

Clifton Dixon/Owner / PATS Sweet Potato Research & Equipment Development, Fabrication & Refurbishing Services

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September 29, 2016

**Sweet Potato Harvest Research Proposal
Presentation to the**

NC Sweet Potato Commission

700 E Parrish Drive, Benson, NC 27504

Board of Directors

Rob Hill, PRESIDENT / Tull Hill Farms / Kinston, NC

Brent Leggett / Vice President / Leggett Farming Partnership / Nashville, NC

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Stacy Thomas / Ham Produce, Inc.

Thomas Joyner / Nash Produce / Nashville, NC

Scott Sullivan / Sullivan Farms Inc. / Lucama, NC

Robert Boyette / Boyette Brothers Produce / Rock Ridge, NC

Dear NC Sweet Potato Commission,

I am providing you this booklet to:

- 1 – Show you the equipment that I have developed with Burch and Boseman Farms these past 2 seasons.
- 2 – Document with pictures issues with sweet potato harvest and growers observations.
- 3 – Share the research details and goals for the work that I plan to conduct at Burch and Boseman Farms this fall.
- 4 – Document the research work I have done with numerous Universities and crops.
- 5 – Share with you a story that This Week in Agribusiness featured. The Minnesota Corn Research & Promotion Council have come up with a unique program **“That is intended to showcase the ingenuity of Minnesota corn farmers or university researchers in solving problems related to production agriculture and environmental stewardship.”** End of quote.

We would like to invite all of you out to see the sweet potato vine & mother root puller that Langley Industrial, Warsaw Welding, Burch Farms, Boseman Farms and I have developed run, as we need to get all the experience that we can to be able to make it the best it can be!

Clifton Dixon /Owner/PATS

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Dr. A. Richard Bonanno / NCSU

Associate Dean, CALS / Director NCCES / Phone: 919-515-1374 / Fax: 919-515-3135

Campus Box 7602 / 120 Patterson Hall, Raleigh, NC 27695-7602 / rich_bonanno@ncsu.edu

Dear Dr. Bonanno,

It was great meeting you at the Covington Endowment Celebration. Thank you for taking the time to talk with you about the booklet I gave you.

As discussed I am very excited about the work I have been doing with Burch and Boseman Farms these past 2 seasons with undercutting, digging and pulling the sweet potato mother root.

In this booklet you will see the work I did with George Naderman, PhD, Former Extension Soils Specialist (Retired) NCSU, numerous farm equipment manufacturers and farmers from 1991 until his retirement.

You will also see a letter from J Wayne Short, District Conservationist praising equipment I designed, contract manufactured and marketed throughout the southeast and mid-south.

Bobby Brock, NRCS State Agronomist and Wayne were convinced that straight no till was the most practical way to raise a cotton crop on coastal plains soils. George was convinced with his past research with conventional tillage that these coastal plain soils had hardpans that reduced yields significantly.

Wayne and Bobby told me that if I would remove the closing coulters and baskets with squeeze wheels like on some of the old KMC strip tills, they would approve it for use on fields that were rated as highly erodible. Not only did it work better in no till conditions, it gave us the floatation to run in conventionally tilled soils. By listening to who I considered at the time another government agency putting undue hardship on the farmers to comply with another regulation we made PATS the best rip-strip-till in hard soil conditions in the world! I would like to posthumously thank Bobby for his help & friendship over the years.

The reason I have created this booklet is to demonstrate to you that I have the ability to work with the NC sweet potato farmers, welding shops, OEM component suppliers and NCSU to develop a complete harvesting system! I look forward to talking with you.

Sincerely,

Pats Sweet Potato Research Services

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Burch Farms / Cooperator				Burch Farms Road, Faison, NC							
Field #	Variety	# Rows	Row Length	Day Middles Cut	Date Middles Cut	Day Roots Pulled	Date Roots Pulled	Day Undercut and Bedded	Date Undercut and Bedded	Day Harvested	Date Harvested
BU???-1	Covington		????			Tuesday	4-Oct Tuesday			Monday	10-Oct
BU???-2	Covington		????			Wednesday	5-Oct Weds			Monday	10-Oct
BU???-3	Covington		????			Thursday	6-Oct Thurs			Monday	10-Oct
BU???-4	Covington		????			Friday	7-Oct Friday			Monday	10-Oct
BU???-5	Covington		????			Saturday	8-Oct Saturday			Monday	10-Oct
BU???-6	Covington		????			Sunday	9-Oct Sunday			Monday	10-Oct
BU???-7	Covington		????			Monday	10-Oct Monday			Monday	10-Oct
BU???-8	Covington		????			Tuesday	4-Oct Tuesday			Week of October 17	
BU???-9	Covington		????			Tuesday	4-Oct Tuesday			Week of October 24	
BU???-10	Covington		????			Tuesday	4-Oct Tuesday			Week of October 31	

	Daytime Temp	Night Temp	Precip	Vine Height	Vine Condition	Skin Condition	Lbs of Cannors	Lbs of # Ones	Lbs of Jumbos
BU???-1									
Bu???-2									
Bu???-3									
Bu???-4									
Bu???-5									
Bu???-6									
Bu???-7									
BU???-8									
BU???-9									
BU???-10									

PATS / Burch Farms research objectives:

- 1 – Find out if pulling the mother root cuts down on scarring that occurs on the de vining rollers on their mechanical harvester.
- 2 – See the difference in the tightening of the skins by how many days between pulling and harvest.
- 3 – Document sweet potato quality with harvesting at 1, 2, 3 and 4 weeks after pulling mother roots.
- 4 – Document daily high and low temperature.
- 5 – Document daily rainfall.

Kendall Hill told me he went to New Mexico in the early 90’s at the request of one of his sweet potato customers to work out some issues on quality.

He told me that they had already shredded the vines and re bedded the rows to protect the potatoes.

He feels that if the weather cooperates and it do not rain too much that the sweet potatoes could be cured in the ground.

This could be a major breakthrough in quality and reducing spoilage.

This could be especially valuable in the export market!

PATS Sweet Potato Research Proposal at Boseman Farms

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Boseman Farms / Cooperator
Battleboro, NC

Field #	Variety	# Rows	Row Length	Day Middles Cut	Date Middles Cut	Day Roots Pulled	Date Roots Pulled	Day Undercut and Bedded	Date Undercut and Bedded	Day Harvested	Date Harvested
BO???-1	Covington		????	Wed		Thursday	13-Oct	Thursday		Wed	19-Oct
BO???-2	Covington		????	Wed		Friday	14-Oct	Friday		Wed	19-Oct
BO???-3	Covington		????	Wed		Saturday	15-Oct	Saturday		Wed	19-Oct
BO???-4	Covington		????	Wed		Sunday	16-Oct	Sunday		Wed	19-Oct
BO???-5	Covington		????	Wed		Monday	17-Oct	Monday		Wed	19-Oct
BO???-6	Covington		????	Wed		Tuesday	18-Oct	Tuesday		Wed	19-Oct
BO???-7	Covington		????	Wed		Wedns	19-Oct	Wedns		Wed	19-Oct
BO???-8	Covington		????	Wed		Thursday		Thursday		Week of October 24	
BO???-9	Covington		????	Wed		Thursday		Thursday		Week of October 31	
BO???-10	Covington		????	Wed		Thursday		Thursday		Week November 7	

