

AN INVITATION TO MANUFACTURE THE "VINE-ROW"

INTRODUCTION

- (a) Purpose of bulletin
- (b) Brief statement of the machine and its use

SWEET POTATO VINES AS A LIVESTOCK FOOD

(prepared by Horticulture Dept.)

- (a) Yield and food value
- (b) Silage
- (c) Dehydrated product

DESCRIPTION OF THE "VINE-ROW"

- (a) Mechanical
- (b) Horse or tractor power

ANALYSIS OF THE LIFTING AND WINDROWING ACTION

FIELD OPERATION

- (a) For small farmer
- (b) For large operator
- (c) What farmers will use

PERFORMANCE

- (a) Labor saved
- (b) Damage to roots
- (c) Vines saved

OTHER USES

- (a) Side delivery rake

PATENT

CONSTRUCTION DETAILS

- (a) Working drawings
- (b) Bill of material

INVITATION

- (a) To view machine in operation
- (b) To submit a proposition for manufacture

1. analysis of steel
2. shape of potato row
3. potential market ask weaver.
4. See Ellis

Potential Market and other possible uses

RYERSON *Certified*
ALLOY STEEL

DEFECTED

Date 4/30/46

Inspector E. W. Haskell

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Charged to			North Carolina State College Mr. Giles Raleigh, North Carolina		Salesman		Date Shipped <i>4-22-46</i>		Approval	
Shipped to					Order No.		Terms Cash		Invoice No.	
					Date Sold <i>4/23/46</i>		Shipping Clerk <i>P. J.</i>		Branch No.	
			Shipped Via				Billing Instructions		Date Billed	
			Received by							
Ordered	Check	Shipped				Weight	Price	Gross	Discount	Net
100	<input checked="" type="checkbox"/>	<i>108</i>	ft. 7/16" Round Cold Finished NE-8742 Steel in 12' lengths The analysis of this steel is as follows: Tensile Strength PSI 109,000 Yield Point Psi 59,000 % Elong. in 2" 20.5 % Red. of Area 48.2 Hardness - Brinell 363 Rockwell C 38							
						Items ordered not included in this delivery are being secured for earliest delivery.				
						Our COUNT must be accepted unless errors are reported in five days.				
						Cancellation of or deferred shipments on order placed with us can only be made with our consent and upon terms that will indemnify us against loss.				

PACKING SLIP

Design Data

Vine-Row - 1976

Concerning - Finger wheel, steel for

(A) $\frac{1}{2}$ " Round cold drawn steel

S.A.E. 1020

OV N.E. D1112

price .085/lb

yield point = 78,000

Tensile str = 69,000

Elong in 2" = 30%

Reduction Area = 63%

Brinell Hardness = 194

(B) Wearweld Coating

Rockwell C Hardness = 75

(C) $\frac{7}{16}$ " Round ~~to~~ Low Alloy Steel

N.E. 2702, see attached

Let

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RALEIGH, N.C.

April 17, 1946

STORES
S. WEST ST., RALEIGH, N. C.
CHURCH ST., DURHAM, N. C.
S. CHURCH ST., ROCKY MOUNT, N. C.
E. MULBERRY ST., GOLDSBORO, N. C.

Mark Reply-
Attention: P. M. Grubbs

N. C. State College
Raleigh, North Carolina

ATTENTION: Mr. Giles

Gentlemen:

With reference to our recent conversation with you concerning some 7/16" Diameter Round Steel.

Please be advised we were unable to get the Inland Hi-Steel for which you inquired, our supplier stating that none of this is available at present in 7/16" Diameter Round.

Our Supplier, however, has offered an alternate which he believes may prove acceptable, agreeing to furnish 100 feet of 7/16" Round Cold Finished NE-8742 Steel in 12' Lengths. The analysis of this steel is as follows:

N.E. 8742
Carbon - 18-20%
Mn. - 70-90
Phos - .07
Sulph - .04 max.
Silicon - 20-.35
Ni. - .70-.70
Cr. - .40-.60
Moly - 20-.30

Tensile Strenght Psi	- 109,000	93,000
Yield Point Psi	59,000	58,000
% Elong in 2"	20.5	27
% Red. of Area	48.2	52
Hardness - Brinell	363	190
Rockwell C	38	9

We can furnish you the above steel at price of 9¢ per pound delivered to you and shall appreciate an order for your requirements.

Yours very truly,

DILLON SUPPLY COMPANY

P. M. Grubbs

SALES MANAGER



GEHL BROS. MANUFACTURING CO.

H. M. GEHL, PRESIDENT
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Silo Fillers • Hammer Mills • Coal Stokers

PHONE 175

WEST BEND, WISCONSIN

CABLE ADDRESS: GEHLFILLER

January 16, 1945

North Carolina State College of
Agriculture and Engineering
University of North Carolina
Raleigh, North Carolina

Attention: G. W. Giles Associate Professor

Dear Sir:

We have your letter with further reference to the pick-up machine and will say that we are enclosing two photographs, one showing the machine picking up alfalfa green for grass silage and the other dry alfalfa.

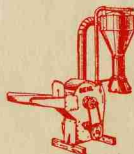
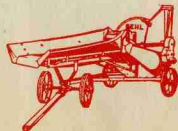
If this isn't exactly what you want, then I wish that you would let us hear from you again.

Yours very truly,



SALES MANAGER

MLG:ME
ENC.

