

Specialty Crop Competitive Grant
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Grant Recipient: Ralph Carney
Grant Project: Potato Wedge Project

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Potato Wedge Project report
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Overview: School Food Nutrition staff have expressed an interest in creating a healthy value-added Alaskan potato product to be served in the school lunch program throughout Alaska. We recognized that this interest represented a market that if filled would create jobs, increase agriculture in Alaska and feed healthy local food to Alaska school children.

We used the funds from the grant to setup, process, and test healthy processed potato products in a cost effective way without the purchase of expensive equipment or space in a facility. We were able to set up a small pilot plant operation which we operated on 2 separate production runs using 3 staff during each production run. The processes used with some enhancements could produce up to 200 pounds per hour and other enhancements and with a proper chilling process could sustain long-term production of up to 300 pounds per hour of finished product. This output though miniscule in comparison to full scale processors, but could still be sufficient to supply several large Alaska School Districts with a nearly year round product.

Below are the equipment, raw materials, the process used, and the production run and finished products, and finally are the testing results and acceptance of those products. Last we have included the details of how the project met the objectives laid out in the grant requirements.

Equipment

- **Potato Peeler** Hobart 6460, peels up to 60 lbs of potatoes per batch, 400 lbs per hour with continuous use.
- **Slicer**
 - **Urschel CC** 5 hp standard potato chip slicer with thick cut V blade output of 50 lbs per 20 second period.
 - **Wenco type accordion type slicer** – estimated output of 60 lbs per hour requiring a high level of manual exertion.
- **Blancher**
 - **Specialty 175** Batch potato chip fryer filled with water, 750,000 btu output, 150 gallons, cooks up to 300 lbs per hour of blanched product using stainless steel wire mesh baskets.
 - **3 gallon stock pot on Electric stove(for kitchen testing)** – Output of 10 – 15 lbs per hour
 - **40 Gallon Groen Jacketed tilting kettle** (a reasonable medium sized option that could be installed to meet a medium output quantity at a lesser cost than our fryer) - We estimate output of up to 120 lbs per hour with this piece of equipment.
- **Chiller**
 - **Sanitary sink** filled with fresh tap water approximately 40 degrees 20 gallon capacity
 - **2 door glass front commercial cooler**
 - **TUCS TC-BCCT-200 Batch Chiller** 200 gallon capacity. Estimate up to the 300 lbs or more per hour
- **Packaging** switch operated manual impulse sealer with 16” jaws

- **Bagging** 12”X 30” clear food grade cellophane 6 mil water tight bag. Capacity of approximately 10 lbs finished product, heat sealed at the top.
- **Boxes** 12” X 12” X 6” corrugated carton contains up to two 10 lb bags of finished product.
- **Refrigerated storage**
 - **2 door glass front commercial cooler** able to store up to approximately 200 lbs of pre-chilled product
 - **Leased space in cooled warehouse** unlimited, space is available at school facilities or for lease.

Raw Materials

- **Potatoes**
 - Chipping potato Variety
 - 2 Table stock Varieties
 - Red skinned small potato variety
 - Purple flesh potato variety
 - Red flesh potato variety
- **Oil Coating**
 - Corn Oil
- **Seasoning**
 - Sour Cream and Onion seasoning
 - BBQ seasoning powder
 - Alberger type fine flake salt

Process – The processes were first developed through experimenting in a home kitchen. We were able to use the experience of that testing and replicated it in the larger scale capable with commercial production equipment available at the Alaska Chip Company factory.