	Daytime Temp	Night Temp	Precip	Vine Height	Vine Condition	Skin Condition	Lbs of Canners	Lbs of # Ones	Lbs of Jumbos
BU???-1	Wed	12-Oct							
BU???-2	Thursday	13-Oct							
BU???-3	Friday	14-Oct							
BU???-4	Saturday	15-Oct							
BU???-5	Sunday	16-Oct							
BU???-6	Monday	17-Oct							
BU???-7	Tuesday	18-Oct							
BU???-8	Wed	19-Oct							
BU???-9									
BU???-10									

PATS / Boseman Farm research objectives:

- 1 – Find out if pulling the mother roots cuts down on scaring that occurs when the workers have to pull the sweet potatoes off of the mother roots.
- 2 – Does it improve worker productivity by not having to pull the sweet potatoes off of the mother root?
- 3 – Does the PATS digger built out of an old peanut plow reduce harvest losses versus the disc digger?
- 4 – Document sweet potato quality with harvesting at 1, 2, 3 and 4 weeks after pulling the mother roots.
- 5 – Document daily high and low temperatures.
- 6 – Document daily rainfall.

As with the Burch plots this could be a major breakthrough in improving quality and reducing spoilage.

As stated before this could be especially valuable in the export market!

I would like to put in another study in with Boseman Farms right before the first frost.

This could be a great tool in preventing freeze damage in years when the crop is late and the grower needs to let them grow as long as possible to get the best turnout.



My experience in sweet potato harvesting began in August of 2014 when Robert Boyette and Danny Kornegay told Joel Boseman and me about seeing sweet potatoes being undercut, in an attempt to tighten the skins by Mississippi State University the previous week at a field day put on by MSU.

At that time Joel's sweet potato crop was ahead of schedule. As he pulls most of his tobacco by hand and the tobacco harvest was behind schedule, he was looking for a way to slow the maturity of his potatoes. He purchased a shreader to achieve this and hopefully tighten the skins on his potatoes.

We built the 6 row under cutter on the facing page to try to achieve this. The problem we had was the disc digger did a poor job of digging because of the loose soil.

I attended a demonstration in early September at Burch Farms in Faison by MSU with their under cutter that is pictured on the facing page. I observed that Burch Farms were having the same problems with the loose soil, just like Joel.

TriEst Ag Group contracted me to design & assist in building a cone roller and going to Maine to fumigate. I had to put this project on hold until I got back.





I visited Tull Hill Farms on 10-23-2014 to talk with Kendall and Michael Hill about under cutting sweet potatoes to control the size and tighten the skins. Kendall adamantly told me that you cannot control the size of sweet potatoes or tighten the skins by under cutting. He told me the only way to shut the plant down was to mow the vines to cut off the energy supply.

Kendall and Michael both stressed the need for a machine to pull the sweet potato mother root to tighten the skins to reduce skinning during harvest and increase worker productivity.

On the facing page you can see where they shredded the vines with a specialty flail mower with longer chains in the middles to attempt to do a better job. Wet weather prevented harvest, so the vines had chance to regrow.

This is why I feel we need to run coultter blades in the middles while running small hydraulic mowers like the ones on Joel Boseman's tobacco flower trimmer sprayers to trim the tops of the beds to tighten the skins and toughen the stems for the PATS mother root puller. Robert Boyette told me that he has trimmed the leaves to toughen the stems to make his puller/shredder pull better and increase the speed in rank vine conditions.





I have been told that the sweet potato industry and NCSU have been working on different concepts of pulling the sweet potato mother root for over 50 years.

The top picture shows the latest concept that NCSU has been working with for years. NCSU and Amadas have built a 2 row like this and ran it at Burch Farms this past summer and fall.

The bottom picture is from 1973 at the research station at Clinton, NC of the tire sweet potato root puller developed by NCSU.

As I felt that the NCSU / Amadas concept had too many moving parts. I built a 1 row prototype with the wheels concept.

On the next page you will see this prototype and the changes I made on it after talking with Terry Strickland.

I took this prototype to many farmers to get their opinions on the video and how well it appeared to work. Terry told me that he had tried pulling the mother roots with wheels years before and could never get them to work satisfactory.

I appreciate Terry sharing his experience with me and putting me on the right track!





Robert, Michael & Wiley Boyette have the most experience in pulling sweet potato vines & mother roots than any other operation that I am aware of.

Pictured is a 2 row machine built by Strickland Brothers years ago he purchased In Louisiana.

The middle picture is the 4 row puller / shredder they have been running the past few years.



An interesting observation Robert made was that when is that when they have very rank vines they like to take a regular shredder and trim the top leaves off to toughen the stems so the mother root will pull better.

This machine does a great job, but in my opinion it is very high maintenance and needs more groundspeed in heavy vines. They have purchased a second Loftness shredder, as one machine could not mow their entire crop.

I feel a more efficient system is needed to deal with vine destruction. By running coulters in the middles like the ones pictured on the rear of the tractor we can terminate the vines in the middle 4, 6 or 8 rows at 6 MPH.

We can add individual hydraulic mowers on each row like the ones I built for Joel Boseman's tobacco flower trimmers several years ago with great results!





This was my first prototype row unit
Joel had a piece of 12" x 6 " tubing that I utilized to
simulate the row.

We had put disc bedders on one of the versions of the
6 row under cutter we had built to cut and cover up the
vines in the middle. Joel and Robert both said that we
should not throw soil in the middle as it would make it
harder to follow with the digger and that it would make
the middles mushy in wet conditions.

Another change that had to be made was to remove the
rear roller and replace it with gauge wheels. We put them
on the front at first, but found they were pushing the
vines down before we could grab them. We then moved
them to the rear and mounted floating vine trainers on
the front.

The first time Jimmy Burch looked at the PATS puller he
remarked that there was no way that the belt would track
the wheels satisfactory. He was absolutely correct.
We are going to replace the wide belt with standard
v belts and pulleys. We will still use a knobby or grooved
tire as an idler and pulling device.





I have been working very hard on sweet potato vine destruction and mother root pulling since Kendall & Michael Hill stressed the need when I visited them on October 23, 2014.

Kendall was very impressed with the pictured concept that Dr. Michael Boyette of NCSU brought to their farm a few years back. He feels that it has promise.

I agree that the vines must be mechanically trained into a pulling device.

In my opinion the device needs to be able to:

- 1 – Float to ride over rocks, roots and other objects that are in a large percentage of sweet potato fields.
- 2 – Adjust the width.
- 3 - Adjust pitch of the trainers.

I have accomplished this by using old rolling cultivator arms salvaged off the rolling cultivator I refurbished for Burch Farms.

I appreciate Kendall sharing this concept with me. I look forward to talking with Tull Hill Farms about possibly of building a training / pulling device that would pull the mother roots and vines from the top of the row and throw them into their existing shredder.



I was very blessed to have the opportunity to work on pulling the sweet potato mother root at Burch Farms this past season in the same field as the NCSU / Amadus flail puller machine.

These are some of the issues that I have addressed and the same issues I feel that they need to address.

