# COMPARISON STUDY IN USING PLOUGH, TRACTOR AND CULTIVATOR FOR RICE FIELD' LAND PREPARATION

Sutjana, I D.P.; and Adiputra, I Nyoman
Department of Physiology School of Medicine / Ergonomic Postgraduate Program
Udayana University Denpasar, Bali Indonesia. phone.(62)0361 720303.
E-mail.idpsutjana@yahoo.com.

## ABSTRACT

Land preparation of the rice field is one of the most important steps for paddy plantation. Formerly plough is one of the main tools for land preparation, but now the farmer used tractor or cultivator. From the farmer experience who are used that tools for land preparation there had advantages and disadvantages. The used of plough for land preparation for long time ago the deep of rice field soil is constant because the plough blade can be adjusted up and down. The plough can be turn to the right or left side so that all part of rice field except the corner can be cultivate. But for pulling the plough must be difficult to find two cows. While if using tractor or cultivator the right or left side and the corner of the rice field can't be cultivate. Deep of rice filed soil become shallow so the fertility of soil reduced. