

## INFLUENCE OF TYPE OF CASSAVA DIGGER PLOUGH TO THE GRIPPING PERCENTAGE OF THE CASSAVA AFTER DIGGING

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### ABSTRACT

Cassava digger and gathering machine consists of 3 major parts; a digger plough, a gripping conveyer, and a gathering conveyer. At present, the gripping percentage of the dig cassava was only 75%, which possibly caused by the half-circle shape of the digger plough. In this study, the trapezoid-shaped digger plough was developed and compared. The experiments were done at the 3 operating speeds; 1.45, 2.13 and 3.42 km/hr respectively. When the developed trapezoid-shaped digger plough was applied, the gripping percentages of each speed were 92.45, 85.00 and 84.78% respectively, while those of the half-circle shape digging plough were 70.82, 67.80 and 68.16% respectively. Further, un-harvested loss of the developed trapezoid-shaped digger plough were 2.08, 2.52 and 4.26% respectively, while those of the half-circle shape digging plough were 8.98, 11.98 and 12.02 % respectively.

**Keywords:** Cassava Digger Plough, Gripping Conveyer of the dig cassava, Cassava Harvesting

### INTRODUCTION

Labor shortage problem has sharply increased for the agricultural sector of Thailand. Cassava harvesting operation was the highest cost contribution of total cost production of cassava. Only digging and lift up cassava rhizome from the soil by cassava digger was successfully developed. The remained cassava harvesting activities up to transporting were major problems. Labor base, labor shortage and unavailability of agricultural machinery were crucial problems for these harvesting activities. Some of research and development of cassava harvesting machine for replacing labor in the harvesting process have done and published. The selected published paper were the design and the evaluation of cassava digger [1], design and development of a semi-combined cassava-root harvester [2], The Design and Testing of the Prototype of Cassava Digging and Gathering Machine. [3] and the digging and gathering machine for cassava harvesting (2003) [4]

For international research; They did the development of cassava digger and gathering rhizome in a tray at the back of the digger, dropped them down and piled them up at the same distance of every row by Odigbol and Ahmed (1982) [5].

For this research to further developed of the digging and gathering machine for cassava harvesting. Due to the theory of this study above mentioned.

Cassava digger and gathering machine consists of 3 major parts; a digger plough, a gripping conveyer, and a gathering conveyer. That gathering after digging 5 row of piles to 1 row of pile; Cassava digger of work will start from the middle row was the first row by digging and pile in the first row. For the 2nd and 3rd row at the left and right of the first row by digging and pile as well as in the first row. For the 4th and 5th row then did the same with the 2nd and 3rd row. Currently the machine has average efficiency was 69.31 percent and the gripping percentage of the cassava after digging was 75.43 percent.

From the elementary study in the subject problem of the gripping percentage of the cassava were 75.43%. Which this study used video records of operating machine. The result is the cassava after digging during move on digger plough and moving into the position gripping of the gripping conveyer. The cassava stalk was oblique and falling (Figure.1) whereas the characteristic of cassava root spread only one side. (Figure. 2) There is a high opportunities to oblique stalk overflow

until falling stalk, which possibly caused the stalk pass through the position gripping of the gripping conveyer and not griper. (Figure. 3 right) This action were the reason for the gripping percentage of the cassava were 75.43%.

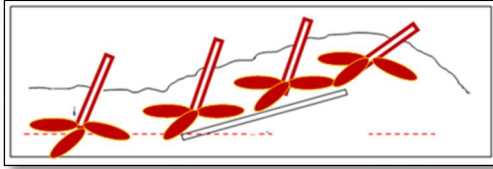


Fig.1. The falling stalk.



Fig.2. characteristic of cassava root spread only one side

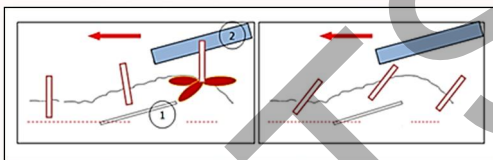


Fig.3. the side view, the action of the cassava stalk during moving on the digging plough. a vertical stalk and gripper (left) a oblique stalk and not gripper (right) 1 Digging plough and 2 Gripping conveyer.