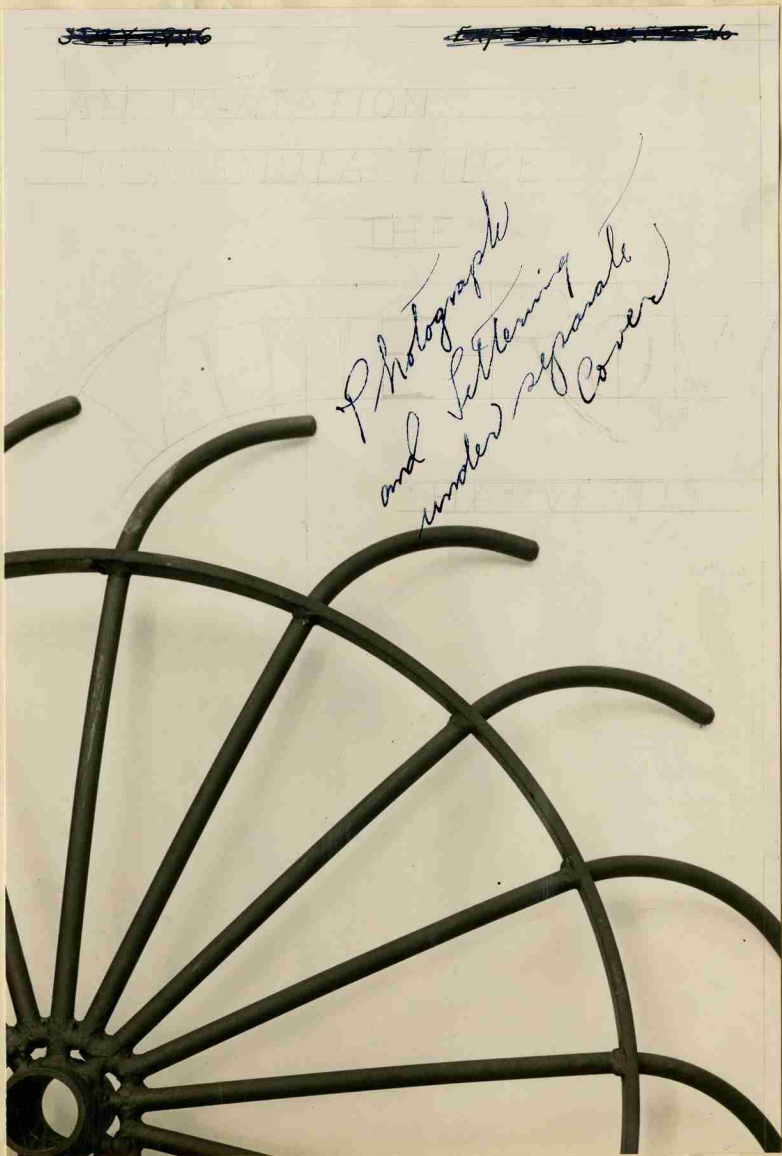


COPY NO. 1

An Invitation to Manufacture the Vine-Row
Photographs Under Separate Cover

Cover Page
6" x 9" Bulletin

5011



INVITATION

You are cordially invited to inspect this machine and to observe it in operation during the month of October 1946. Kindly arrange in advance for an appointment by communicating with:

G. W. Giles
N. C. State College
Raleigh, N. C.

You are cordially invited to submit for consideration a proposition for the manufacture of the "Vine-Row" and its adaptations on or before January 1, 1947. We would be interested in the following:

1. Brief history of the company and organization.
2. Type of machines presently manufactured.
3. Engineering personnel.
4. Production capacity listing manufacturing activities that must be sub-let.
5. Royalty.
6. Number and date for the production of the first experimental machines.
7. Estimated retail cost under present conditions.
8. Method of marketing and area covered.

AN INVITATION TO MANUFACTURE THE VINE-ROW HARVESTER

By

G. W. Giles
Professor of Agricultural Engineering

INTRODUCTION

This bulletin has been prepared to supply the farm implement industry with information on a new machine and a harvesting method developed by the N. C. Agricultural Experiment Station and now released for manufacture. Through this bulletin the N. C. Agricultural Experiment Station invites any interested company or person to submit a proposition for its manufacture.

The "Vine-Row" harvester shown in Fig. 1 was developed to facilitate the harvesting of sweet potato vines. This machine was developed because the vines offered a good source of a large quantity of high quality livestock feed. The vines have been successfully used as silage and their use as hay or as a dehydrated feed seems probable. The harvester is extremely simple and should be inexpensive to manufacture. The machine and the method of use, may be easily adapted to both the large and small grower. There is no machine on the market at the present time for harvesting sweet potato vines. A tractor-operated machine, however, has been developed. (1)

(Bleed Bottom & Outer Edge)

Fig. 1 The Vine-Row Harvester

SWEET POTATO VINES AS LIVESTOCK FEED

"The meat and dairy industries in the South can expand no faster than feeds are made available. For this reason, every effort should

(1) A Machine for Harvesting Sweet Potato Vines. Agricultural Engineering Vol. 27, No. 7 PP 303,304 July 1946, O. A. Brown.

be made to conserve and use all available feed crops. This is particularly true for sweet potato vines, since thousands of tons are wasted in southern growing areas each year." (2)

Sweet potato vines make an excellent feed. Although there is a rather general local use of the vines for a short period near the time of harvest of the potatoes, this is limited in extent. The vines could be harvested just before potato digging time and made into silage, dehydrated meal or hay. These products could be used as feed at any time of the year, and such practices would permit the saving of the entire vine crop.

"The green weight yield per acre of sweet potato vines, at the time the crop is harvested, will vary from 10 to 15 tons per acre. Recent feeding trials made at the North Carolina Agricultural Experiment Station have shown that good silage can be made from sweet potato vines, or a mixture of vines and roots. In fact, this silage has been shown to be as good as corn silage for feeding dairy cattle." (2)

"Winter roughages are often deficient in carotene (pro-vitamin A). Since sweet potato vine silage is rich in carotene, it is especially valuable as a winter feed in the South. Because sweet potato vine silage is highly palatable, stock will usually eat more roughage on the dry basis when fed both silage and hay, or other dry forage, than when receiving only dry feed. Its slight laxative effect on cattle is especially beneficial when legume hay is not available. Once animals are accustomed to the silage, it is eaten with practically no waste." (2)

(2) Quoted from "Sweet Potato Vine Silage", Circular #3, October 1944, North Carolina Agricultural Experiment Station.

From a nutritive standpoint sweet potato vine hay would compare favorably with many legume hays. However, unchopped or uncrushed vine stems dry very slowly, and for that reason it will probably be necessary to perform a separate machine operation of chopping or crushing to properly cure the vines.

Sweet potato leaves and vine terminals are being used in the preparation of mixed feeds. The entire vine may be utilized in a similar manner with proper harvesting equipment, and the dehydrated product would compare favorably with that of other dehydrated feeds.

DESCRIPTION OF THE "VINE-ROW"

The "Vine-Row" shown in Figure 2 straddles one hilled row of potatoes. Two sets of knives spaced approximately seven inches apart cuts the vines loose from the potatoes three and one-half inches on each side of the center of the row. Concave spoked wheels set at an angle to the direction of travel and having specially designed fingers lift the vines from the ground surface and move them into a windrow in the valley between two hilled rows.

The individual finger wheels are floating and will automatically fit themselves to variable bed heights. In operation it requires few adjustments.

The 1946 model as described in this bulletin is horse powered. However, the principle of operation may easily be adapted to a machine designed for tractor power.

(Bleed top, bottom and outer edge)

Fig. 2 Above: 1946 Model "Vine-Row" with tools set for transportation.
Below: Tools set for working position.