1 – Pictured is the rear roller skinning the sweet potatoes. I have solved this by replacing my rear roller with a gauge wheel on each side of the row.

2 – I have been told that the sweet potatoes need to stay in the ground from several days to a week to fully tighten the skins. I feel that the potatoes need to be wrapped up with soil to prevent damage from the sun. On the next page you will see where I have mounted disc hillers to cover the potatoes after the mother roots have been pulled.

3 – As the pictures from Tull Hill Farms demonstrate vines in the middles are tough to terminate. The PATS Sweet Potato Harvest Management System will utilize coulter blades in the middles to chop up the vines a week before digging to allow decomposition to begin.





Pictured are the coulters and sweet potato root puller I built at Burch and Boseman Farms last season. This is how the PATS Sweet Potato Quality and Harvest Management System works.

1 – When the sweet potatoes have reached the desired size we run the coulters down the middles and a hydraulically powered individual mower on top of each row to trim the leaves. This will be rear mounted on a 4, 6 or 8 row toolbar.

2 – The PATS Sweet Potato Mother Root Puller will be run as soon as possible to pull the roots, chop the vines and wrap the potatoes up with soil to protect them from the sun.

3 – The PATS sweet potato digger, built from old peanut diggers with modifications (see page 14) will be able to dig 4, 6 or 8 rows at the time.

This system will allow the grower to:

- 1 – Better manage the size of his sweet potatoes.
- 2 – Improve quality by tightening skins.
- 3 – Reduce harvest losses.
- 4 – Improve labor efficiencies.





**Introducing Precision Application Tillage Systems
Sweet Potato Harvest Management System That Will:**
1 – Improve quality and reduce spoilage by tightening the skins of the potato before harvest.

2 – Allow potato size to be determined by cutting the vines and pulling the mother root.

3 – Pulling the mother root reduces the time required to put the potatoes in the bucket, not having to pull the potatoes from the roots.

4 – Puts 2 rows into a single windrow with potatoes better exposed to allow for an easier hand harvest.

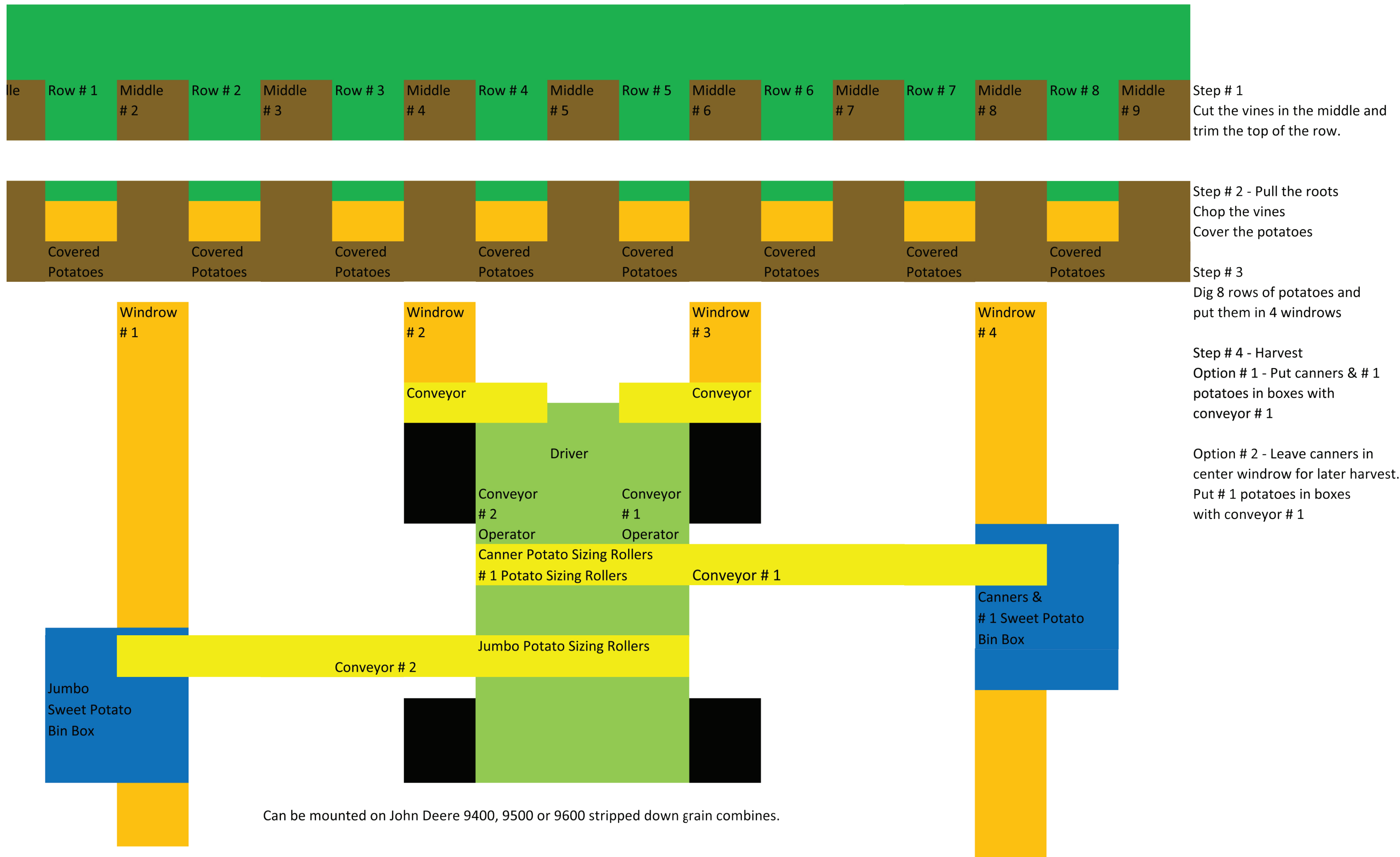
5 – Does not leave deep furrow like the disc plow, making it easier for the hand labor to walk to the truck.

6 – With the sizing option on the 4 row self propelled harvester, potatoes can be sized into # 1's and jumbos with the option of putting the cannors into the # 1's. The cannors can also be left in a windrow and covered to allow harvest when boxes are available or processors are ready to take them in bulk.

Another option is to put the # 1's and jumbos in 1 box while putting the cannors in a separate box.



PATS Sweet Potato Vine & Mother Root Management System with Mechanical Sizing and Harvesting Option!





Pictured is the row unit that I built this summer with the assistance of Warsaw Welding, Burch and Boseman Farms.

The most significant innovation of this machine is the hydraulically powered vine lifters. I have struggled with trying to get the vines trained into the pulling device these past 2 years.

It is very critical to run low enough to grasp the vines and mother root, but not come in contact with the potatoes.

I have not got 100% of the mother roots pulled with the wheels being in a horizontal position. With the new vine training device I feel that we can position the wheels in a more vertical position allowing for a straighter, more upward pull on the vines and mother roots.

I am also going to mount gauge wheels behind the pulling device. I am also going to mount coulters behind the gauge wheels to wrap the exposed potatoes up.

There will be a shield to direct the flow of the vines and mother roots behind the gauge wheels and coulters directly on top of the row. I plan on having this row unit finished by Thursday to allow farmers to stop and see it run on the way to the field day in one of Burch Farms potato fields on NC 403 between Clinton and Faison.