The cassava after digging, that during move on digger plough need to control the vertical stalk for gripping conveyer could gripping stalk to the continue transport, which control a part of vertical stalk as above, concerned with operating state of digging machine. The action of cassava was especially to moving of the soil and cassava during move on digger plough. This research was assume, the affected to moving of the soil and cassava to the type of digging plough and the type of digging plough be suitable. Which helped to a vertical cassava stalk, when moving on digging plough and help to the gripping conveyer could gripping cassava stalk

Therefore, the object of research was study the influence of type of cassava digger plough to the gripping percentage of cassava after digging, that development digging plough was trapezoid shape to compare with half circle shape.

## RESEARCH AND METHODOLOGY

The study of cassava digger plough tested in the field of cassava farmer at Khon Kaen province where sandy loam area, Rayong 5 were cropped and the harvest time in April. The details are as follows.

### The design methods and the construction of cassavas digger plough for in this study.

From concept to cassava stems after digging is vertically situated during the movement cassava digger plough. Therefore the researcher collected data in the spread of cassavas in the soil by reference with moving direction of digging during work. (Figure 4.) the random sample of 100 rhizomes used for design data.



Fig.4. the method of cassava characteristic measure, referent by the machine moving.

The scope design of cassava digger plough was emphasized to the soil drainage during the most moving on cassava digger plough to reduce the variability of the shape for the mound on digging plough, was selected trapezoid shape opposite to the original design are the half circle shape of digger plough.

### The methods and the comparison effect of cassava digger plough.

1. The test for number of factors consists.
  - cassava digger plough 2 types: The trapezoid shape digger plough and the half circle shape of digger plough
  - Movement speeds 3 Levels; 1.45, 2.13 and 3.42 km/hr.

2. Control factors for constant during test consist.

- Adjust digger to declined angle at 15 degree.

1. The Replication, the size of field test, and planning test.

- The three replication of one treatment and each replication use the field test 400 m<sup>2</sup>.

- Factorial in Complete Randomized Design.

1. The value indicates of the test results and Data collection methods.

- The gripping percentage of the dig cassava after digging. Record the data by install the camera digging. (Figure 5,6) for record motion picture in front of gripping conveyer belt to transport and after tested to counting rhizome with gripping and not gripping and analysis percentage of cassava gripping after digging.

- Percentage losses of cassava after digging. Data record by randomized in testing area size 10x1.20 m. the three blocks of testing unit and gathering cassava with gripping and not gripping then analysis percentage losses.



Fig.5. Position of video record.



Fig.6 The back side of machine (Which removes gathering conveyer, cause be convenient to check the gripping after digging.)

## RESULT

Form the study influences of types of cassava digger plough to the gripping

percentage of the cassava after digging. The details are as follows.

### The results of cassava digger plough.

The physical data of cassava to randomize from the field total 100 rhizomes, referring to the direction of motion of the machine while working and the data show the spread of cassava 4 sides. As shown in table 1.

Table 1 The characteristic of cassava measurement, referent by the machine moving.

	The spread of cassava			
	Front side* cm.	Back side cm.	Left cm.	Right cm.
Avg.	17.94	28.40	21.19	23.91
SD	12.65	14.00	11.73	10.22
P75	26.25	36.00	29.50	31.00
P90	35.20	43.00	37.00	35.10

\*Front side was the machine movement.

- The average weight of cassava was 1.46 Kg.

- Moisture was 46.54 %

From the data to the spread of cassava and has design type of cassava digger plough by the developed trapezoid shape. As shown in Figure 7. The length of cassava digger plough of the spread to extend in front at 75 percentile and selected the maximum used of P<sub>75</sub> for covering to the direction of motion to back and forth. In this research to design selected the length of cassava digger plough were 37.4 cm and the width of cassava digger plough was covered the spread to side at 90 percentile and selected the maximum used of P<sub>90</sub> by design selected width of cassava digger plough were 73.9 cm.

In addition to adjust in front of digging to decline angle for helping to start operation and controlling to directional stability of digger plough. The backside of digger plough was made a hole in the center area for the speed of soil drainage to moving on the digger plough.