ANALYSIS OF THE LIFTING AND WINDROWING ACTION OF THE FINGER WHEEL

(Bleed outer edge)

Fig. 3 The resulting action of the finger wheels

A view illustrating the action of the finger wheels is shown in Fig. 3. It will be noticed that the point of each finger is dragged thru the soil a short distance parallel with the axle on which the wheel revolves. This action occurs because the wheel is set diagonally to the direction of travel and its velocity is slower than the velocity of the machine. The velocity of the toothpoint with respect to its axis will be a function of the cosine of the angle that the wheel makes with the direction of travel. By composition of the velocity vector quantities the resultant velocity will be parallel with the wheel axle. This drag stroke operation of each point lifts the vines where they are rooted in the soil and moves them at an angle to the direction of travel or to the row of potatoes. It will be further observed that the wheel is concave. This encourages the point of the tooth to slide under the vines. A convex tooth or even a straight tooth would tend to drag over the top of the vines. Each finger is curved backwards from its direction of rotation and in the plane of the wheel so that it sheds the vines soon after the end of the drag stroke.

Fig. 4 shows graphically the effective drag strokes made by a 30" finger wheel with its axis inclined 55 degrees from the line of travel. The finger points in the end view of the wheel that are in

contact with the soil are simply projected to a horizontal plane passing thru the wheel and its axle. The resulting drag strokes would occur on flat, level ground. An explanation of the symbols is as follows:

alpha α = angle between axis of wheel and line of travel = 55°

R = radius of finger wheel = 15"

Beta β = angle between respective fingers or spokes of wheel = 20°
for 18 fingers

theta θ = angle between plane of wheel and direction of travel = $90^\circ - \alpha$

Y = perpendicular distance between respective drag strokes

X = length of the drag stroke

Z = effective width covered by a finger wheel

For determination of Y refer to Fig. 4 B

$$\sin \beta = \frac{Y}{R} \quad \text{or } Y = R \times \sin \beta$$

substituting $Y = 15 \times .34 = 5.1$ inches

For determination of X and Z refer to Fig. 4 A

$$\tan \theta = \frac{X}{2 \times Y} \quad \text{or } X = \tan \theta \times 2Y$$

substituting $X = .7 \times 10.2 = 7.14$ inches

$$\sin \theta = \frac{Z}{2Y} \quad \text{or } Z = 2Y \sin \theta$$

substituting $Z = 10.2 \times .57 = 5.8$ inches

These calculations are purely theoretical. Under actual operating conditions the finger wheel will revolve slower due to the resistance caused by the vines. The resulting effect causes an increase in the value of X. Y and Z are not changed.

The following factors affect the pattern of the drag strokes:

1. Depth of penetration of the finger points in the soil.
2. Resistance of the vines as affected by their weight and by the strength of their secondary root system.
3. Diameter of the finger wheel.
4. Angle α

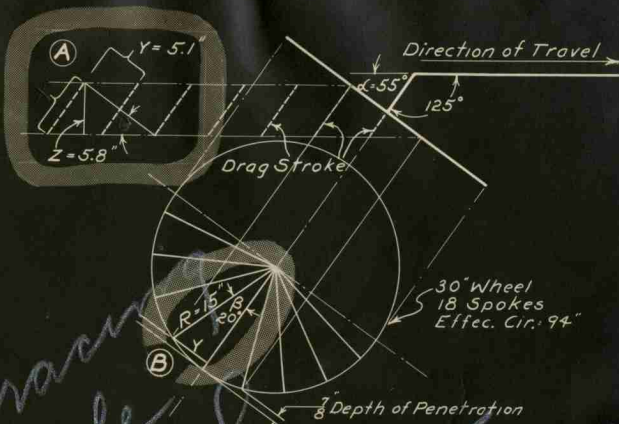


FIG. 4

*Track
will be
furnished
for cut*

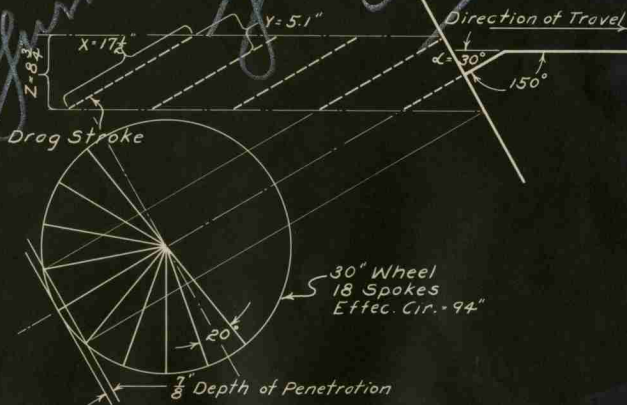


FIG. 25

Fig. 4 and Fig. 25

Increasing the depth of penetration will increase X and Z. The factor Y is little influenced. In the above calculations a depth of $7/8$ inches was assumed. This is approximately the working depth for the Vine-Row. It is influenced by the weight of the wheel, firmness of the soil and the resistance of the vines since the line of draft for each individual wheel is necessarily upward.

Greater resistance of the vines will decrease the speed of the finger wheel causing an increase in the value X. The value Z and Y are not influenced.

Increasing the diameter of the wheel will increase the value of Y for any given number of spokes. It will also increase both X and Z values. This offers the best method of increasing the harvesting efficiency of the machine. Along with a larger diameter the angle may be decreased without the possible trouble of vines wrapping around the wheel. However, one must not overlook the fact that the larger wheel will necessitate heavier construction and a larger machine, with the resulting greater cost.

Decreasing the value of α will increase the value of X and Z. A graph showing the pattern for a 30 inch wheel set 30 degrees from the direction of travel is illustrated in Fig. 5. It will be observed that the pattern of the drag strokes covers a greater area and is more effective in covering that area. However, difficulty will be encountered with the wheel rotating and thus moving the vines to the side and also in shedding vines at the end of the drag stroke if it does rotate. Field experience indicated that the 55 degree angle is ideal for a 30 inch wheel operating under most conditions.

Fig. 6 Experimental Finger Wheel

Figure 6 shows an experimental wheel in which the curved ends of

the fingers are set parallel with the wheel axis, or the drag stroke, and by cam action are rotated 90 degrees soon after the end of the drag stroke in order to properly shed. This wheel was tried only at the 55 degree angle and did no better than the regular wheel (See Fig. 7). The complicated construction would materially increase the cost of the machine. Experimental work will be continued.

