



Preliminary Report: **Louisiana and North Carolina Sweetpotato Packingline Surveys**

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The Southern Sweetpotato IPM Project was launched in 2003 with the mission to identify Integrated Pest Management (IPM) tools for southern sweetpotato growers that enable better control of problem pests, decrease production costs, and reduce the use of high-risk pesticides.

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Gerber

INTRODUCTION

Packinghouse surveys were designed to critically examine the effects of packingline design and practices on susceptibility of sweetpotato roots to postharvest rots (i.e., *Rhizopus* soft rot). In particular, researchers are interested in the effect of root injury on susceptibility to disease. These studies involved 46 packinghouses in North Carolina and Louisiana.

The surveys examined all packingline operations including sequence of machinery components, length and speed of the packingline, decay control products/strategies used, and impact (bruising) measurements. Packingline impacts were quantified and characterized using a SmartSpud® (Sensor Wireless, Charlottetown, Canada). This instrumented device was placed on the packingline where it was conveyed alongside sweetpotatoes, measuring the impact forces exerted and sending the data via a radio signal to a handheld personal digital assistant (PDA) as it traversed the line. The information on the PDA is downloaded onto a computer where the results can be displayed in more detail and analyzed.

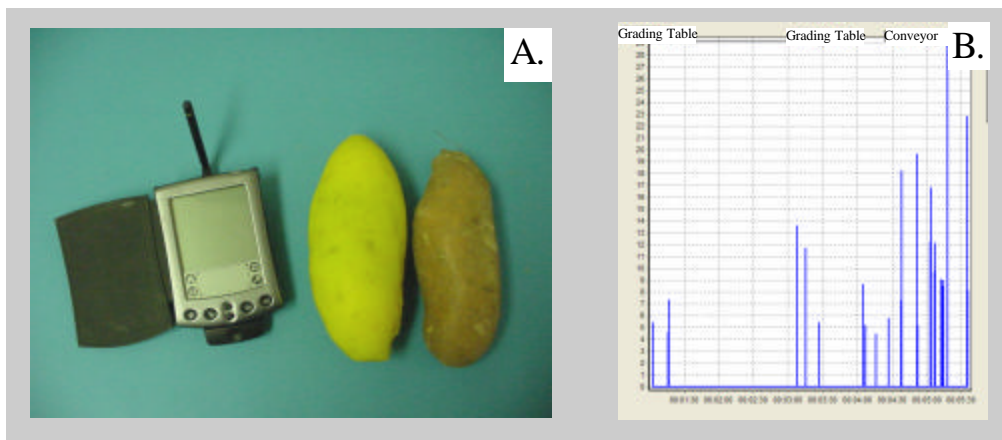


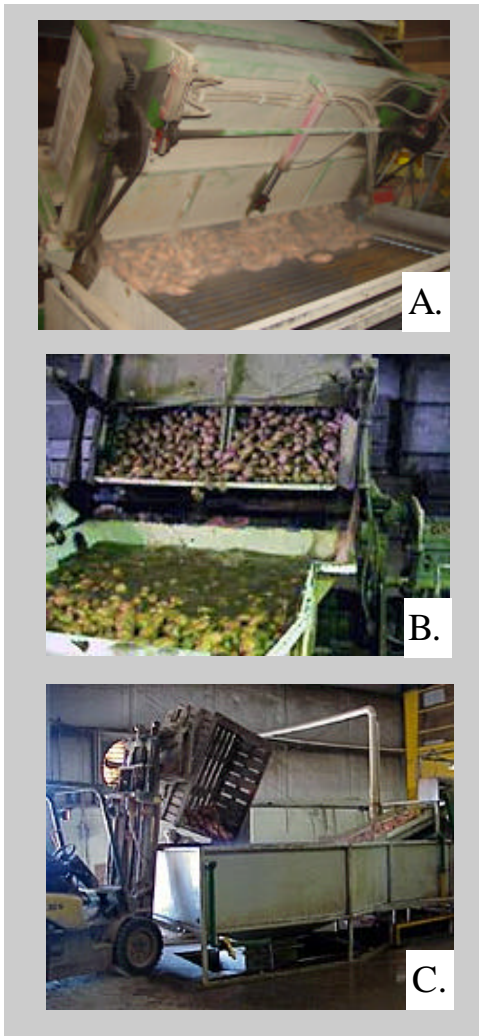
Fig 1. PDA, SmartSpud®, and US#1 sweetpotato (A). At right shows graphically displayed data received from the SmartSpud® during a run through a packingline (B)

In appreciation of all the assistance we have received from packers, we wanted to get some information out to you as soon as it might be helpful. However, the results in this report are preliminary. They should allow you to compare your operation to others, but we do not yet know how the damage we are measuring will translate into actual soft rot occurrence.