I have been experimenting with cone rolling since I built a 2 row machine for the Tri-Est Ag Group in the summer of 2013. We have tried many diameters and widths.

We have always had a problem with:

- 1 – Dragging up in soft and or wet conditions.
- 2 – Leaving large deep cracks in the beds.
- 3 – Soil buildup on the rollers.

Scott Fisher showed me hydraulically driven cone rollers that are being used on Europe. I built the pictured hydraulically driven 8 row for Burch Farms and the 4 row for Scott and Bobby Britt of Albertson, NC this year.

It has:

- 1 –Eliminated dragging up in soft and wet soil conditions.
- 2 – Eliminated cracks in the beds.
- 3 – Eliminated soil buildup on rollers.
- 4 – Allowed us to reduce the diameter of the roller from 20" to 14" and the disc blade from 26" to 20". This has greatly reduced the weight. It has substantially reduced the cost of the rollers and blades. This helps offset the added cost of the hydraulics. This attachment can be mounted on existing ripper bedders & chisel plows.





Pictured is the PATS cultivator that Warsaw Welding & I built for Millstream Farms. I have a longstanding relationship with Henry as I have sold them an 8 row PATS strip-till in 2001, a Besler cotton stalk puller in 2004 and a PATS hooded tobacco sprayer in 2011.

Allen Rose gave me one of the best compliments I have ever received. I was showing him the cultivator that Henry was buying. I told him I did not have the exact price, as Warsaw Welding was going to give the price after it was built. Allen said he found that hard to believe. I asked him what he meant. He said that he did not know of anything that Henry Chancy purchased without knowing the price. I promised Henry that the PATS cultivator would have features that were superior to the standard KMC and Lilliston cultivators and the net price would be less than the Norwest cultivator. We delivered on that promise!

I delivered the cultivator parts with my pickup truck. I was hired to weld, assist in painting and assembly. Henry was adamant that the best way to paint old toolbars was with a paintbrush. I did not agree at first, but after seeing that you could paint on rainy days and not having to worry about drift I knew he was right. By brushing on the marine primer the paint stays on much better also!





Pictured is the parts that Warsaw Welding and I built for Jones Family Farms this year. As you can see they took the option of painting and assembling their cultivator and painting it, as Jim calls it “sweet potato orange”!

Like Millstream Farms, Jones Family Farms utilized an existing toolbar, clamps and shanks. They both also purchased SMA 16" hard surfaced spiders that many farmer have been pleased with the past few years.

Warsaw Welding is a dealer for SMA and is very competitive in their pricing.

I would like to thank Jimmy Burch for recommending Henry and Jim buy a cultivator from me with parallel linkage as he has been very pleased with the 2 – 8 row parallel linkage cultivators he purchased in 2015 from me.

Warsaw Welding and I look forward to talking with you about refurbishing your old KMC or Lilliston cultivator into a machine that will do a better job than when it was new!

You will have the option of buying it unpainted and unassembled or painted, assembled and ready to go to the field.



My first experience with Warsaw Welding was when Burch Farms purchased a 4 row cone roller from me in 2015. In my 15 years of farming and 25 years of traveling the United States designing, contract manufacturing and marketing innovative farm equipment, I have never seen a company like Warsaw Welding!

Founded by Bill Grady in 1986, has grown to be the most diversified welding repair I have ever seen. With his son Chris very proficient in CAD drawings and sister Annette managing the office they are able to perform an amazing amount of repairs and custom fabrication.

On the day the facing picture was made Bill and his staff were repairing a 20" push lawn mower, fabricating mounts for fishing rods, putting pins and bushings on a 50,000 pound trac-hoe, solving electrical and hydraulic issues on a car carrier and repairing a dump trailer. The bottom picture shows a land plane custom built for a local farmer.

They have a very large stock of hydraulic hoses and fittings that many local farmers, loggers and truckers depend on to get hoses made quickly and at a reasonable price. They also have an impressive stock of bolts,



Bearings, plumbing parts, hydraulic fluid, trailer parts and many other items to keep their customers going.

Pictured is a truck with a vacuum tank they repaired. Can you believe that they cut out the old plate from the tank and hinge, cut a new plate, rolled it, welded it back in so the rear door seals. An amazing piece of work!!!

Also pictured is a stainless steel hopper that is going to be used to hold edible peanuts that they fabricated.

Warsaw Welding reminds me of Pawn Stars on the History Channel, because you never know what is going to come through the door next. Drive shafts, PTO shafts, radiators, stainless & aluminum fuel tanks & hog feeders.

Bill and Chris work all day, everyday like they are fighting a fire. They treat each customer whether it is a 20 " lawnmower or that 50,000 pound trac-hoe with the same respect and urgency!

Annette and her office assistant Mrs. Mina Walker work with just as much diligence in helping the customers find their parts and creating the numerous invoices needed to keep up with the repair jobs Bill, Chris and the multitalented Warsaw Welding shop staff complete daily.

I thank everyone at Warsaw Welding for their support!



I first met Ron Langley, owner of Langley Industrial Machining located in Sharpsburg, NC in May of 2011.

Joel Boseman and I were building a hooded tobacco sprayer. We got him to build parts for Joel's, Danny Kornegay's and Henry Chancey's machines.

After we finished the 2011 season I went to Ron with a totally new concept that had many advantages over the 2011 model. The 2012 model is pictured on the facing page. As with the sweet potato mother root puller, I have not had the resources needed to bring it to market.

Also pictured is the cotton stalk cutter / puller / chopper that I have been working on for the past 25 years in several different concepts. Ron helped me build a 1 row prototype in 2013 that led me to building this machine for Dawson Brothers Farms located near Hawkinsville, GA. I have the Dawson's toolbar that the trainers and coulters were mounted to at Ron's. I plan to build a new style machine with the same concept, but a different style of trainers when I have the money.