(Bleed outer edge and either top or bottom)

Fig. 7 Experimental wheel in use

(Bleed outer edge and either top and bottom)

Fig. 8 Vines are Moved to the Valleys on the First Trip

FIELD OPERATION

Fig. 8 shows the harvester being used to windrow the vines in the valley. Where potatoes are grown on wide rows, or where the vines are rooted down in the valley, a second trip may be necessary to completely loosen all the vines. If a second trip is necessary, both sets of wheels are adjusted outwardly. For the farmer with a small acreage the vines may be picked up by fork from the windrow as they lay in the valley, or they may be raked first into piles and forked afterward into a wagon. The windrow is important for it permits wilting the vines for a short period. The moisture content is relatively high on sweet potato vines, being too high to make ideal silage. Wilting the vines for a long period cannot be done successfully because of relatively slow loss of water from the stems as compared with the leaves.

One of the big advantages is the way the "Vine-Row" may be fitted into a method of harvesting for both the large and small grower.

The farmer with a large acreage may use a pick-up type of commercial forage crop harvester or chopper as shown in Fig. 9.

(Bleed outer edge and either top and bottom)

Fig. 9 Commercial chopper may be used to pick up vines from a windrow.

When the commercial chopper is to be used the fingered wheels on the "Vine-Row" are interchanged and a second trip is made to move two windrows together on the top of one bed. (See Fig. 10). This resulting windrow may again be allowed to wilt and is of a size suitable for the

(Bleed outer edge and either top and bottom)

Fig. 10 Two windrows may be brought together on top of the bed. Note that the finger wheels are interchanged.

chopper and is in a better position to be picked up. The finger wheels might well be designed to mount on the front of a field chopper so that the separate operation of bringing two windrows together may be eliminated. The field chopper is a very popular machine and is one of the most important labor saving machines for the harvesting of grass silage and hay. It may be used to particular advantage in the case of sweet potato vines, for the chopped vines are much easier to unload at the silo. Unchopped vines are difficult to unload and feed into an ensilage cutter.

PERFORMANCE

Preventing mechanical injury to the potato was an important objective in the design of the machine. Tests indicate that no more than 4 per cent damage occurs to the potatoes by the Vine-Row. The greater percentage of the damage was done by the parallel knives. A knife cut is not as serious as a bruise as it heals readily. This damage is considered to be only slightly more than that done by present vine cutters attached to the beam of the plow when the potatoes are dug. This method

of harvesting the potatoes however, will cover up the vines and will not permit them to be saved for feed.

Observations indicate that approximately 80 per cent of the vines are saved by the use of the "Vine-Row".

ADDITIONAL USES AND MARKET POSSIBILITIES

The "Vine-Row" may prove valuable for the grower who harvests his potatoes with a mechanical type digger. The vine removal problem has always been important when mechanical diggers are used. Removing the vines by hand, regardless of the purpose, is time consuming and has no place in efficient mechanized farming. It is estimated that 30 man hours per acre are required to cut the vines with a hoe and pull to the middles. The "Vine-Row" will do this job in approximately one and one-half hours per acre.

A certain percentage of farmers who usually dig their potatoes by plowing them out may want one of these machines for removing the vines previous to digging. Their present method is to remove the vines by hand or to drag them off by hay rakes or to use a vine cutter attached to the beam of a plow. (3) Most farmers who are not interested in saving the vines will find this type of vine cutter satisfactory. Where one is not saving the vines for feed, the cutter permits the vines to be covered up during the same trip for digging, and they are thus returned to the soil.

- (3) Plan #548 - Sweet Potato Vine Cutter for Middle Buster, Dept. of Agricultural Engineering, N. C. State College, Raleigh, N. C.

It is difficult to estimate the sales potential for the Vine-Row. Table I gives some data on sweet potatoes in North Carolina that may be of help. Table II gives the total 1945 acreage in sweet potatoes for the important potato producing states.

TABLE I
SWEET POTATOES - NORTH CAROLINA 1943

	<u>.1 - .4</u> Acres	<u>.5 - .9</u> Acres	<u>1 - 2.9</u> Acres	<u>3- 9.9</u> Acres	<u>10 acres and over</u>
No. Farms -	26,512	14,559	11,442	2,183	139
Total Acres -	7,121	10,092	17,731	10,504	2,155

(Data on the individual counties for the state may be had upon request.)

TABLE II
SWEET POTATO ACREAGE - 1945

1. Louisiana	123,000 acres
2. Georgia	89,000 "
3. Alabama	75,000 "
4. Mississippi	68,000 "
5. North Carolina	66,000 "
6. South Carolina	62,000 "
7. Texas	52,000 "
8. Virginia	31,000 "
9. Tennessee	30,000 "
10. Arkansas	20,000 "
11. New Jersey	15,000 "
12. Kentucky	14,000 "

The sweet potato is one of the south's most important crops, both from the standpoint of food and feed. Table I will show that the bulk of the acreage in North Carolina is now produced in plots less than 10 acres. It is expected that with the rapid expansion of commercial dehydration plants and with mechanization of the crop that the plot size will increase. The utilization of the vines makes almost complete utilization of the crop possible.

The "Vine-Row" was developed primarily for the harvesting of sweet potato vines, but it is thought that the principle of operation may have other farm field uses such as windrowing hay.

(Bleed outer edge)

Fig. 11 Experimenting with the Vine-Row in hay

Such a machine (See Fig. 11)utilizing this principle of fingered wheels would seem to have the following advantages:

1. Each spoked wheel is independent and floating and would fit uneven land such as caused by terraces. The lack of flexibility is the most serious objection to the present side delivery rakes.
2. No complicated and expensive power drives from ground wheels.
3. The amount of hay placed in a windrow may be varied by adding or decreasing the number of fingered wheels or by adjusting their spacing on a tool bar.

PATENT

Steps have been taken to secure patent protection for this machine and its principle of operation.

CONSTRUCTION DETAILS

The design on the following pages is for the 1946 Vine-Row and is included for the manufacturer's study and to aid in making up an estimated production cost. It is assumed that the company who is awarded the manufacturing rights will change and improve on the design in order to get the best production method based on the equipment and processes used in their plant. The rubber tires used on the 1946 model as shown in Fig. 2 are not considered desirable. They were substituted when it became impossible to secure standard farm implement tires.