Please also note two additional items: 1) since different SmartSpud® devices were used in Louisiana and North Carolina, it is possible that there may be some differences in the readings between the two states, and we suggest you compare trends and not actual numbers, and 2) the SmartSpud® is designed to mimic a US#1 sweetpotato, so jumbos or US#2's may be exposed to a much greater cumulative impact, especially if they are repacked.

We will send a complete report at the end of the project. In the mean time, please contact us with any questions.

Sweetpotato Packingline Characteristics



Dump: Some packinglines have ‘dry’ dumps in which the sweetpotatoes are dumped onto a bed of rollers. These have covers for the pallet boxes that allow the operator to meter the flow of roots onto the line. The remaining packinglines use different methods of dumping the roots into the tank. Most invert the pallet boxes with forklifts, while some place the pallet box in a dumper (controlled by an operator) that inverts the box, some with a cover that meters the flow of roots.

Impacts occurring in dump tanks are highly variable and the degree of impact depends on how many sweetpotatoes are already in the tank when a box is dumped, how quickly the box is dumped, and the size of the tank. In addition, the handheld computer does not receive a signal from the SmartSpud® while it is under water, so some impacts from sweetpotatoes falling on the SmartSpud® while it is under water are not recorded. Thus, there is great variation in impacts on each packingline as well as among different lines.

Fig 2. Examples of dump types: a ‘dry dump’ with a lid to meter dumping roots directly onto rollers (A), a dumper with a lid to meter dumping of roots into a dump tank (B), and using a fork lift to dump pallet boxes directly into dump tank (C).

Eliminator: Many packinglines have one eliminator and a few lines have two eliminators. These eliminators consist of metal bars spaced 1.5 inches apart that allow small sweetpotatoes and trash to fall through. Because the bars are supported by the chain guides, impacts can be severe if sweetpotatoes fall directly onto the bars. SmartSpud® readings ranged from a low of 0.9 g onto eliminators where the sweetpotatoes rolled down a gentle incline (total drop of 5 inches) to a high of 30.7 g in a case where the sweetpotatoes fell about 16 inches directly onto the eliminator bars.

Brush beds: Almost all packinglines had at least one brush bed and about half had two brush beds. On a few lines, impacts were below the threshold of detection for the SmartSpud®. Variability is probably due to height of the drop and whether the SmartSpud® hit a brush, a metal incline, or a sweetpotato.

Sweetpotato Packingline Characteristics (cont.)

Sizers: Most packinglines have a single expanding roller (Kerian) sizer, although some have , an electronic sizer, a drop-roller sizer, or a combination of a Kerian sizer and an electronic sizer. Variation in impacts for sweetpotatoes moving onto the sizer is similar to that for the eliminators and the degree of impact depends on the height of the drop, whether there is an incline and whether there is padding. SmartSpud® measurements were quite low on lines where the sweetpotatoes rolled down a gradual padded incline onto the sizer, but were quite high on a few lines where there was a high drop directly onto sizer bars. Since the height of drop through the Kerian sizer onto the belt is uniform, the impact measurements recorded by the SmartSpud® are also consistent from line to line and average about 12.1 g.

Onto grading line rollers: The impact of hitting rollers on the grading line is similar to hitting bars of the eliminator and/or sizer and also varied depending on height of the drop, whether there was an incline and/or padding. In one LA packingline , the drop was only 3.5 inches and the impacts were all below the threshold recorded by the SmartSpud®. On the other extreme, roots dropped 12 inches directly onto the roller and the average SmartSpud® reading was 23.5 g.

Into box: The drop into boxes was similar on most of the packing lines where the sweetpotatoes fell off a conveyor into the box. The drop to the bottom of an empty box was about 20-24 inches. The variation in SmartSpud® reading is related primarily to how full the box was when the SmartSpud® dropped into it.