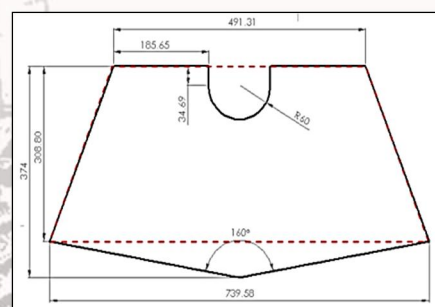


Fig.7. The trapezoid shape.

The result operating of cassava digging plough 2 types, that the result as follows.

**The Percentage of gripping after The dig-ger plough operation.**

After digging, that counting of rhizomes to gripping plough. The result showed that the trapezoid shaped digger plough has percentage gripping more than the half circle shaped digger plough, the gripping percentage were 92.57, 85.63 and 84.84 %. When harvester machine moving of operating speed; 1.45, 2.13 and 3.42 km/hr in respectively. As shown in table 2 and the result of data analysis in table 3.

Table 2 The result of influence of shaped digger plough and percentage of gripping.

shaped	Speed	% Gripping				% Gripping Avg.
	Kg/hr.	Rep 1	Rep 2	Rep 3	Avg.	
Trapezoid	1.45	89.47	88.24	100.00	92.57	87.68
	2.13	94.12	80.95	81.82	85.63	
	3.42	78.95	93.75	81.82	84.84	
Half circle	1.45	61.90	72.22	78.33	70.82	68.93
	2.13	68.42	74.12	60.87	67.80	
	3.42	65.00	65.00	74.47	68.16	

Table 3 The result of variability of percentage gripping when used a different digging plough

Source	df	SS	MS	F	P-value	
Shape	1	1,582.42	1,582.42	31.578	0.000	**
Speed	2	103.68	51.84	1.035	0.385	ns
Interaction	2	21.20	10.60	0.212	0.812	ns
Error	12	601.34	50.11			
Total	17	2,308.63				

From the result analysis of variability the result showed that the changed of type of digger plough for the half circle shaped digger plough were the trapezoid shaped digger plough of increase percentage gripping was significantly. That was increase average of gripping were 14.13%. However increase of operating speed range 1.45-3.42 km/hr. percentage not changed gripping wasn't significantly.

**The cassava percentage losses after digging plough.**

From the random measuring of percentage losses after digging plough were three replications of one treatment. The result showed that the trapezoid-shaped digger plough has percentage losses less than the half circle shaped digger plough, which percentage

losses were 2.08, 2.52 and 4.26%, the 2 operating speeds were 1.45, 2.13 and 3.42 km/hr in respectively. As shown in table 4 and the result of data analysis in table 5.

Table 4 The result of influence of shaped digger plough and percentage loss.

Shape	Speed Km/hr.	% losses				% Avg. Losses
		Rep1	Rep 2	Rep 3	Avg.	
Trapezoid	1.45	2.02	4.21	0	2.08	2.95
	2.13	0	5.18	2.38	2.52	
	3.42	3.38	2.39	7.02	4.26	
Haft circle	1.45	8.23	14.29	4.42	8.98	10.99
	2.13	9.76	10.75	15.43	11.98	
	3.42	10.59	13.27	12.2	12.02	

Table 5 The result of variability of percentage losses when used a different digging plough.

Source	df	SS	MS	F	P-value	
Shape	1	290.89	290.89	33.012	0.000	**
Speed	2	21.18	10.59	1.202	0.334	ns
Interaction	2	5.08	2.54	0.288	0.754	ns
Error	12	105.74	8.81			
Total	17	422.88				

From the result analysis of variability the result showed that the changed of type of digger plough for the half circle-shaped digger plough were the trapezoid-shaped digger plough of decrease percentage losses was significantly. Which reducing of percentage losses were 8.04%. However, the increase of operating speeds range 1.45-3.42 km/hr. Not were done with the change of percentage losses was significantly.

**CONCLUSION**

From the physical data of cassava, when the design type of digger plough were the trapezoid-shaped by the width of 73.9 cm, and length of 37.4 cm. When the tested and compared with the half circle-shaped digger plough, The result showed that the trapezoid-shaped digger plough to increase able to average of the gripping percentage were 14.13% and also reduce the average of percentage losses were 8.04%.

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