada
- ***Angela Boss*** and ***Carolyn Teasdale***, BC Ministry of Agriculture, Food and Fisheries
- ***Emily MacNair*** and ***Foster Richardson***, Climate & Agriculture Initiative BC

The Fraser Valley Agricultural Adaptation Working Group included representatives from:

- BC Blueberry Council
- BC Dairy Association
- BC Ministry of Agriculture
- BC Poultry Association
- City of Abbotsford
- City of Chilliwack
- Climate & Agriculture Initiative BC
- District of Kent
- Fraser Valley Regional District

In addition, Integrated Crop Management Services would like to thank all of the other agricultural producers, packer-processors and industry professionals who participated and contributed to this project.

The cover photo shows blueberries at the Richmond Country Farm Produce Market. The unedited image is by ***WriterGal39***, via Flickr.

Funding for this project has been provided in part by the BC Blueberry Council and in part by the governments of Canada and British Columbia under the Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Funding is administered by the Investment Agriculture Foundation of BC and the BC Agricultural Research & Development Corporation.

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BC blueberries Powered by nature.

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Final Project Report
Prepared by Integrated Crop Management Services Inc.

Definitions

Hand lug: A 20-30 lbs capacity hand-carried tray which is rectangle in design and deep, used for transporting harvested fruit destined for fresh market.

Berry flat: A 20-30 lbs capacity hand-carried tray which is square in design and shallow, used for transporting harvested fruit destined for fresh market.

Tote: A 400 lbs capacity container which is used for transporting harvested fruit destined for processing.

Reflective Tarps used in the Project

During the season, five purchase orders were made from Bushpro for the project. These included tarps of various sizes, as well as customized hand lug and tote slip-on covers which were developed specifically for this project. The total spent for the project was $4,625.32 of the $4,500.00 budgeted for covers. The breakdown of the orders was as follows.

Description	# Purchased
Cherry Bin Cover	10
6’ x 9’ Tarp	1
9’ x 12’ Tarp	1
12’ x 13.5’ Tarp	14
15’ x 18’ Tarp	2
18’ x 24’ Tarp	1
Hand Lugs Slip-on Cover	15
Tote Pallet Slip-on Cover	20
Hand Lugs Small Cover	10

Who were the partners involved in the Project?

Packer/Processor Participation.

At the start of the project, two processors were identified, Fraser Valley Packers & Westberry Farms. As the season progressed, two more were brought on board, Berry Haven Farm & Silver Valley. These four packers/processors ranged from small to large in scale of size and gave a good representation of the industry. A brief profile of each packer/processor and their previous experience with reflective tarps follows.

Name of Packer/Processor	Scale of Operation	Previous Experience with Reflective Tarps	Comments
Fraser Valley Packers	Large	No	• Operating 6 production lines

Name of Packer/Processor	Scale of Operation	Previous Experience with Reflective Tarps	Comments
			• Processes fresh and frozen products for major brands within the marketplace • Processes over 20 million pounds of fruit per year • States that they are the largest processor in the region
Westberry Farms	Medium to Large	Yes: 10-15 years experience	• Family owned operation • Processes under their own brand as well as major brands within the marketplace
Berry Haven Farm	Small	No	• Active in blueberry, blackberry, raspberry, and strawberry crops • Works with small scale growers • Markets fruit under their own brand • Focus is on quality and not quantity • Had heard of the tarps in the past but had never followed through with purchasing any
Silver Valley Farms	Large	No	• Manages ~2300 acres of blueberries in the Fraser Valley region • Provides extensive support to its grower partners • Focus is on quality • Has retired Provincial Berry Specialist hired on as a Consultant

Grower Participation

Each packer/processor involved in the project had 5-10 of their growers test the tarps and slip-on covers. In addition to these growers, I also reached out to several that Integrated Crop Management Services has worked with in the past. These additional growers and their operations represent the diversity of the industry. A brief profile of each additional grower/farm follows.