(Bleed outer edge)

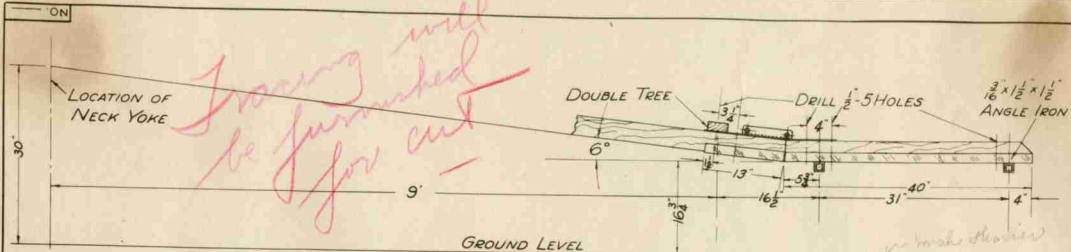
Fig. 12 Testing the wear on the fingers

FRAME ASSEMBLY

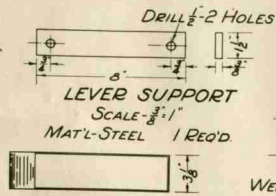
Picture A - on left hand page opposite from

Drawing Sheet 1.

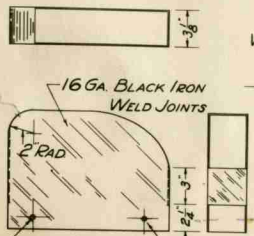
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Ironing will be furnished for cut

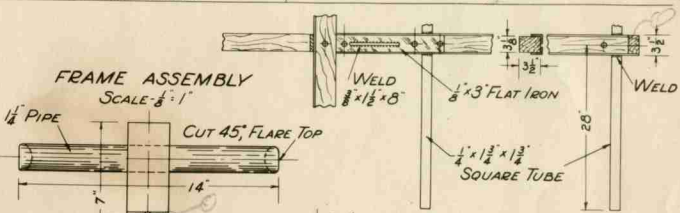


LEVER SUPPORT
SCALE $\frac{3}{8}''=1''$
MAT'L-STEEL 1 REQ'D

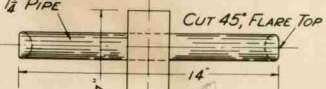


FOOT REST
SCALE $\frac{3}{8}''=1''$
MAT'L-STEEL 1 REQ'D

DRILL $\frac{1}{2}''$ BOTH SIDES
FOR NO 12 $\frac{3}{4}''$ R.H. WOOD SCREW
TOOL BOX
SCALE $\frac{1}{4}''=1''$ 1 REQ'D



FRAME ASSEMBLY
SCALE $\frac{1}{2}''=1''$



SEAT SUPPORT
SCALE $\frac{1}{2}''=1''$ 1 REQ'D

VINE HARVESTER
DEPT. OF AGR. ENGR.
N.C. STATE COLLEGE

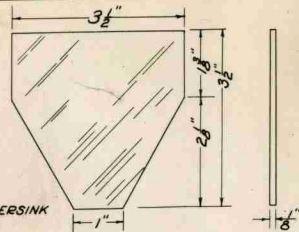
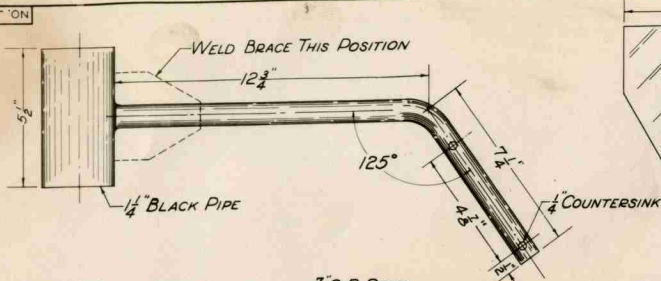
UNLESS OTHERWISE SPECIFIED
FRACTIONAL TOLERANCE $\pm 1/16$
DECIMAL TOLERANCE ± 0.010 ⁸⁴
ANGULAR TOLERANCE $\pm 1/2$

CH. NO.	CHANGE	DATE	BY

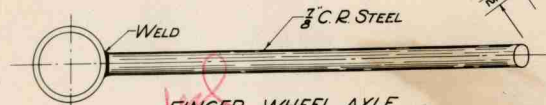
DRAWN BY	APP.
DATE	SCALE
DESIGNED BY	SHEET NO. OF 5

FINGER WHEEL AXLE

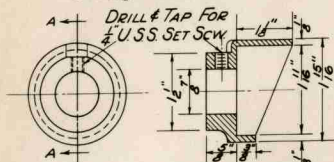
Picture B - on left hand page opposite Drawing Sheet 2.
To occupy entire page.



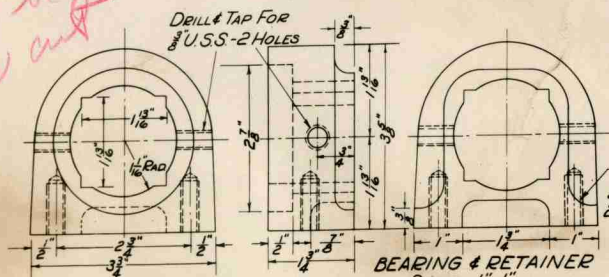
BRACE
SCALE - 1" = 1"
MATL - $\frac{1}{4}$ " MILD STEEL 4 REQ'D



FINGER WHEEL AXLE
SCALE - $\frac{1}{2}$ " = 1"
MATL - STEEL 4 REQ'D



SECTION A-A
FINGER WHEEL RETAINER
SCALE - 1" = 1"
MATL - CAST IRON 8 REQ'D



BEARING & RETAINER
SCALE - 1" = 1"
MATL - CAST IRON 8 REQ'D

*Trammy
will be printed
for cut*

VINE HARVESTER

DEPT. OF AGR. ENGR.
N.C. STATE COLLEGE

UNLESS OTHERWISE SPECIFIED
FRACTIONAL TOLERANCE $1 \frac{1}{64}$
DECIMAL TOLERANCE 0.010
ANGULAR TOLERANCE $1 \frac{1}{2}$ "

