ENGINEERING TUBE CASTING MACHINE OF ORGANIC PLANTING POUCH

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Abstract

Problem in using polybag for the seed container is the necessity of seed replacement into field that still uses cutting or tearing method of polybag. Unfortunately, the methods cause to rooting damages or the root will be sheared. Koesriharti (1987) reports that seed dying often occurs after replacement, or the growth will be prohibited for the rooting system has been failed. Other problem in using polybag is waste consideration, because polybag composites of polyester.

An alternative to reduce plastic matters is by decreasing the use of polybag. Nowadays, the use and research on planting pouch from organic substance are developed. Instead of less dangerous to environment and cheaper, it increases humus desired by plants. One material of organic planting pouch is enceng gondok. Because it contains high fiber and undesirable plants, they should be usable waste.

Machine casting the planting pouch is expected to change dry enceng pieces into tube shapes. The process involves pressing and rolling the dry pieces by roll mechanism.

Research is conducted from April to September 2001 in TSSU and Agriculture Laboratory of Machine and Capacity. Casting machine designed comprises to frame, hopper, calendar roll, strip roll, coil roll, capacity sustaining mechanism, and power source.

Machine experiment has been conducted by involving enceng pages in 0.5 mm thickness and 50 mm width. Tube result by D = 40 mm indicates that machine performance capacity is about 1,2 m/hours and its productivity is 435.9 mm. Financial analysis based on initial investment as much as Rp. 550.000 obtains BT value for Rp. 143.913 per year, while BV for Rp. 6.789.600 per year. BEP value is Rp. 211.351.316 in product capacity of 44.8253 m/year. NPV value is Rp. 48.370.560,13. Net B/C Ratio to 88,94 and IRR to 75,45 % is also observed with selling price for Rp. 4.715 per meters.

INTRODUCTION

Using polybag for the seed container is often used when replace the seed into field. It still uses to cut or to tear the polybag. However, the methods cause to rooting damages or the root will be sheared. Koesriharti (1987) asserts that seed dying often occurs after replacement, or the growth will be prohibited for the rooting system has been failed. Other problem in using polybag is waste matters for it contains of polyester.

Land microbes less dissolve plastic waste. Bahar (1986) says that plastic waste is inorganic substance that is difficult for nature process to dissolve. Even if it is dissoluble, ultra violet of the sun should be involved to destroy the plastic. The process is expensive and in high technology. Cheapest way, or have been the common manner, is to burn and bury it in the ground. Plastic burning in open space and less controlled burning will cause to danger because the smoke contains particles that can damage the lung and result in dangerous precipitation. The greater use of polybag is the easier plastic pollution for land.

Reducing the use of polybag is an alternative. Planting pouch from organic substance has been founded. It is friendly to environment. It also gives benefit of increasing humus on land. Environment problem such as organic waste, enceng gondok, papers, wood, charcoal, husk, fern, moss, straw, and bushes, can be used as the material of planting pouch (Agoes, 1994).

For the use of planting pouch, replacement of seedling results into the field is less needed, because the pouch can be planted directly along with the seed. Organic substance

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in pouch will be dissolved by land microorganism and will stick together with the land.

One of used organic substance is enceng gondok. Enceng gondok is water plant usually disturbing water drainage in damp or farming field. Enceng gondok is usable waste because it contains high fiber and it is less profitable plant. Triyanto (2000) suggests that enceng gondok can be used as mules plant by mixing it with papers and glue, and formed into pages. The condition indicates that enceng gondok can be developed into organic planting pouch.

Material forming from raw material (mush) to finished material (planting pouch) still concerns about a problem. Manual forming is still in use. Mush is pressed by mill tool to form pages and then it is dried. The pages are dried. The pages often result in difference thickness, height, and width. Therefore, a tool to produce similar and continuing pouch should be needed.

The casting machine forms enceng pages to become tubes. Process involves pressing and milling the pages by press and mill roll mechanism. To sustain the work capacity from power motor to the rolls, belt transmission and gear wheels system are used.