Grower	Scale of Operation	Previous Experience with Reflective Tarps	Comments
#1	Medium	Yes: 10-15 years experience	• Farms full time • Harvests crop by machine • Ships to various local processors/packers • Very progressive grower and early adaptor of new technology
#2	Small	No	• Harvests crop by machine, targets an 8 day interval • Low number of varieties, all early season, short harvest period • Harvest period is early to mid July until Early August • Does custom picking for local growers
#3	Medium	No	• Harvest crop by machine • Has multiple varieties on farm and has a medium to long harvest period • Harvest period is early to mid July until Mid/late August • Innovative and progressive growers and adaptive of new technologies
#4	Small	No	• Starts harvest with hand-picking of the crop, then switches to machine harvesting at completion of raspberry harvest • Has multiple varieties, early to mid season and a long harvest period • Harvest period is early July until early September • Is open to new technologies but does not actively seek them out • Grower which is representative of the majority of industry
#5	Medium	No	• Vertically integrated operation growing various berry crops

Grower	Scale of Operation	Previous Experience with Reflective Tarps	Comments
			• Very innovative grower and on top of new trends and technology • Always looking for the next competitive advantage • Markets berries under own brand • Has multiple varieties, early to late season and a long harvest period • Harvest period is early July until mid September • All fruit is hand picked
#6	Small	No	• Mostly early varieties and a medium length harvest period • Starts harvest by hand picking, then switches to machine picking towards the end of the season • Fruit is sold by means of direct sales from farm as well as various farmers markets
#7	Small	No	• Crop is machine picked • Fruit is sold by means of direct sales from farm as well as various farmers markets • Open to innovation and moderately progressive operation • Low number of varieties, all early season, short harvest period • Harvest period is early to mid July until early August • Does custom picking for local growers

How were the tarps used?

Bushpro, the supplier of the reflective tarps, has various tarp sizes commercially available, as well as some customized sizes designed for use by the cherry industry. Typically, these tarps are meant to be draped over the produce or plant needing to be kept cool.

After meeting with various growers and processors in early summer to determine the industry needs and gaps, the following field scenarios and applications of the tarps were identified in the demonstration plan, along with possible solutions.

Application/Field Scenario	**Possible tarp solution**
Individual lugs (46" W x 41.5" L)	Standard cherry bin cover
4-5 lugs stacked	Use a larger 15' x 18' tarp and sew it to make a slip-on cover to go over the stack
A pallet of individual 20 lbs trays (41" W x 49" L)	Use a larger 15' x 18' tarp and sew it to make a slip-on cover to go over the stack
A group of lugs or trays that are stacked in the field	15' x 18' or 18' x 24' tarp to drape over and down the side of the stack
Transport truck	Design and build a rack for a truck and use a larger tarp to cover load

During the season, the purchased tarps were used in various scenarios to determine their usefulness for the industry. The different scenarios tested are as follows.

Scenario: Protecting individual hand lugs during hand picking

Background Information: A common practice with hand picking is to pick directly into individual hand lugs or flats. Typically, they hold between 20-30 lbs of fruit, and the picker will have the tray sitting next to the row that they're picking. Depending on the picker experience and crop yield, it may take 20-40 minutes to fill a lug. After it is full, it may still sit between the row for some time until it is gathered up, weighted, and placed in a collection area to be taken further for sale or processing.

Solution: Bushpro made small covers that can be placed over the top of the lugs or trays. The dimensions selected, allow them to be placed on either design used in the industry. These were tested by G & D Growers and Krause Berry Farms. Feedback was positive.

Ease of use: This design is extremely easy to use by the picker as it is simple to place on top of the tray. The design also allows for stacking of the trays if needed.

Concerns or Issues Identified: The cover fits snuggly on a flat, however it is a little loose on smaller hand lugs. Under windy conditions, there could be some potential for the cover to blow off. A solution to this would be to have the manufacture add a draw string so the slack can be taken out once installed, or just add a small piece of wood on top to hold it down.

Economics: $1.95 per unit

Photo(s) of the tarp in use:

Figure 1: Custom designed cover in use on berry flats.

Figure 2: Custom designed cover in use on a berry hand lug. The cover design allows for staking of hand lugs.

Scenario: Protecting a stack of hand lugs sitting in the field or within a grower's yard

Background Information: As the fruit is hand picked or machine picked, the filled hand lugs are, typically placed as a stack on a pallet within the field or yard. They will stay there until the grower has enough picked to load the truck and take to the processor or direct sales. Sometimes, these stacks can sit in the field for 2-5 hours at a time, exposed to the hottest periods of the day.