Fungicide application: Most lines use Botran every time a load is packed, but a few lines use both Botran and Storox or no fungicide at all. One line used Storox exclusively. In LA, about half the lines had a dip tank in the line to apply fungicide, while half applied the fungicide as a spray. In NC, some packinglines also applied fungicide as a curtain/waterfall or in wax. Chlorine was used in a variety of ways. On several lines, the operator added bleach to the dump tank at the start of a run. Some operators mixed hypochlorite with the fungicide in either the dip tank or spray, while other lines had a separate spray for hypochlorite.

Fig 3. Common methods of fungicide application; Curtain/Waterfall (A), Dip (B), and Spray (C).

Table 1. Number of drops and turns, cumulative impacts, and average length of 24 LA and 12 NC packinglines.

	LA			NC		
	Average	Max.	Min.	Average	Max.	Min.
Number of drops	9	13	5	11	19	6
Number of turns	2	4	0	3	8	0
Cumulative impacts (g)*	87	152	46	148	302	31
Length of line (ft)	80	212	39	123	277	37
Speed of line (ft/min)	28	59	12	19	34	7

*Cumulative impacts measured on all drops and turns on the packingline. Average of five runs with the SmartSpud®.

Table 2. Decay control product use and application methods on 22 LA and 21 NC packinglines.

	% of Packinghouses	
	LA	NC
DECAY CONTROL PRODUCT USED		
Botran	77-91*	81
Other (Storox, Bio-Save, etc)	5-18*	9.5
None	5-9*	9.5
APPLICATION METHOD		
Spray	50	32.5
Curtain	0	4.5
Dip	45	42
In Wax	0	21

* Several packing lines vary whether they use a product or which product they use from one time to another.

Table 3. SmartSpud® readings associated with common drops on sweetpotato packinglines. The SmartSpud® was run across each packingline five times and the data in the table below is derived from the averages for 23 LA and 12 NC packinglines.

Components/Transfer Point	LA				NC			
	Average Cumulative Impact (g)	Max.	Min.	Number surveyed	Average Cumulative Impact (g)	Max.	Min.	Number Surveyed
DUMP								
Dump (by hand)	NA	NA	NA	0	6.8	7.1	5.1	1
Dump onto bars (dry dump)	13.0	17.3	8.7	2	NA	NA	NA	0
Dump into tank w/ metal lid	16.7	22.9	12.8	3	9.3	11.1	5.4	1
Dump directly into tank	14.5	33.2	2.3	19	11.1	36.1	0.0	10
MISC.								
Onto eliminator (metal bars)	8.7	30.7	0.9	18	8.9	16.1	0.0	9
Onto grading line (pvc bars)	7.7	23.5	0.0	23	8.8	29.2	0.0	17
Onto brushes	8.2	23.5	0.0	34	8.2	35.9	0.0	24
Onto conveyors (plate supported)	5.9	14.9	0.0	14	13	35.4	0.0	20
SIZERS								
Onto Kerian sizer	12.7	23.7	12.7	22	22.6	30.6	4.5	7
Out of Kerian sizer (onto conveyor)	12.4	22.1	5.9	22	15.8	34.2	4.6	7
Onto drop-roller sizer	19.2	25.7	10.1	1	NA	NA	NA	0
Out of drop-roller sizer (onto conveyor)	5.8	13.3	0.0	1	NA	NA	NA	0
Electronic sizer	NA	NA	NA	0	21.6	53.8	4.6	5
BOX FILL								
By hand or falling off conveyor	10.7	25.4	5.9	24	14	39.5	0.0	6
Automated box filler	NA	NA	NA	0	30.3	72.5	4.2	6

**Table 4. Percent of packinglines that use a technique or have each type of component
(25 LA and 21 NC packinglines surveyed)**

	% of Packinghouses	
	LA	NC
DUMP		
Dump by hand	0	9.5
Dump onto bars then into dump tank	0-8*	9.5
Dump directly into dump tank	84-92*	81
Dump onto rollers (dry dump)	8	0
MISC. COMPONENTS		
Use an eliminator	56	75
Use a waxer	0	57
Use drying fans	0	43
SIZERS		
Do not use sizing equipment	12	9.5
Use 1-2 Kerian Sizers only	84	62
Use an electronic Sizer only	0	19
Use a drop-roller sizer only	4	0
Use both Kerian Sizer and electronic sizer	0	9.5
BOX FILLERS		
Use automatic box fill equipment	0	28.5
Box fill from off end of conveyor	96-100**	62
Box fill by hand picking	0-4**	9.5

* Two packing lines have movable sets of rollers that are used only when roots are muddy, otherwise roots are dumped directly into the dump tank.