1. Peel Potatoes – a 50 lb batch of potatoes is weighed out and placed in the Hobart 6460 peeler until peeled to desired appearance.
2. Slice Potatoes
 - a. Large Scale production option Urschel CC, could use other high output cutter, they are expensive but we had the Urschel CC available in our facility.
 - i. V Slice cutting head and new blades are placed on machine
 - ii. The machine is turned on
 - iii. Potatoes are fed through the slicer
 - iv. Slices fall into rinse tub
 - b. Potato wedge slicer
 - i. Cutting lever pulled up
 - ii. Potato placed into cutting head
 - iii. Cutting lever pushed firmly down
 - iv. Potato wedges fall into rinse tub
3. Blanch Potatoes
 - a. Potato chip fryer is filled with water and heated to 170 to 185 degrees
 - b. Sliced or wedged potatoes are weighed into 20 lb batches and placed in mesh baskets.
 - c. Mesh baskets containing potatoes are placed into hot water in fryer with occasional agitation of baskets until completely blanched, approximately 18 – 25 minutes. Blanching time will vary depending on potato variety, specific gravity, and type of slice and size of batch.
 - d. Remove potatoes from blancher.
4. Chill Potatoes

- a. Place blanched potatoes into chilled water to bring potato temperature below 41 degrees for safe storage. This is very difficult to achieve with tap water alone and will require some type of cooling or chilling device to keep up with a high output process.
 - b. Remove from chiller
5. Season potatoes (If desired product is to be unseasoned than proceed to packaging)
 - a. Tumble batches of potatoes lightly in corn oil
 - b. Sprinkle desired seasoning onto oil coated potatoes.
6. Package potatoes
 - a. Weigh out 10 lb batches of seasoned potatoes and place them into food safe bag.
 - b. Remove as much air as possible from bag
 - c. Seal top of bag with impulse sealer
 - d. Place two 10 lb batches of potatoes into corrugated box
 - e. Label box with product, date, and production number
7. Storage
 - a. Store boxes in chilled area, refrigerated product should be used as soon as possible or frozen for longer term use.
 - b. Gas flushes and other process have been and are being developed to extend shelf lives for refrigerated blanched products, but these are beyond the scope of our testing. We were able to store our product for 7 days which is longer than we needed as our production would be processed primarily for next day use in a school or frozen in their freezer.
8. Preparation
 - a. Place potato portions onto cookie sheet covered with cooking paper and heat in oven at 350 degrees until done.
 - b. Testing in school food facilities showed that the products could also be placed in small portion plastic trays for heating but that it frequently left much water in the bottom of the tray. This problem may be circumvented by allowing blanched product to dry slightly then season and place it in the packaging while hot, placing the bags into the chiller in their packaged state.

9. Production Observations & Recommendations

We were able to produce an acceptable product in our production facility and found that we could achieve a relatively high level of output in peeling, slicing and blanching our products. When we reached the cooling, seasoning and packaging stages of the process we found that the lack of a high output chilling device would severely hamper our production, in addition to this we found that the oil coating, seasoning and packaging parts of production were very cumbersome without some type of production automation. In our production test we found that to process a ton of potatoes we will have lifted each batch by hand up to 5 times which is moving 5 of potatoes by hand and was very exhausting.

The Achilles heel in our testing was the chilling process. Without properly chilling the blanched product the process leaves the manufacturer with a potential food safety issue. Tap water is not cool enough to bring the product below the food safe storage temperature of 41 degrees. Relying upon the freezer or chiller at an outside facility passes the responsibility of chilling onto that facility and creates a food safety issue in the form of potential biological hazards. The system has to guarantee a safe product.

- **Kitchen production Run** - The output of finished product developed in the home kitchen were delivered to the Mat-Su Schools food facility in Palmer and experimented on in conjunction with kitchen staff to help identify which products, types of cuts and seasonings were most useable by kitchen staff and most palatable by students. This testing was very helpful in providing direction on our following production runs. Products included the following
 - Potato Varieties
 - Chipping Potatoes
 - Table Stock Potatoes
 - Red Skinned Potatoes
 - Purple Flesh Potatoes
 - Slice Types
 - Wedge Cuts
 - ¼" Ridge slices
 - Seasonings
 - Salted
 - Sour Cream & Chive
 - Barbecue Seasoned
 - Melted Cheese
- **First Factory Production Run** - We produced approximately 100 lbs of finished product at the factory. We delivered this product to Wasilla High School cafeteria to test acceptance by students at lunchtime in the cafeteria with help from Division of Agriculture. Products served were from chipping potato and red skinned potato varieties in both wedge and ridge cuts. Products were seasoned with salted, Barbecue and Sour Cream & Chive seasonings.
- **Final Factory Production Run** – This was our largest production run with a total of 300 lbs of finished product delivered to the Anchorage Schools District. The product was immediately placed into a sub-zero freezer area at the facility to be later thawed and tested.