Solution: Various sizes of the commercially available tarps were given to growers to place over the pallets of hand lugs. The most common size given out were the 12' x 13.5' tarp, as this size would cover two pallets at a time.

Ease of use: Under calm conditions, these tarps can be used very easily by one person. In windy conditions, it can be more complicated to be applied by one person. However, it can be done once the user has experience using it.

Concerns or Issues Identified: As the wind picks up, it can be a challenge to apply by one person. Alf Krause mentioned that the larger tarps can be awkward to work with by one person.

Economics: Depending on the size of tarp, prices range from $19.98 to $162.73 per unit

Photo(s) of the tarp in use:

Figure 3: A standard 12' x 13.5' tarp in use covering two pallets of hand lugs in 33 °C temperatures.

Scenario: Protecting fruit at a direct sales stand

Background Information: Growers who do direct sales by means of a fruit stand on their property or at Farmers' markets typically have few ways to keep the produce cool and protected from exposure to the sun and heat. The stands have limited shelter to provide shade and protect the fruit. In addition, space is limited and their supply is typically sitting in a stack within the stand or behind it, exposed to the sun and/or heat.

Solution: Smaller tarps and cherry bin covers were given to growers who do direct sales. They were able to place these over the produce and protect it from the sun. Feedback from these users were positive and said that they noticed a big difference in the fruit quality.

Ease of use: The small tarps and cherry bin covers were very user friendly within the stand.

Concerns or Issues Identified: None were identified.

Economics: $9.78 per cherry bin cover, $19.68 per 6'x9' tarp

Photo(s) of the tarp in use:

Figure 4: A standard tarp in use covering harvested fruit at a holding area within a field.

Scenario: Protecting the fruit from field to the processor/packer

Background Information: The pallet of hand lugs or totes will sit in the field after it is picked, then placed on a truck or trailer for transport to a packer/processor. Depending on the time of year or time of day, these trucks may be sitting in a line for 3-5 hours at a time, exposed to the sun, heat and elements. In addition to this, depending on the time of year, the capacity of the packer/processor may be delayed, and the fruit is placed within a holding area, sometimes without cover, such as a parking lot.

Solution: A slip-on cover was developed with specific dimensions for a pallet of hand lugs or a stack of totes. These covers provide protection on all sides of the stack as well as the top. The cover designed for hand lugs are made to fit a stack 7 high and provide clearance for the forklift. The cover designed for the totes are made to fit a stack of four high and provide clearance for the forklift. The covers can be placed on the stacks in the field, allowing the fruit to be protected from the sun and heat, and remain in place while the stack is loaded and transported on the truck and trailer, still providing protection. If the processor is backed up and the fruit needs to be placed in a yard for holding, then the cover will continue to provide protection during this period.

Ease of use: Once familiar with the cover, one person can place it on a pallet. However, it is much easier to install with two people. The cover works well on a trailer or truck. This system is very versatile and can be easily adapted by a small grower transporting one or two pallets in the back of a pickup truck, or easily upscaled to larger operations.

Concerns or Issues Identified: It does take a little more time at the plant to take the cover off. In which case a grower may feel pressured if they are holding up the line or forklift driver. However, the benefits

of the tarp outweigh this slight delay. Feedback from Silver Valley was that the tarp works best if used before the berries "heat up".

Economics: Tote cover: $79 per unit, Lugs cover: $75 per unit

Photos of tarps in use:

Figure 5: Custom designed slip-on cover in use covering 7 layers of hand lugs

Figure 6: Custom designed slip-on cover in use covering a pallet of hand lugs, compared to conventional rectangular reflective tarp, preparing to be transported to the processor.

Scenario: Protecting the fruit on a machine harvester as it is picked and stacked

Background Information: Many growers are operating machine pickers which do not have canopies installed to protect the workers or picked fruit from the sun, heat or elements. As the fruit comes off the machine and is placed in hand lugs or totes, they are stacked on the platform until the machine picker reaches the end of the row. Depending on the yield, machine specs, bush type and field layout, it may take an hour or more to reach the end of the row.

Solution: One grower used a provided tarp to create a simple canopy on his machine picker to protect the workers and the fruit.

Ease of use: The grower was very mechanically inclined, so it was easy for him to install it. There are companies which do make canopy frames for pickers which growers could install.