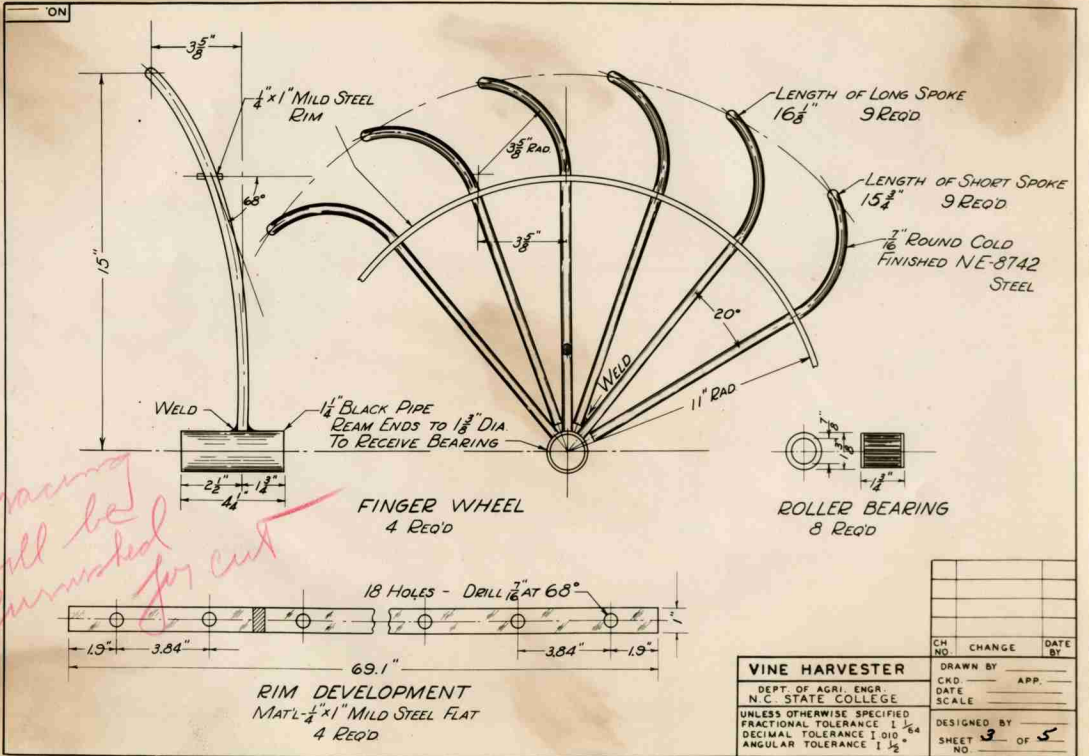
CH NO	CHANGE	DATE BY

DRAWN BY _____
CHKD. BY _____ APP. _____
DATE _____
SCALE _____
DESIGNED BY _____
SHEET 2 OF 5
NO. _____

FINGER WHEEL

SHOP SEQUENCE
IN THE
CONSTRUCTION OF
THE FINGER WHEEL

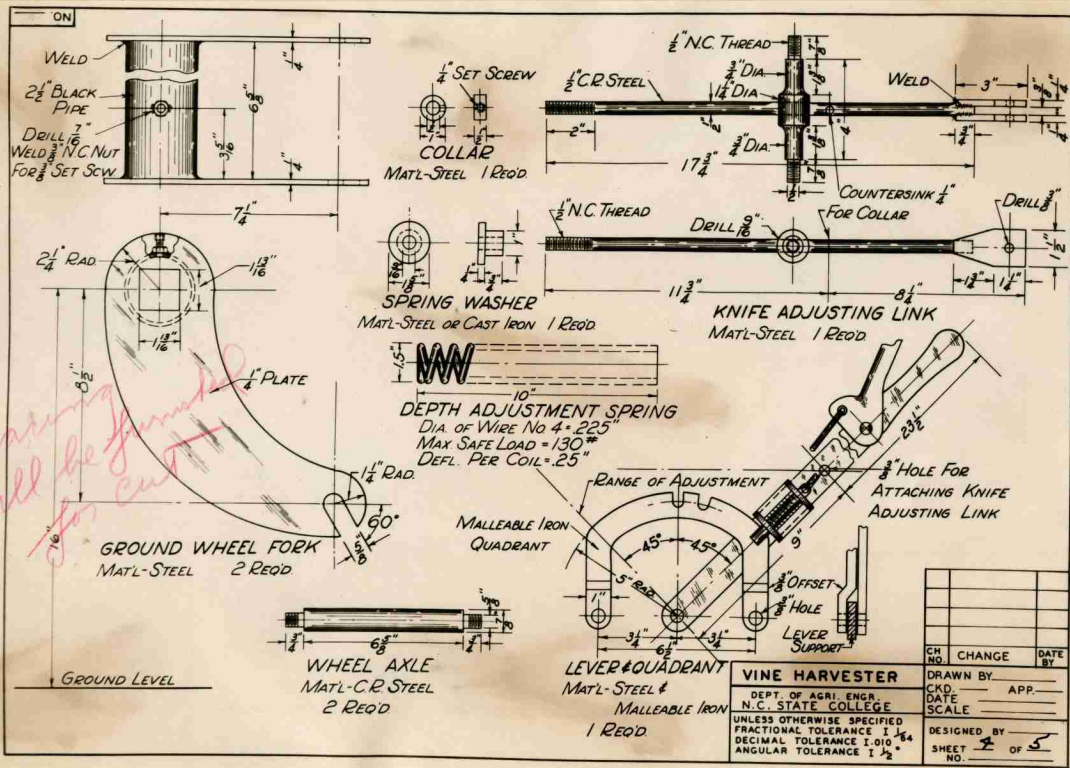
Picture C - on left hand page opposite Drawing Sheet 3.
To occupy entire page.