Research is designated to engineer and construct tube-casting machine by dried organic materials to form planting pouch. Construction results are tested. It is suggested that the machine gives solution of the similar and continuing pouch of planting.

**RESEARCH METHOD**

Research is conducted from April to September 2001. TSSU (Technical Support and Service Unit) is used during research, and testing is implemented in Agriculture Laboratory of Machine and Capacity. The steps include engineering of dimension, material and shape, testing, and work analysis. Tools used are workshop equipments such as welds, grindstone, saw, screwdriver, picker, drill and so on. Material used in machine engineering is some L and U plates, gear wheel, pulley, lacer/bearing, iron plates, and bolts.

The planned mechanism is initiated by pressing dried organic pages with calendar roll to make it solid and smooth. Pages are rolled by mill roll to shape the pages into tube. Tube is then used as planting or seedling pouch. Since the mechanism is observed, machine plan should be engineered. It is shown in Figure 1.

![Figure 1. Tube casting machine plan of organic planting pouch](image)

Machine parts and the function are explained as follows:

a. Frame, it is functioned as fundament or place for the tools to stand. Good propped machine will result in good casting production.

b. Feeder, it is used as raw material patch and distribute them to calendar roll. The material contains mixing of enceng gondok and dried pages. Feeder engineering should concern about smooth distribution of material into machine. Therefore, feeder is also called as feeding channels.

c. Calendar roll, it makes organic pages to solid to result in smooth and slick pages. Roll is supported by two similar large roll. Both are in same line but rolled in different direction. Distance of both rolls affects the thickness of product, when product length is considered. Product width is also determined by length of calendar roll.

d. Mill roll, it mills pages from calendar roll. The roll is nearby calendar roll, and it is placed at an angle such that pages will milled spirally.

e. Strip roll, it strips pages coil adhered in mill roll. The roll has smaller diameter than mill roll. It is placed next to mill roll, but rolls faster.
Casting Machine of Organic Planting Pouch
(Ekoyanto Pudjiono)

f. Capacity sustain mechanism, it functions as power source (power motor). Mechanism planned should be adjusted with desired slips, in such that power source will supports working units.

Testing is conducted by condition to observe machine performance. Ability to cast tube for planting pouch from organic substance. Testing includes two parameters, such as performance testing of machine and results testing. Since the product has similar character with those in papers, testing procedure is not difference with paper testing.

Performance testing contains testing units, such as to test work capacity, productivity, and to ensure symmetric shape and similar measures. Product testing is adjusted with modification test proposed by Syarief and Soenarjo (1986) through measuring pages thickness. Procedure of paper thickness measuring, normal tense, and pull strength are included.

Syamsuddin (1992) says that analysis of financial availability is designated to determine whether the project is available. Therefore, casting machine should be assessed, based on financial aspects to decide whether the machine should be developed.

RESULT AND REVIEWS
Casting machine engineering of organic planting pouch means to cast organic material pages into tube by milling mechanism. Casting ability is tested by experiment towards treatment factors. In general, some treatments are considered, such as:

a. Input materials

Four tests are involved in input materials. Material with 200 mm and 50 mm widths, and 1,3 mm and 0,5 mm thickness are used. It is as shown in table 1.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>1,3</td>
<td>Fail</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>1,3</td>
<td>Fail</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>0,5</td>
<td>Fail</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>0,5</td>
<td>Good</td>
</tr>
</tbody>
</table>

Result indicates that material with 50 mm width and 0,5 mm thickness give the best casting quality compared to the rest of three. Material with 200 mm width and 1,3 mm thickness results in thick roll, and causes machine breakdown, because distance of mill roll can not flexible towards rolls thickness. Overlapping to the next stacks is often observed.

b. Power Source Velocity

Speed treatment does not affect the casting quality. Main feature is the increase of casting debit. High speed is not recommended, because the machine is engineered in low speed.