Concerns or Issues Identified: Attention needs to be taken to make sure that the canopy cover is large enough to cover the platform and provide shade for the fruit.

Economics: Varies depending on the size of the tarp and material used.

Photo(s) of the tarp in use:

Figure 7: Standard tarp in use on a berry picker setup to provide shade to crew and harvested fruit.

Scenario: Protecting the fruit on a truck or trailer during transport

Background Information: Pallets of hand lugs or totes filled with picked fruit are placed on trucks or trailers for transport to a packer/processor. Depending on the time of year or time of day, these loaded trucks or trailers may be sitting in a line up for 3-5 hours at a time, exposed to the sun, heat and elements. In addition to this, the travel time from the field to the packer could be lengthy depending on the distance the grower has to travel.

Solution: Develop a roll out system for a truck or trailer. Goodwin Greenhouses have been brought on board to build a prototype. We were not able to get something made for this season. However, we do plan on building something this fall/winter so it can be used by growers for the upcoming season.

Ease of use: to be determined

Concerns or Issues Identified: to be determined

Economics: to be determined

Photo(s) of the tarp in use: to be determined

Data Collection

Temperature monitoring

Hobos were used to collect temperature and humidity data from harvested fruit covered by tarps vs not covered by the tarps. This data collection occurred on a daily basis for a number of days during extreme heat events and normal temperatures.

Data collected over an 8 hr period, which simulated the time harvested fruit can be held in the field to the time it is delivered to the processor, showed that the temperatures were lower under the tarp than when the tarp was not used. It also showed that the relative humidity remained higher and steady, compared to when the tarps were not used.

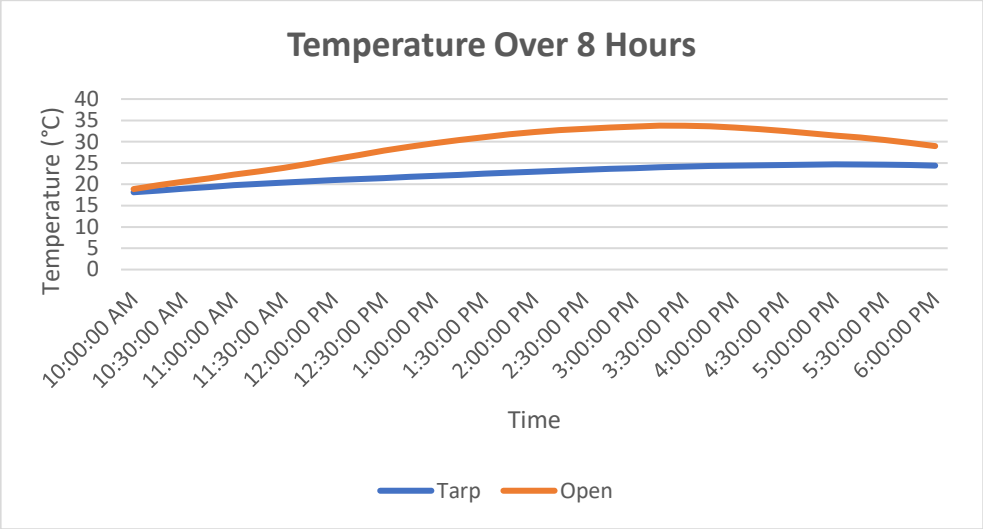

Figure 8: Average temperature recorded over an 8 hour period from 7 separate days. n = 21