** One line hand picks some times and lets them fall from end of conveyor other times.

Problem Areas



It is impossible to run sweetpotatoes through a packingline without some impacts occurring. However, most lines had at least one thing that could be improved. At the dump, when the SmartSpud® actually dropped directly into water, as expected, no impact was recorded. However, in many cases, the SmartSpud® actually hit other sweetpotatoes and in many cases, a big impact was recorded. This usually occurred because either the pallet box was dumped very fast, or because there were already too many sweetpotatoes in the dump tank when the next box was dumped:

Fig 4. An example of roots being dumped properly into water (A) and examples of roots being dumped into a dump tanks that were overfilled with sweetpotatoes resulting in large impacts of one sweetpotato onto another (B and C).

This survey concentrated primarily on US#1 sweetpotatoes. However, some measurements were made where jumbos or US#2's were dropped back into a pallet box, and readings were also very high, averaging about 20 g when dropping into a partially full box to as high as 40 g when dropping into an empty box.



Fig 5. Jumbos dropping back into pallet box for later repacking.

Problem Areas (cont.)

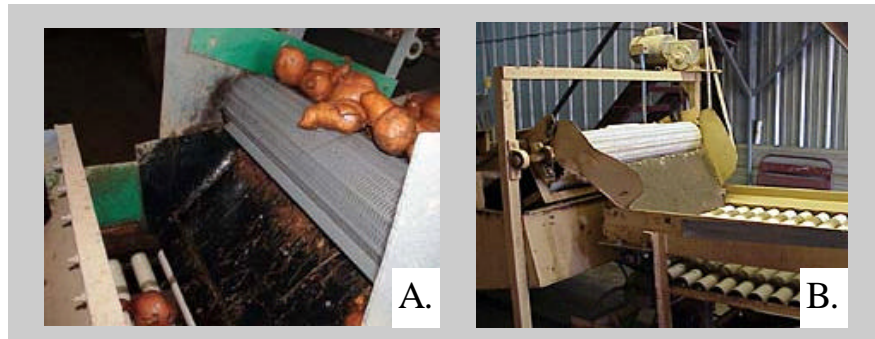


Fig 6. Examples of steep drops which resulted in high SmartSpud® readings.

Large impacts also were recorded in some cases where the SmartSpud® transferred onto eliminators, sizer bars, or rollers on grading or picking tables. The greatest impacts occurred where the drop was high and the roots fell directly onto the bars, which occurred more frequently if the line was moving fast. The two examples above had average readings of about 30 g:

In other cases, where the drop was small and a padded incline was put in to cushion the transfer, readings were about 3-4 g (Fig 7A). Use of deceleration flaps (Fig 7B) also reduced impacts by reducing the speed of sweetpotatoes moving through the transition.

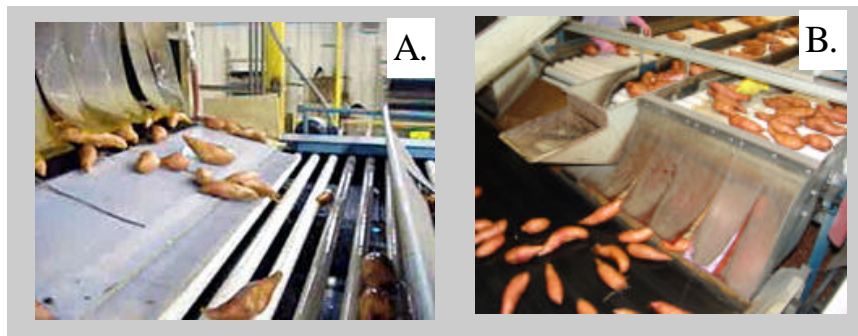
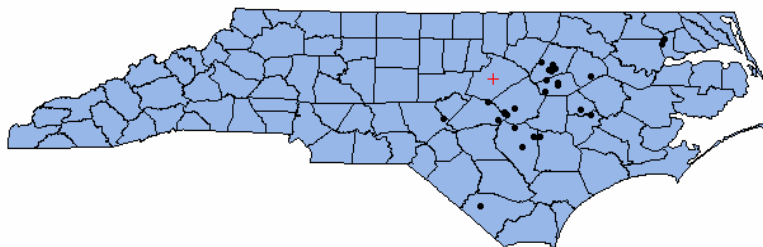
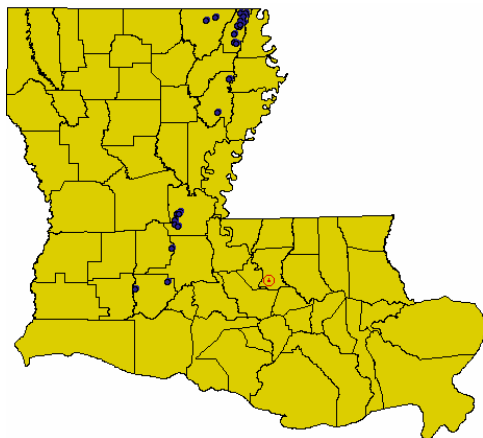