Results

- **Potato Variety** – There was no significant taste preference between potatoes varieties noted. Any major differentiation had more to do with color and size of the products than appearance. The purple colored flesh potatoes tended to loose much of their color in the blanching and especially storage process and were not as appealing as when originally sliced. The red skinned potatoes were the most desirable variety in all tests as they were smaller and could be portioned out more easily, the skin still maintained most of its red color through the blanching and storage process and just made the product look better. There was no noticeable difference in quality between the chipping varieties and the table stock varieties. Overall textures varied between varieties but with proper blanching these differences were minimized in our observations and tests.
- **Slice type**
 - The most desired slice type was the “8 wedge per potato” slice using the hand cutter. The wedges were easier to handle during cooking and serving. The wedge was also more appealing to food nutrition staff because this type of cut results in a finished product that is visually much more similar to the original raw potato, which provides an educational benefit to students.

- The V Cut slice is a ¼ thick slice with a ripple or ridge type surface on both sides. Though this slice was not as desirable as the wedge, it was still very well accepted by students in the cafeteria and school staff.
- **Seasoning** – In initial stages oil was not used prior to seasoning, but it was noted that coating the potato lightly with oil allowed the seasoning to adhere more readily. The oil coating tended to keep the potato from drying out in the reheating process in the school kitchen and so was used for all the product tested on students. The quantity used in production was less than 5% of the finished product.
 - Sour cream & Chive Seasoning -This was found to be the most desirable by staff at initial testing but though well accepted by students it was not the favorite.
 - Barbecue Seasoning – This was the most favored product by students in testing and was also very well accepted by food nutrition staff in our first round of testing.
 - Salted – This product tended to score lower than the seasoned products but when ketchup or other toppings were made available it was also very acceptable.
 - Cheese – In 1st round testing at the Mat-Su Schools Food Facility the staff put some melted cheese on them and it was very good.

Overall Conclusions – All the Alaska potatoes blanched with the exception of the purple flesh potatoes made an acceptable finished product. The most favorite variety was clearly the small red skinned variety. Though all the flavors tried were enjoyed by students the barbecue seasoned products tended to go the fastest, especially in the wedge shape. In moving forward with a product to penetrate the market, the following information will be helpful in accessing the feasibility of moving forward with such a facility or production line.

- Product- Blanched Potato wedge or ¼” slice plain or with light oil and seasoning in 10lb sealed bag and chilled below 41 degrees .
- Cost – The estimated cost of raw materials and conversion costs to make an Alaska product are around 50 cents per lb, but this does not take into consideration the cost of building and maintaining that facility.
- Price – Prices FOB Alaska for equivalent products range from 80 cents per lb up to \$1.00 per lb, a product made from local potatoes could potentially sell for up to \$1.10 - \$1.20 per lb.
- Market
 - Schools – Alaska State grants are currently in effect that provide \$3,000,000 per year to schools to purchase Alaska products for serving to schools. This program opens the market for a cooked potato product. Federal guidelines being followed by school programs have restricted nutrition requirements so that the only current commercial processor of potatoes in the State of Alaska, the Alaska Chip Company, is not able to benefit from the program. Blanched potato quantity estimates to supply the Anchorage School District for kindergarten through 8th grades are approximately 3,125 pounds per week of finished product. Estimates received school districts varied and appear to change. We estimate a market which including Anchorage, Mat Valley, and Fairbanks could be up to and over 6,000 lbs per week from these schools with the potential to double depending on buyer preference and grant availability.
 - Food Service – Inquiries to food service distributors indicated that there would be a market for a locally grown and processed potato product. Fresh cut products and blanched chilled products are a niche market in the lower 48 but due to shipping and shelf life issues the market in Alaska is relatively un-tapped, there is some question as to just how large this market is.
- Profitability & Risk