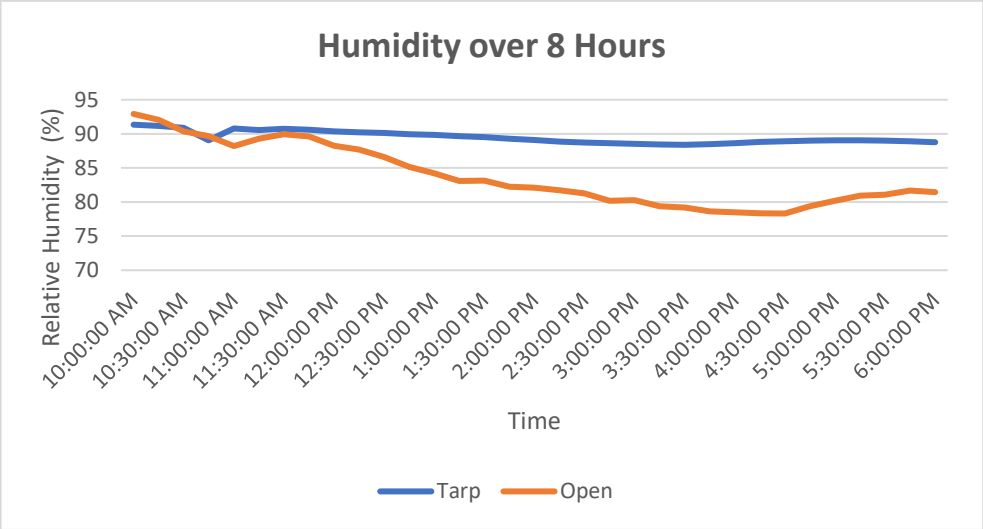

Figure 9: Average relative humidity recorded over an 8 hour period from 7 separate days. n = 14 (Tarp), n = 20 (Open)

Weights of berries

Fresh weights and dry weights were taken from sampled berries which were covered and not covered by the tarps. Data collected over an 8 hr period, which simulated the time harvested fruit can be held in the field to the time it is delivered to the processor, showed that tarps reduced berry weight loss by 59% compared to fruit which were not covered.

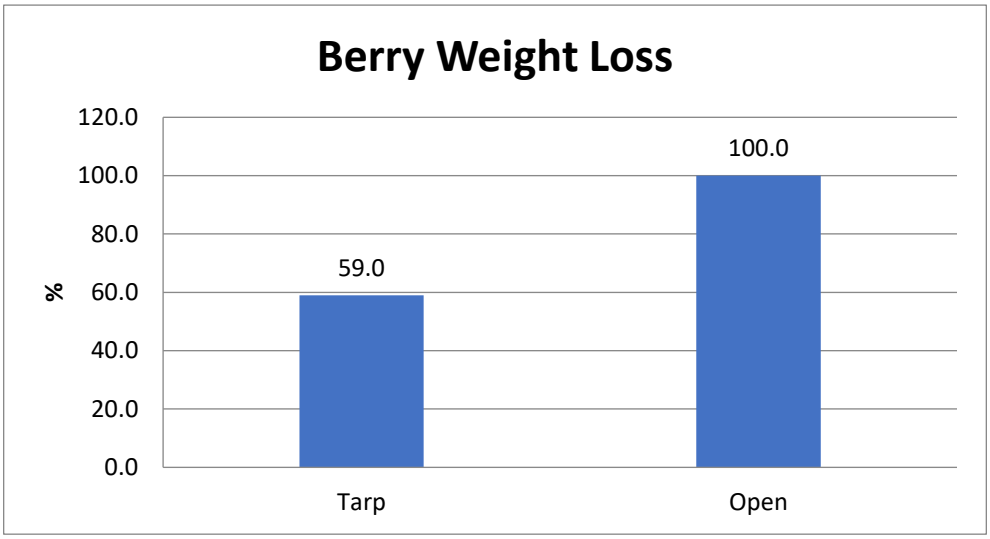

Figure 10: Average weight loss recorded over an 8 hour period from 7 separate days. Open had a loss of 14.8%. n = 15

General Observations and Summary

The use of the reflective tarps was very well received by the growers and the packers/processors. The progressive growers and packers were doing their own internal testing, and made good use of the tarps and covers.

There were a number of extreme heat events during the growing season where the temperatures reached 35°C or higher. The growers who were picking on these days and using the tarps easily saw the benefit of tarping. The feedback from one grower was *"Tarps worked great today. The uncovered is cooking in 33 degrees. Covered is like in the fridge".* Another grower said that he ran into labour issues due to COVID-19 and could not get his fruit to the packer in a timely manner. He commented "*having the fruit sitting under the tarp saved his fruit and that the quality*".

The main intended use of the tarps and this project was to demonstrate that the tarps and covers worked during extreme heat events. However, feedback from growers were that they were extremely impressed with how they also kept the rain off of the fruit when it was raining. They felt that this was a very positive benefit and would go a long way in helping to justify the investment in the technology.

Overall, the feedback from growers and packers indicated that these tarps are another valuable component in the toolbox and will go a long way to helping ensure fruit quality in the future.