Tracing will be furnished for cut

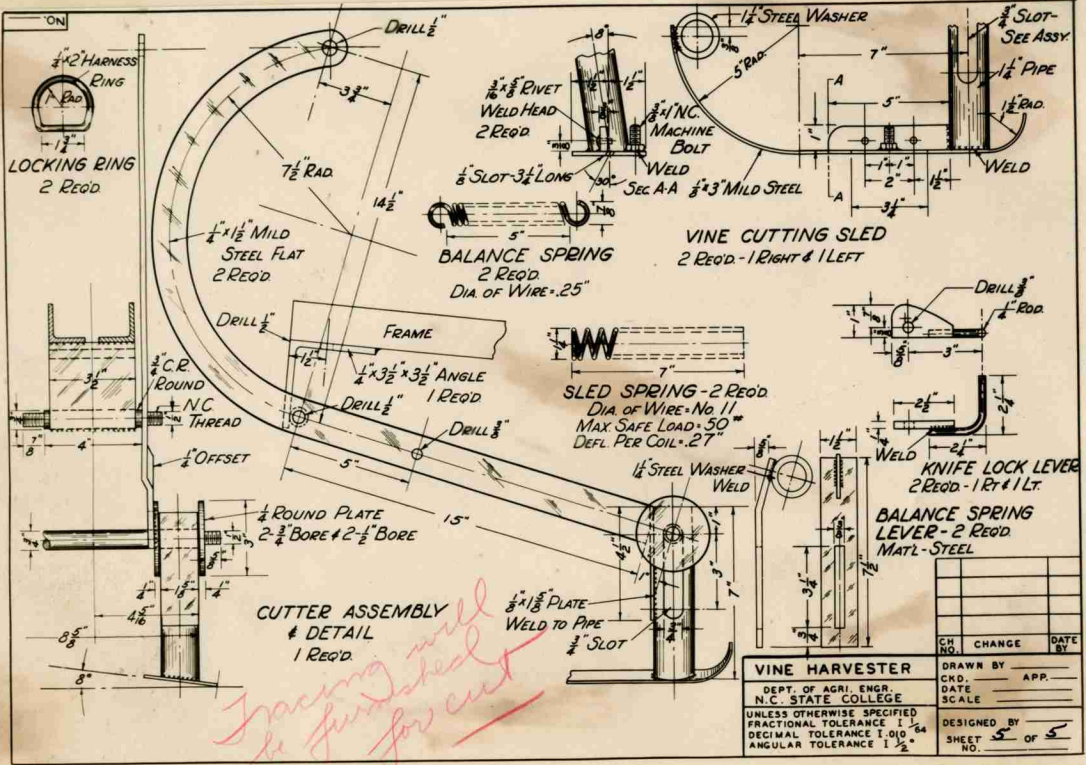
LEVER SYSTEM
AND
WHEEL SUPPORT

Picture D - on left hand page opposite Drawing Sheet 4.
To occupy entire page.



VINE CUTTERS

Picture E - goes on left hand page opposite Drawing Sheet 5.
To occupy entire page.



Tracing will be furnished for cut

BILL OF MATERIAL

<u>Pc. Work</u>	<u>Sheet No.</u>	<u>Description</u>	<u>Quantity</u>	<u>Material Kind</u>	<u>Size</u>	<u>Weight Total Pounds</u>	<u>Remarks</u>	<u>Mfgr's. Notes</u>
		15		11	9		13	
				<u>MAIN FRAME</u>				
1	1	Tongue	1	Wood	3"x3"x10-1/2"			
2	1	Double Trees	1	Wood or Steel	Standard	17#		
3	1	Frame, Wood	1	Oak	3-1/8"x3-1/2"x40"			
4	1	Frame, Metal	2	Steel Angle	3/16"x1-1/2"x1-1/2"x53"	15.8#		
5	1	Tool Bar	2	Steel Sq. Tube	1/4"x1-3/4"x1-3/4"	25#		
6	1	Lever Support	1	Flat Steel	3/8"x1-1/2"x8"	1.25#		
7	1	Foot Rest Assembly	1	Black St. Pipe	1-1/4"x14"	4.5#		
			1	Flat Steel	1/4"x2-1/4"x6-3/4"			
			1	Flat Steel	1/4"x2-1/4"x7"			
8	1	Tool Box	1	Black Sheet Iron	16 Ga.	6.2#		
					312 Sq.in.			
9		Wood Screws	4	R.H. Steel	No.12 3/4"		For mounting tool box	
10	1	Seat Support	1	Spring Steel	3/8"x3"x34"	10.2#		
11		Seat	1	Steel	Standard	4.2#	Commercial	
12		Carriage Bolts & Nuts	3	N.C.	1/2"x4-1/2"			
13		Machine Bolts & Nuts	1	N.C.	1/2"x7"		For double trees	
14		Carriage Bolt, Nut & Washer	1	N.C.	1/2"x1"		For seat	
					<u>Total Weight Assembled</u>	<u>141.5#</u>		
				<u>GROUND WHEEL & MOUNTING</u>				
15	4	Ground Wheel Fork Assembly	2			11.1#		
	4		2	Black St. Pipe	2-1/2"x6-5/8"			
	4		4	Flat Steel	1/4"x6"x14-3/4"			
	4		2	Set Screws, Sq. H.	3/8"x1-1/4"			
	4		2	Nuts, N.C.	3/8"			
16	4	Wheel Axle	2	1020 Round C.R.	7/8 x 8-1/8"			
			2	Nuts, N.C.	3/4"		For axle	

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BILL OF MATERIAL - cont'd.

<u>Pc. Work</u>	<u>Sheet No.</u>	<u>Description</u>	<u>Quantity</u>	<u>Material Kind</u>	<u>Size</u>	<u>Weight Total Pounds</u>	<u>Remarks</u>	<u>Mfr's Notes</u>
<u>GROUND WHEEL & MOUNTING</u>								
17		Wheel & Tire including bearing & seal	2	Implement tire	4:00-9	30#	Steel wirel may be used	
<u>FINGER WHEEL & MOUNTING</u>								
	3	Finger Wheel Ass.	4			70#		
18	3		4	Flat Steel	1/4"x1"x69.1"			
19	3		4	Black St. Pipe	1-1/4"x4-1/4"			
20	3		36	Round N.E.	8742			
22	3		36	Steel	7/16"x15-3/4"			
23	3	Roller Bearing	8	Ditto	7/16"x16-1/8"		Commercial	
	2	Finger Wheel Axle Assembly	4		7/8" x 1-3/4"			
24	2		4	1020 Round C.R.	7/8"x20"	26#		
				Steel				
25	2		4	Black St. Pipe	2-1/2"x5-1/2"			
26	2		4	Flat Steel	1/8"x3-1/2"x3-1/2"			
27	2	Finger Wheel Retainer	8	Cast Iron		5#		
28	2	Set Screw Socket	8	Cup point, Self locking	1/4"		Commercial	
29	2	Bearing & Retainer	8	Cast Iron		20.8#		
30	2	Set Screw	8	Sq. Hd.	3/8"x 1-1/4"		Commercial	
31		Felt Washer	8	Felt	7/8" dia. x 1-3/8" dia.		Not shown on drawing	
32	2	Lift Support "U"	4	Flat Steel	5/16"x1-1/2"x18"	9#		
		Cap Screws	16	N.C.	3/8"x1"		Commercial	
<u>LEVER SYSTEM</u>								
33	4	Lever	1	Steel	32")	6#		
34	4	Quadrant	1	Malleable	90°)			
35	4	Machine Bolt & Nut	2	N.C.	3/8"x1-1/2"			
36	4	Machine Bolt & Nut	1	N.C.	3/8"x1-1/2"			
	4	Knife Adjusting Link Ass.	1			4.1#		
37	4	Rod	1	1020 Round C.R.	1/2"x17-3/4"	1.0#		
38	4	Cross Arm	1	Ditto	1-1/4"x5-3/4"	2.0#		

offset 7/8"

104

BILL OF MATERIAL - cont'd.