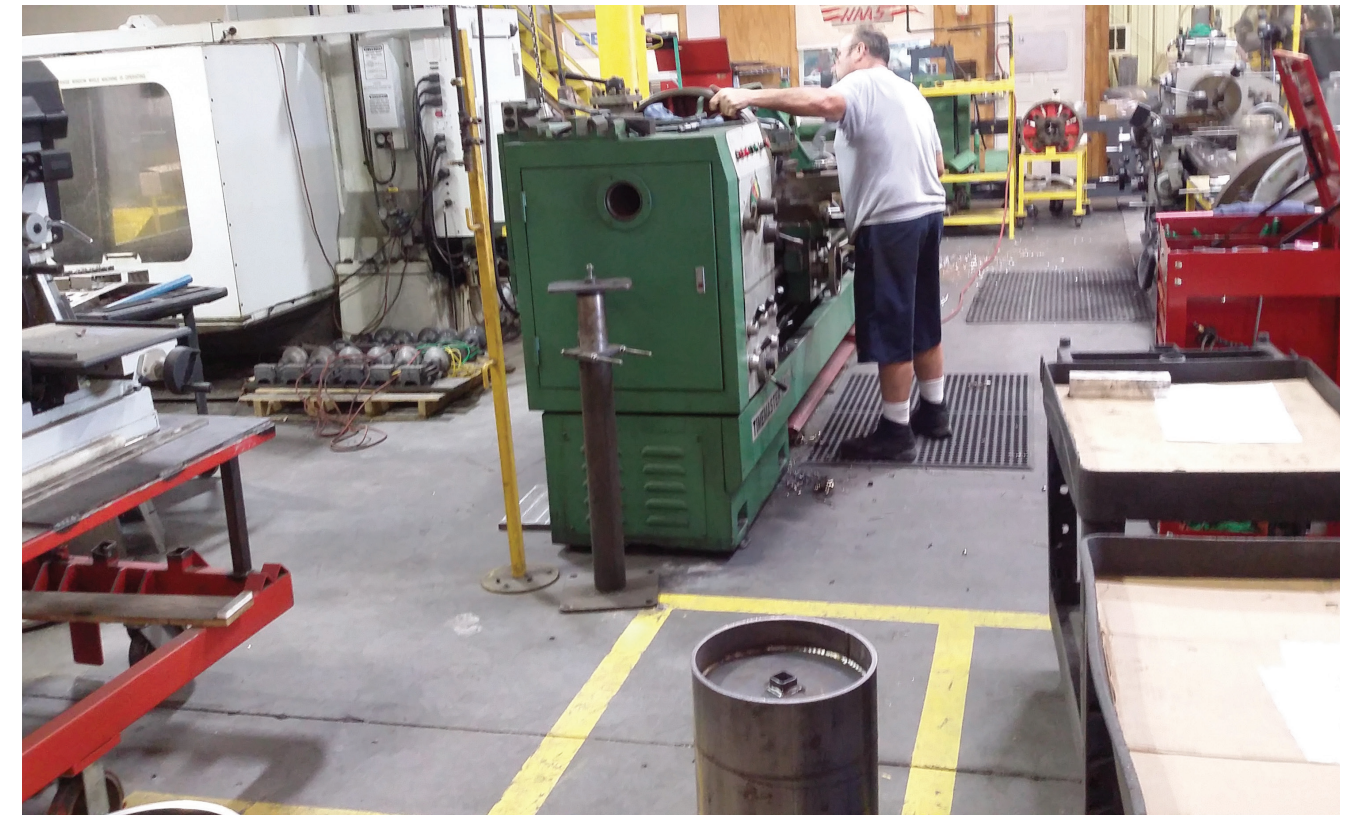
Ron has hundreds, if not a thousand hours of CAD design time over the past 5 years on all my different projects. He helped Burch Farms, Boseman Farms and me with CAD design and parts to build several different



prototypes of the PATS Sweet Potato Mother Root and vine puller. I have \$4,500.00 on my personal account with Ron that I plan on paying as soon as I sell enough cultivators and hydraulically driven cone rollers.

Pictured is Langley's staff machining parts and welding the plates into the rollers for the first hydraulically driven cone rollers that Ron and I designed for Scott and Bobby Britt. As with the conventional cone rollers that Langley built for customers of mine, everyone has been pleased with the quality and the pricing Ron gave them when the order was finished. As you can see in the pictures, Ron has a state of the art CNC manufacturing facility. His clients include Firestone, Goodyear, Smithfield Foods, Butterball as well as numerous pharmaceutical companies.

With the structural capabilities of Warsaw Welding and the CNC capabilities of Langley Industrial, we have a team that can help us design, make parts, fabricate and assemble our ideas without the overhead of manufacturers that have full time engineers. I plan on developing a marketing program that offers the customer the option of buying their equipment at any stage of completion, with the option of assembly assistance at their farm.



I was hired by Orthman Manufacturing in 1991 to represent them in NC, SC and GA.

In November of 1991 I met Hodge Kitchin at Scotland Neck, NC. He made me aware that he had to comply with new regulations concerning fields that had been designated highly erodible land (HEL) by the NRCS. Hodge had seen cotton planted straight no-till and did not like what he had seen. If he did not comply with ground cover requirements he would lose \$50,000.00 in government payments.

He liked my concept of re-bedding his land and banding cover crop in the middles. I talked with Wayne Short / Halifax County NRCS District Conservationist about options to comply. He was very adamant that he felt straight no-till was the best option. Hodge was just as adamant that he still needed a bed and that he wanted to rip under the row. We contacted Dr. George Naderman, a NCSU tillage researcher on his ideas on how to comply and not lose government payments.

We put in replicated research plots comparing no-till versus in row tillage. The in row tillage yields were statistically higher than no-till. These were the first of many tests that George and I put in until his retirement.



**Clifton Dixon,
Michael
Boyette,
Robert Boyette**

Summer 1995

***Row Incorporating, Bed
Conditioning & Precision
Placing Potash Mix***

April 1995





DR. GEORGE NADERMAN

(Photo taken at a Triticale research plot, Ft. Barnwell, NC. June 13, 2002.)

Dr. George Naderman stays as busy and committed to helping farmers and the environment of North Carolina as he did before his retirement. As seen in this picture, he and his good friend Bobby Brock were visiting Bill Smith, discussing the advantages of Triticale as a cover crop and the promising new varieties Resource Seeds, Inc. is developing.

George and I go back to the fall of 1991, when we first cooperated on some research plots with Hodge Kitchin at Scotland Neck, NC. Through the years I have tried to apply the knowledge and experience of George to the tillage systems I've developed.

In the mid '90s there was increasing interest in no till, as farmers put Conservation Plans into effect, as required for highly erodible land by the Farm Bill at that time. George kept reminding people, as he still does, that strip tillage (not just no-till) is likely to be needed to loosen the hardpan that forms in many sandy-natured soils of the eastern Coastal Plain. He bases this on his many test plots in farmer's fields here, as well as from the thorough research of NC State University and various other research institutions in the Southeast. The land does vary, even in the same field. There may be soil areas with very hard pan layers a foot or more deep, that limit root penetration and need deeper ripping. And even in the same field, some areas may not be need ripping at all--where ripping over a few inches deep will just cause problems by bringing up heavy clay that is at or just below the surface.

George has stressed the need for a variable depth ripper ever since I've known him. In a nut shell, what George has proven to me through the research data and field observation is:

1. All soils do not need subsoiling (either with no-till or conventional tillage).
 2. The lighter colored, more sandy soils have serious, deeper pan layers, and usually need ripping down through that dense layer—probably even with conservation tillage. Darker soils, even somewhat sandy ones, have little or no pan layer, and need a shallow loosening, if any at all.
 3. Deep tillage into clayey subsoils, on "clay galls" or on clayey hillsides usually does more harm than good.
- That's why I have worked so hard on perfecting this hydraulic row unit that has the ability to vary the depth of the ripper on the go.

At a field day this year near Wilson, NC, a farmer asked me what I had to pay George for all his help. I told him the only thing I ever paid George is attention.

So at this time, I would like to thank George for all his help throughout the years and wish for him a healthy, happy and productive retirement.

ZONES OF SOIL LOOSENING PRODUCED AT DIFFERING DEPTH BY A NEW "VARIABLE DEPTH RIPPER," AS COMPARED TO OTHER DEEP TILLAGE MACHINES

George Naderman, PhD, Former Extension Soil Specialist (Retired)

North Carolina State University, Raleigh, NC

This information is the major portion of a poster presentation offered (together with four co-authors) at the Annual Meeting of the Southern Branch of the American Society of Agronomy, Orlando, FL, February 4, 2002.