Fig 7. Examples of drops with low SmartSpud® readings due to shallow inclines and deceleration flaps.

Recommendations to reduce impacts on packinglines

- Dump roots slowly into water and not onto roots in the dump tank.
- Reduce the height of drops between packingline components through the use of long inclines.
- Add high-quality padding to cushion drops.
- Add deceleration flaps or blankets to reduce the speed of the roots over drops.
- Avoid sharp turns on the packingline. Add padding if turns are unavoidable.
- Remove belt supports from under conveyor belts if possible.
- Reduce the length and speed of packinglines.
- Reduce the amount of roots being re-run through electronic sizers

**We thank the following packinghouses for their help
in obtaining the information contained in this report:**



Cullen Farms, Evergreen, LA
Dawson Farms, Delhi, LA
Deep South Gold, Inc., Oak Grove, LA
Earl Roy Produce, Hessmer, LA
E & L Produce, Washington, LA
Garber Farms, Iota, LA
Greenworld Farms, Mansura, LA
Hayman Farms, Oak Grove, LA
James Deshotel Farms, Bunkie, LA
Joel House, Oak Grove, LA
John Crosby, Darnell, LA
Jones Farms, Pioneer, LA
Joubert Farms, Church Point, LA
Kennedy Farms, Oak Grove, LA
Kinnaird Farms/ Galion Potato Co., Bastrop, LA
McDermott Farms, Oak Grove, LA
McHe Farms, Bonita, LA
Newton Produce, Bunkie, LA
Oak Grove Produce, Oak Grove, LA
Pat Hill Farms, Oak Grove, LA
Quebedeaux Produce, Inc., Mansura, LA
Southern Produce Distributors, Inc, Oak Grove, LA
Thornhill Farms, Wisner, LA
Wistaria Corporation, Oak Grove, LA

5 Girls Produce, LLC, Clinton, NC
B&B Produce, Inc., Benson, NC
Bateman Produce Farms, Inc., Edenton, NC
Bissett Produce Company, Inc., Spring Hope, NC
Burch Brothers Farm, Faison, NC
E.J. Vick Farming Co. LLC, Wilson, NC
Farm Pak Products, Inc., Spring Hope, NC
Godwin Produce Co., Dunn, NC
Ham Produce Company, Inc., Snow Hill, NC
J. Roland Wood Farms, Benson, NC
Lee Farms, Four Oaks, NC
Millstream Farms, Dunn, NC
Nash Produce Company, Nashville, NC
Peele Brothers Inc., Edenton, NC
Pride of Sampson, Inc., Clinton, NC
Sandyland Produce Co., Tarboro, NC
Scott Farms Inc., Lucama, NC
Southern Produce Distributors, Inc., Faison, NC
Spring Acres Sales Co., Spring Hope, NC
Tull Hill Farms, Inc., Kinston, NC
Wayne E. Bailey Produce Co., Inc., Chadbourn, NC
Wingfield Farm Inc., Tyner, NC

If you would like your packingline surveyed using the SmartSpud® please contact:
In Louisiana, Chris Clark at 225-578-1381
In North Carolina, Gerald Holmes at 919-515-9779