<u>Pc.</u>	<u>Sheet</u>	<u>Description</u>	<u>Quantity</u>	<u>Material</u>	<u>Size</u>	<u>Weight</u>	<u>Remarks</u>	<u>Mfr's</u>	
<u>Work</u>	<u>No.</u>			<u>Kind</u>		<u>Total</u>		<u>Notes</u>	
						<u>Pounds</u>			
<u>LEVER SYSTEM</u>									
39	4	Nuts	2	N.C. Self Locking	1/2"				
40	4	Yoke	2	Flat Steel	1/4"x1-1/2"x3"	1.14#			
41	4	Collar	1	Steel With Self Locking Screw	1/2"		Commercial		
42	4	Spring Washer	1	Steel or Cast	9/16" Bore				
43	4	Nut	1	N.C. Self Locking	1/2"				
44	4	Depth Spring	1	Closed End Compression	No. 4 Wire 25" Def. 1-1/2"x10"				
<u>CUTTER SYSTEM</u>									
	5	Cutter Assembly	1			26.5#			
45	5	Lever Strap	2	Flat Steel	1/4"x1-1/2"x36"	7.6#			
46	5	Pivot Bracket	1	Angle	1/4"x3-1/2"x3-1/2"	1.5#	Weld to Frame		
			1	1020 Round C.R.	3/4"x5-3/4"	.72#			
47	5	Nuts	2	N.C. Self Locking	1/2"				
48	5	Retaining Plate Outside	2	Flat Steel	1/4"x3" dia. 1/2" Bore	1.2			
49	5	Retaining Plate Inside	2	Flat Steel	1/4"x3" dia. 3/4" Bore	1.2			
50	5	Sled Axle	1	1020 Round C.R.	3/4"x10-3/8"	1.4			
51	5	Sled Standard	2	Black St. Pipe	1-1/4"x7"	2.6			
52	5	Slide Plate	2	Flat Steel	1/8"x1-5/8"x4-1/2"	.52			
53	5	Sled Spring	2	Closed End Comp.	Roll Wire 50" Lead 27" Def. 1-1/4"x7"				
54	5	Sled	2	Flat Steel 1020	1/8"x3"x13"	2.6			
55	5	Spring Holder	2	Washer	1/8"x1-1/4"x2"		Commercial		
56	5	Machine Bolt & Nuts	2	N.C. Self Locking	3/8" x 1"				
57	5	Knife Holder	2	Flat Steel	3/8"x 1 x 5"	1.75			
58	5	Rivets	4	R.H. Soft	3/16" x 5/8"				
59-59		Knife Section	2	Mower, Smooth Edge	3" St.		Commercial		
60	5	Knife Lock	2	Flat Steel	1/4"x1"x2-1/2"	.35			

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BILL OF MATERIAL - cont'd.

<u>Pc.</u> <u>Work</u>	<u>Sheet</u> <u>No.</u>	<u>Description</u>	<u>Quantity</u>	<u>Material</u> <u>Kind</u>	<u>Size</u>	<u>Weight</u> <u>Total</u> <u>Pounds</u>	<u>Remarks</u>	<u>Mfgr's.</u> <u>Notes</u>
<u>CUTTER SYSTEM</u>								
61	5	Locking Ring	2	Round	1/4"x4-1/2"	.12		
62	5	Balance Spring	2	Harness Ring	1/4" x 2"		Commercial	
			2	Tension Hook End	7/8" x 5" .25" Wire		Commercial	
63	5	Spring Adjusting Lever	2	Flat Steel	1/4"x1-1/2"x7-1/2"	1.6		
64	5	Spring Holder	2	Washer	1/8"x1-1/4"x2"		Commercial	

=====
Total Weight of Assembled Machine as Shown in Fig. 2 = 350#

The possible use of hard facing material to coat that portion of the finger tips subject to erosion was given consideration. The final criteria in the use of materials and construction procedure is, of course, in the final analysis, economy to the farmer. The test unit shown in Fig. 12 was devised to aid in making a sound decision. Two similar wheels were built of 1/2 round, cold drawn steel SAE 1020 with a Brinell hardness of 144 and tensile strength of 69,000 PSI. On one of the wheels the finger points were weld coated with a self hardening abrasion resisting metal having a Brinell hardness of ^{approximately} 400 after being deposited. The wheels were operated in a mixture of sand and gravel having a maximum diameter of 3/4 inch and were set to travel at exactly the same angle to the instantaneous line of draft as they do during normal strait-line operation of the harvester. A test conducted over the equivalent of 160 acres of 3-1/2 foot rows indicated that the non-coated wheel would last a minimum of 300 acres. The hand coated wheel was little affected. A machine being used to harvest a small acreage each year (less this 50 acres) would probably become obsolete or deteriorate from weather action before the wheels would need replacing. Hard facing is not recommended.

Considering further the wheel construction, it was decided to make the spokes out of 7/16 inch N.E. 8742 low alloy structural steel having the following properties: Tensile Strength = 109,000 PSI, Hardness - Brinell = 363. The weight saved because of its greater strength offsets the greater cost. It is further thought that the greater hardness would make the life of the finger satisfactory even for a larger operator without hard facing the points.

A laboratory test such as described above is not satisfactory in itself. The sand, because of the continued stirring, ^{loses} ~~is~~ its severe abrasive action. Any soil used for such a test would also be changed in its physical properties thus rendering the test inaccurate. Such

a test would only be indicative of what might be expected and should therefore be supplemented by a further study of experimental machines operating under field conditions. The sweet potato vines would undoubtedly have some influence on wearability of the teeth.

ACKNOWLEDGMENTS

(place this paragraph in small type.)

Acknowledgment is made to J. K. Coggins, Professor of Agricultural Education, N. C. State College for many of the photographs in this bulletin.

Material for the value of sweet potato vines as a livestock feed was based on studies conducted jointly by the U. S. Department of Agriculture and the Departments of Horticulture, Animal Industry, and Agricultural Engineering of the North Carolina Agricultural Experiment Station. Many helpful suggestions were contributed by members of the sweet potato committee in the development of the machine.

Appreciation is expressed to the many growers in the state who cooperated in the tests and especially to L. O. Page, Farm Superintendent, North Carolina State Hospital, Raleigh, N. C. for permitting the testing of the machine during the development period.

Data for sweet potato production was supplied by R. P. Handy of the Agricultural Statistics Division of the North Carolina Department of Agriculture.

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THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAVER, DIRECTOR
STATE COLLEGE STATION
RALEIGH

~~OFFERS OF THE STATION TO THE PUBLIC ARE AS FOLLOWS~~

THE SWEET POTATO

VINE-ROW

HARVESTER

actual size

THE SWEET POTAT

no shown on
the no the for something