(This begins on the next page.)



**Clifton Dixon, Dr. George Naderman
Greene County, North Carolina, 1997**



**Dr. George Naderman, Clifton Dixon
Center for Environmental Farming Systems of
Goldsboro, North Carolina, 1998**



November 16, 2006

Mr. Ronnie Heiniger
North Carolina State University
Department of Crop Science
VGJ Center – Route 2, Box 141
Plymouth, NC 27962

Mr. Heiniger

I am writing this letter of recommendation for Clifton Dixon. During his tenure at Orthman Manufacturing, Inc (OMI), I found Clifton to be a competent, knowledgeable and thoughtful associate. Clifton's passion for problem solving of the toughest producer issues led him to design and develop the most advanced and robust row-crop tillage equipment available to the market place.

Clifton's designs live on today as Orthman has contracted with him to manufacture and distribute the Precision Application Tillage System he developed over the past decade.

Clifton has been a friend to agriculture and has always had the best interest of the producers at heart. A harder working man in agriculture, you will not find than Clifton Dixon. Clifton's strong work ethic, agronomic background and equipment design capabilities make him a great fit with any production agricultural facility.

Respectfully,

John McCoy
President
Orthman Manufacturing, Inc.



Natural
Resources
Conservation
Service

Halifax County Agricultural Center
359 Ferrell Lane, Room 151
Post Office Box 8
Halifax, North Carolina 27839-0008

(252) 583-3481 Ext. 3
Phone
(252) 583-1814
FAX

January 24, 2002

John McCoy
Orthman Manufacturing, Inc.
P. O. Box B
Lexington, NB 68850

Dear Mr. McCoy,

I have been in the field and seen Clifton Dixon's latest rig run. Clifton has finally made the grade. His new rig will meet our long-term no-till ground cover requirements. It will also keep the blow outs under control in our clayey soils while doing a good job on the hardpans in our sandy soils. Clifton has finally reached the level of ground cover, soil protection, and long-term organic matter and soil tilth improvement we have been "conflicting" with him on for the last decade. I am glad to see such an enthusiastic, dedicated, and persevering person as Clifton finally pulling with us. His new rig meets all our cover requirements, something that his old rigs could not, and it definitely is the best rig I have seen for controlling blowouts. I can truly tell my people that Clifton's rig will do the job now! If you have any questions or need my assistance, please call.

Sincerely,

J. Wayne Short
District Conservationist

JWS:pb

CC: Clifton Dixon

CLIFTON DIXON'S TRIBUTE TO HIS FAMILY



Frank D. Dixon
August 20, 1915 - December 28, 1990
Eunice Moore Dixon
March 24, 1914 - July 8, 1984



Sue D. Riff, Clifton F. Dixon and Marty D. Mills
Moore Family Reunion, September 15, 2002



Craig A. Cox, SWCS Executive Director and Clifton Dixon
July 17, 2002 Soil and Water Conservation Society Awards Meeting

My love of farming began on a small diversified farm in Black Jack, NC, a small farming community located near Greenville, NC nearly a half century ago.

Although our main crop was tobacco my father had a very diversified operation. He had a small flock of layer hens that supplies his weekly egg route in Greenville. We also had a small hog operation and an annual hog killing to fill the smoke house up with hams, cracklin's and sausage that he occasionally sold on that weekly egg route. He also had sweet potatoes, Irish potatoes and other seasonal vegetables that his weekly customers were happy to get when available.

Life was a lot different back then in Black Jack. When most of us school kids got home in the afternoon, we would change into our work clothes and do our chores. For me this meant gathering the eggs and putting them into the cartons used to deliver them. Also, there were hogs and cows to feed, and on special occasions, getting to help with land preparation or cultivating. Driving that Massey Ferguson 135 was a special treat for me just as I enjoy driving tractors while demonstrating my PATS equipment throughout our great country.

My mother was a Home Economics School Teacher. She dearly loved her job and her students. I still remember many of her former students visiting her until her death in 1984.

Summer was supposed to be a vacation from work for school teachers, but not for my mama. The summer was spent freezing and canning fresh vegetables and our pantry was full of Mason Jars with newly canned vegetables that our family had worked so hard to produce.

As I look back at a special childhood I must admit I was very spoiled. To start with, I was an accident. Mama and Daddy were 41 when I was born. My oldest sister, Sue, was married and my other sister, Marty, was in college and my brother, Johnny Carr, was in the marines when I entered the second grade in 1962. Johnny Carr also loved farming, but never got the chance because he was killed in a car accident less than 2 miles from home in 1964. My parents never got over the loss.

My parents urged me to go to college, but I just had to farm. They co-signed my first PCA loan in 1974. The first few years went well, but inflation and drought in the late 70's had created a tremendous debt and when interest rates hit over 20% that was the straw that broke the camel's back. Through reorganization my parents and sisters got to save the home farm, but I lost all of the other farms and a lot of my parents' and sisters' money.

After going broke farming the second time in 1987, I was fortunate that my father let me move back home with him. I had a job in the winter with the Carolina Farmer Newspaper calling on dealers throughout the southeast. Daddy would ride with me a lot and I am very thankful for that quality time we had together in his later years.

I lived in the old homeplace until 1995. With me on the road travelling so much, it was hard to keep the old big house livable so I rented 2 small offices in Greenville for \$250 per month with utilities furnished and sleep on the couch what little time I'm in Greenville. I am on the road most of the time and sometimes don't come home for as long as 2 months.

At this time, I would like to thank Sue and Marty for their continued love and support. So with the story told, I want to dedicate this award to my family.

Kinchafoonee Farm Services

Preston, Georgia • Wednesday, July 31, 2002



Mr. Wayne Dillard

President of
Kinchafoonee Farm Services
& Farmer

Mr. Jimmy Carter

Former President of the
United States of America
& Farmer

Clifton Dixon

Owner & Developer of Precision
Application Tillage Systems &
Former Farmer

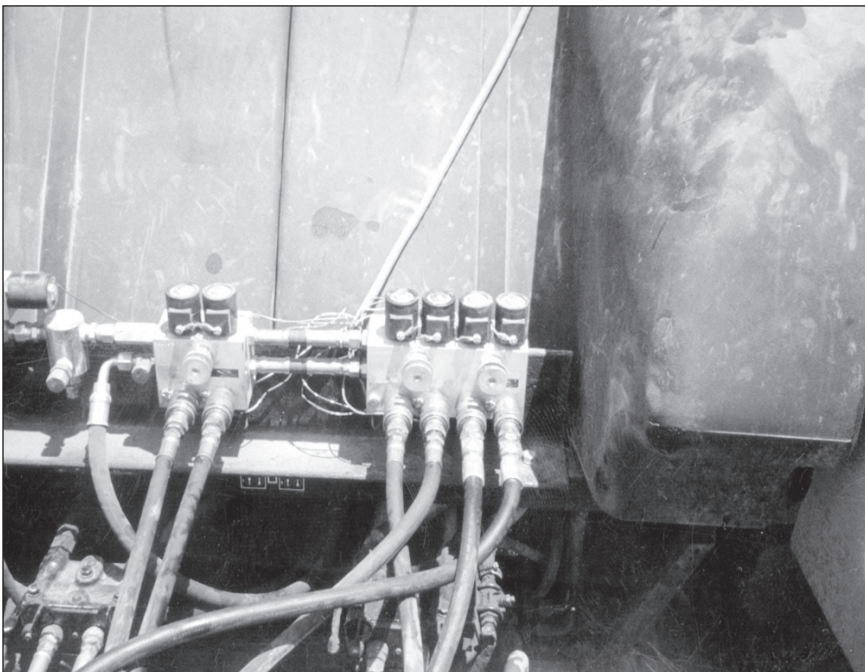
Former President Jimmy Carter congratulates
Clifton Dixon on receiving the 2002 National Honor
Award from the Soil and Water Conservation Society
for his contributions to the conservation of soil, water
and related natural resources.