It is also indicated that, based on the result, casting mechanism has been functioned to press and mill organic substance. First mill is supported by manual manner, particularly to glue the material and direct the roll. These manual manners can increase the possibility of achieving symmetric and uniform shape.

Working capacity of machine is observed by figuring out the casting rate or the amount of output in each time. Analysis in enceng gondok pages with 50 mm width and 0,5 mm thickness shows that the capacity from casting machine is 1,2 m/hours.

Productivity measures are implemented to observe length output of dried pages. Tube length is in meters. Analysis in pages with 50 mm width and 0,5 mm thickness, and 1000 mm length shows that actual productivity of casting machine is 435,9 mm. Theoretic calculation is 478,5 mm. This difference is resulted because mill roll circles in unfixed direction and the angle of roll will similar to 15°.

Factors are considered in financial analysis. They include fund utility, timing and financial profit. Financial analysis only measures the engineering of laboratory scale, by using Break Event Point (BEP) method, Rolling Principal Cost (BPP), Net Present Value (NPV), Net B/C Ratio, and Internal Rate of Return (IRR). Rolling principal cost is cost calculated during rolling process.

Therefore, analysis is focused on tools engineering, not on its commercial value. BPP
values to Rp. 6,933,513 while Fixed Cost (BT)
is Rp. 143,913/year and Variable Cost (BV) is
Rp. 6,789,600/year. These costs are resulted for
rolls of 1,2 m/hours and in selling prices of Rp.
4,715/m.

BEP point value is Rp. 211,351,316 for
product capacity in 44,8253 m/year. BEP point
is too high because tools capacity is lower and
the work is not in sustaining manner. It is also
because expensive operational costs.

Initial investment of Rp. 550,000,00
results in NPV value for                        Rp.
48,370,560,13, B/C ratio for 88,94 and IRR for
75,45 %. Sensitivity analysis shows unfixed
cost inclination per year. This figure shows that
casting machine should be available to develop
because NPV is higher than null, Net B/C Ratio
is greater than one, and IRR is bigger than bank
interests grade, that is, higher than 12 %.

CONCLUSIONS AND SUGGESTIONS

Conclusion
It is summarized that:
1. During the test, rolls mechanism in tube
casting machine of planting pouch is well
functioned to press and mill organic
substance. Manual manners are in gluing
and controlling rolls direction.
2. The machine specifies for:
   ▪ Power source        : Electric
   ▪ Motor              : 1325 Rpm
   ▪ Amount of calendar rolls : 2 items
   ▪ Amount of strip rolls  : 3 items
   ▪ Amount of mill rolls   : 1 items
   ▪ Transmission system   : Vanbelt and
gear wheels
   ▪ Body plate thickness : 4 mm
   ▪ Capacity             : 1,2 m/hours
   ▪ Dimension            : 550 mm
                           height, 280 mm width, and 470 mm
                           length.
3. During experiment in difference pages
   thickness and width experiment, the best
   result is pages with 0,5 mm thickness and
   50 mm width.
4. Analysis on pages indicates that work
capacity of machine is 1,2 mm/hours and
   actual debit of casting machine is 435,9
   mm.
5. Financial analysis of initial investment by
   amount Rp. 550,000,00 shows that BT
   values to Rp. 143,913 per year; BV values
to Rp. 6,789,600 per year in machine
capacity of 1,2 m/hours. BEP values to Rp.
211,351,316 by product capacity of 44,8253
m/years and by selling prices to Rp. 4,715
per meters. NPV values to 48,370,560,13,
while Net B/C Ratio is 88,94 and IRR is
75,45 %, therefore the project is available to
develop.

Suggestions
Further research should consider dry
pages of enceng gondok production in
continuing and uniform manner, and the gluing
manner towards pages in such that rolling
process will be in symmetric and uniform.
The next research also pays attention to
the affect of thickness and material strength in
normal rate on input of casting machine.

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