- The State of Alaska Food to Schools Grant has expressed interest in and would be an existing market for a local processed potato product and this market would be a great stepping stone for a startup to get into operation. The grant program is renewed annually and the longevity of the program is uncertain and creates an element of concentration risk, but has much potential. A startup would be strongly encouraged to diversify its customer base and reduce the economic reliance upon the grant as soon as possible. With Anchorage, Mat Valley, and Fairbanks Schools consuming 6,000 lbs of product per week the following could be projected. At \$1.10/lb would generate revenue of \$237,600 for the 9 month school year, with a 50% profit margin could provide a gross margin of \$118,800. General and administrative expenses for a company of this size would be estimated to range from between \$80,000 – \$120,000 per year depending on size and efficiency of the facility.
 - Facility Size – To meet the 6,000 lbs per week to supply the schools I would recommend a facility that could produce twice the current projected market or 12,000 lbs per week, 300 lbs per hour of output for a 6 hour day and 2 hours for cleanup. If the market ballooned the facility could quadruple output by processing around the clock and produce up to \$1,000,000. Equipment would cost in excess of \$500,000. Purchasing used equipment may get cost below \$300,000 but generally results in installation delays and production issues. Purchasing of a used complete production line would be most economical for this purpose. The following equipment would be needed:
 - tote dumper
 - conveyor to peeler
 - peeler
 - conveyor to slicer
 - manual batch weigher
 - fryer/blancher with hood
 - metal baskets for fryer if it is not conveyed
 - chiller, metal baskets for chiller if not conveyed
 - conveyor to packaging station
 - manual packaging station
 - Forklift
 - Facility of 3100 sf
 - 20x20 Chilled storage area for finished product
 - 30x30 cooled raw potato/vegetable storage area
 - 30x50 production area
 - 15x20 office area

Project Goals

Goal #1 Identify the necessary equipment to process a healthy potato snack product in an efficient and cost effective way.

See detail above under equipment.

Goal #2 Document and test production process and recipes necessary to produce a product suitable for the school lunch

See detail above under production process.

Goal #3 Identify at least three products for sampling in schools

- Blanched Barbecue potato wedge

- Blanched Barbecue potato ridge Slice
- Blanched Sour Cream & Chive potato wedge
- Blanched Sour Cream & Chive ridge slice
- Blanched Plain or salted potato ridge slice

Goal #4 Document packaging options and shelf – life solutions for identified products.

Our greatest challenge was to get the blanched potato to a cool temperature within a reasonable period of time without the use of a high output chiller. During the blanching process we took the potatoes from 45 degrees up to 170 degrees. To then bring that temperature all the way back down to 41 degrees which is considered a food safe temperature was very difficult in large scale production. We recommend a high output chiller to achieve this in large scale production. We are still looking into other options to get around the lack of a chiller hurdle. When chilled properly we found the potatoes to have at least a shelf life of 7 days which was adequate for our needs. Industry literature says that with proper chilling the 7 day life can be extended up to a month. We chilled our product primarily using tap water and a refrigerator. The product was packaged in heat sealed plastic bags. We packaged two 10 lb bags per box for delivery.

Goal #5 Sample products with three schools districts.

We sampled products with the Mat-Su school district staff at the Mat-Su School District Food Prep facility in Palmer and worked closely with staff to develop products that would be accepted and hopefully liked by students. We followed up with testing at Wasilla High School as described above and they ate all 100 lbs of the various products with favorable results. Our final testing was to deliver 300 lbs of prepared potatoes to the Anchorage School District. This was placed in their freezer for storage for later use. The product was later thawed and tested in their main food facility. Feedback from the Anchorage school district was that the potato products had to be completely thawed for use as the product all freezes together when frozen. When the product was thawed and cooked on cookie sheets with cooking paper they provided an acceptable product. The staff was interested in purchasing these products from us to serve to students.

Sincerely,

Ralph Carney