Top Left:
The first field Joel tested his PATS without burn down.



Above:
Joel, left, and Wayne Boseman, work on their first PATS row unit 5 years ago.



Left:
Planting corn in burned down cover crop.

Below Left:
FASSE electric over hydraulic valves on Boseman Farms Challenger.

Gregory Poole



Gregory Poole Equipment Company
PO Box 469
Raleigh, NC 27602

Date: June 12, 2001
To: To whom it may concern
From: Kelly Rubado, Ag Sales Representative
CC:
Regarding: Clifton Dixon and PATS Tillage Equipment

We have a great working relationship with Mr. Clifton Dixon marketing his strip till equipment here in North Carolina. Clifton has been a great deal of help finding new prospects for us on large tillage tractors. We have sold 2 of his strip till units for delivery in 2000 and 10 units delivered this year. Our customers are very pleased with quality of the machines. Performance surpassed everyone's expectations. Three machines were 8-row on 3-pt hitch and the other machines mounted on a caddy 8 and 12 units. We have sold 2 Challenger tillage tractors and rented a Challenger 85E because of our exposure marketing the PATS machines. We have also provided a Challenger tractor for Clifton's demo's that gave us further exposure in the area. Thurston and Orthman Manufacturing, who build the components for the PATS machines, are recognized in the industry for providing very high quality products. Clifton is very knowledgeable in strip till agronomic's. Its has been a pleasure working with Clifton in providing our customers with a very high quality Conservation Strip Tillage machine and giving us the opportunity to sell our Cat tractors. If you have any questions please feel free to call me anytime.

Kelly Rubado
Ag Sales Rep
Gregory Poole Equip Co
1-252-944-6233 Mobile No.

Raleigh
4807 Beryl Rd.
Raleigh, NC 27606
800-451-7278

Fayetteville
US Highway 301 S. & NC 59
Hope Mills, NC 28348
800-362-7278

Washington
US Highway 17 at Springs Rd.
Washington, NC 27889
800-645-7278

Wilmington
151 Backhoe Rd. N.E.
Leland, NC 28451
800-641-7278



**Carlton Company King
Air Wilson-Rocky
Mount, NC Airport
Thursday, June 15, 2000**

**Gregory Poole & Carlton
Demonstration Boseman
Farms
Battleboro, NC**

Special Guest

Zack Geer
Carlton Company
Byrl Harrell
PATs
John, Jr. & Gary Dawson
Farmers,
Hawkinsville, GA
Jim & Teel Warbington
Farmers, Vienna, Georgia
Ronnie Lee
Farmer, Dawson, GA
Layton W. Jensen
President, Thurston
Manufacturing Co.,
Thurston, NE



Above - Cotton planted on Boseman Farms with PATs

Below - Guests observe beans being planted behind wheat on Boseman Farms



June 13, 2001

Mr. Clifton Dixon
133 Oakmont Drive, Suite 8
Greenville, North Carolina 27858

Dear Clifton:

We are finishing up our planting season in southwest Georgia at this time, and I wanted to give you an update on the eight PATs units delivered to our customers.

These units have done an excellent job during this season. As you know, once again, we have had less than adequate moisture and our customers are crediting their PATs units for good stands of cotton and peanuts.

We feel these units are an excellent match with our "Caterpillar" Challenger Tractors. The Caddy System's ability to remove the weight from the three point hitches has solved many of our problems.

In short, we feel that a "Caterpillar" pulling a PATs Unit is a quality tractor pulling a quality implement.

We appreciate your efforts.

Sincerely,

CARLTON COMPANY

Sid W. Barge
Senior Vice President/Sales

SWB/bsm



Albany, Georgia 31702 P.O. Box 1067 912-435-6262	Baxley, Georgia 31513 Box 462 912-367-0068	Brunswick, Georgia 31521 Box 310 912-265-5010	Dublin, Georgia 31040 Box 909 912-272-1661	Savannah, Georgia 31402 Box 1058 912-964-7150	Valdosta, Georgia 31603 Box 1651 912-242-6510
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PATS last full year was 2005. On the following pages you will see that I:

- 1 – Put in rip-strip-till tobacco with UT & UKY.
- 2 – Cut and pulled cotton stalks with Texas A & M.
- 3 – Had proposed cotton stalk research with MSU.
- 4 – Put in cotton stalk cutting research with VT / VSU.

I drove over 93,000 miles and spent 230 nights in hotels that year and loved every minute of it.

The reason I am presenting this is to show my commitment help the agricultural community and universities to build & modify existing equipment to help improve the farmer's bottom line.

I have been working on pulling cotton roots since 1992, when Hodge Kitchin told me of the need to get the cotton roots out of the harvested peanuts and off of his ripper shanks.

This has led to my quest for the last 24 years to develop a system with the equipment to economically chop the cotton stalks up and get the roots out of the ground!

I am getting very close to making this quest a reality. I have accomplished this by building countless prototypes.

November 1, 2005

John McCoy
Orthman Manufacturing
Lexington Nebraska

Dear John,

I am writing this letter to inform you of some research and demonstration work as well as express my interest in working with the PATS (Precision Application Tillage Systems) tillage system developed by Clifton Dixon. Many of our Delta soils in Mississippi respond positively to deep tillage. We have documented benefits in several research studies at the Delta Research and Extension Center at Stoneville, MS. With the increasing fuel costs many growers are looking for ways to cut fuel usage by cutting inputs and trips across the field.

The PATS system appears to be a tool that would allow producers to transform many operations into a one-time-over system thus reducing fuel and labor costs. Nematodes, particularly the Reniform nematode populations are increasing at drastic rates every season. Another reason I am interested in this system is because the implement has the ability to roll the roots out of the ground and move the row over where the middle was the previous season. This idea has tremendous possibilities in placing the cotton roots in areas less affected or populated by nematodes, thus possibly increasing yield. Also with this piece of equipment we would be able to apply Telone, currently one of the best chemical methods for suppression of our nematode population across an entire field or site-specifically by linking the system with GPS software. This will be the first year that I will have hands-on experience with the PATS technology, however I have heard positive comments from several growers in Mississippi and other states that are currently using PATS. I plan to work with Mr. Dixon and his PATS system in two different cotton production areas of Mississippi this year. I also have plans on working with wheat cover crops, hopefully with the help of the NRCS in conjunction with the PATS system to help decrease fall and winter soil erosion. I believe this research with the PATS system will be a good step in providing sustainability in cotton production on some of our problem fields in Mississippi. If you would like to talk further on this topic please do not hesitate to get in touch with me. I would like to get some feedback on experiences you may

have with the PATS system. I will be happy to share with you any data or findings from this research if you are interested.

Sincerely,

Tom Barber
Cotton Specialist
Mississippi State University Extension Service

Thomas Barber
Extension Cotton Specialist
Department of Plant and Soil Sciences
117 Dorman Hall box 9555
Mississippi State, MS 39762
Office: 662-325-2701
Fax: 662-325-8742
Email: tbarber@ext.msstate.edu



Texas Agricultural Experiment Station

THE TEXAS A&M UNIVERSITY SYSTEM

10345 Agnes St.
Corpus Christi, TX 78406-1412
Phone: 361/265-9201 Fax: 361/265-9434
Web: <http://ccag.tamu.edu>

Agricultural Research and Extension Center at Corpus Christi

June 27, 2005

Mr. Clifton Dixon
133 Oakmont Drive Suite 8
Greenville, N.C. 27858

Dear Clifton:

Thank you for stopping by the Texas A&M Agricultural Research & Extension Center at Corpus Christi on June 23, 2005.

As I indicated to you the TCE Agronomist (Dr. Steve Livingston) and the Nueces County Cooperative Extension Agent (Mr. Harvey Buehring) were out of town and could not meet with you on that day. I will visit with these two gentlemen to see if they could assist with setting up a possible demonstration of your strip-till equipment on a cotton producer farm following harvest which would most likely be in late July or early August.

Again, thank you for showing us the video and leaving the materials with us.

Sincerely,

Dr. John E. Matocha
Professor, Soils and Plant Nutrition

Cc: Dr. Steve Livingston, Mr. Harvey Buehring



The Texas A&M University System

710 East Main Street, Suite 1
Robstown, Texas 78380-3148
August 5, 2005
Telephone 361 767-5223

Clifton Dixon
133 Oakmont Drive, Suite 8
Greenville, North Carolina 27858

Dear Clifton:

Enclosed is my business card as promised. We appreciate your interest in the farming practices of our area and sharing the experiences you have had in developing tillage equipment to meet the changing needs of today's low margin farming operations. David Shubert of Kingsville has expressed an interest in the equipment you demonstrated in Nueces County on August 4 & 5.

If you are planning a return trip next summer, we will get you in contact with David who farms on 36" banded rows.

I also want to thank you for the copy of the video you made of your plow during the demonstrations in Nueces County. I will share it with Mr. David Mayo and others who may be interested.

Sincerely,

Harvey L. Buehring
County Extension Agent AG/NR
Nueces County

HLB:mh

Virginia Cooperative Extension Field Trial
Bruce and Larry Whitley Farm, Sedley, Virginia
2005-2006

Dr. Wade Thomason, Virginia Tech Small Grain Specialist
Clifton Dixon, Owner/Developer of PATS/CRP
Wes Alexander, Extension Agent ANR
Bruce Whitley, Operator

October 7, 2005

Clifton Dixon
133 Oakmont Drive
Greenville, NC 27858

Dear Mr. Dixon:

I am excited about working with you and the Whitley's on a deep tillage system utilizing your CRP invention. Dr. Wade Thomason, Virginia Tech Grain Specialist, has agreed to work with us as principal investigator.

This trial will give us invaluable information to sustain profitability in agriculture.

An additional benefit will be information gained useful in compliance with NRCS and the cost share continuous no-till program.

Attached is an outline of our proposal.

Sincerely,



Wes Alexander
Extension Agent

- Objective: 1. Compare broadcast vs drilled wheat
2. Compare conventional discing, no-till and CRP (deep tillage)
3. Compare the economics of all treatments
4. Carry over effect of tillage on double cropped soybeans

<u>Trt No.</u>	<u>Treatments</u>	<u>Width</u>	<u>Comparisons</u>	
1	Disc/Broadcast Wheat/Field cultivator	48-50'	1 vs 2,3,4,5	All vs. Standard
2	Mow, Disc, Drill	30'	2 vs 1	Drill vs. Broadcast
3	Mow/NT Drill wheat	30'	3 vs 1,2,4,5	Adv. of Ripper?
4	PATS CRP Ripper Tool/drill wheat	30'	4 vs 1,2,3,5	Adv. of Ripper/Drill?
5	Broadcast Wheat/PATS CRP Ripper Tool	48-50'	5 vs 1,2,3,4	Adv. of Ripper/Broadcast?

PATS = Precision Application Tillage Systems
CRP = Cut Rip and Pull

Wanda Wade

From: "H P Denton/PRO/PS/EXT/UTIA" <pdenton@utk.edu>
To: <bbasics@cox.net>
Sent: 07/06/2005 10:10 PM
Attach: Dixon letter - tobacco letter strip-till.doc
Subject: letter for Clifton Dixon

Paul Denton
 Professor and Extension Burley Tobacco Specialist
 University of Tennessee

(865)974-8839 phone
 (865)974-1947 fax

Dear Clifton,

Attached is the letter you requested from me concerning our experiences with strip till tobacco. Look at this and let me know what you think.

(See attached file: Dixon letter - tobacco letter strip-till.doc)

Paul Denton
 Professor and Extension Burley Tobacco Specialist
 University of Tennessee

(865)974-8839 phone
 (865)974-1947 fax

Wanda Wade

From: "Bob Pearce" <rpearce@uky.edu>
To: <bbasics@cox.net>
Sent: 07/05/2005 12:33 PM
Subject: message for Clifton Dixon

July 5, 2005

To: Clifton Dixon

From: Bob Pearce
 Extension Tobacco Specialist
 University of Kentucky

Re: plot update

I just wanted to update you on the status of the conservation tillage tobacco plots at the Spindeltop research farm in Lexington, Kentucky and the on-farm trial in Taylor County. The plots in Lexington were transplanted approximately two weeks after tillage with the PATS machine. The transplants established and grew well for about 3 to 4 weeks. Since then we have experienced hot dry weather and have begun to irrigate. Currently the plants are just over knee high. At this stage I have not observed any growth differences when comparing the no-till tobacco with the strip tillage where we ran the PATS machine. We will continue to monitor these plots and will harvest them for a yield determination at the end of the season.

I worked with Alvin Bright at his farm in Taylor County last week. The tobacco that he planted first was doing very nicely, it was over waist high and will likely be ready to top in 2 weeks. His later tobacco was also growing well including the crop he planted in the pasture field behind the barn. In the areas where we had run the PATS machine I could not see any obvious growth differences, but we will continue to watch these plots and make a yield determination.

There are a lot of tobacco growers who are interested in conservation tillage, but may not want to go completely no-till. The PATS system could be a tool for such growers to consider. We certainly appreciate your assistance in establishing these plots, and I look forward to sharing the results with you and working with you on future trials.

Dr. Bob Pearce
 Extension Tobacco Specialist
 (859)-257-5110
<http://www.uky.edu/Ag/Tobacco>

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For their assistance in the layout and printing of this booklet!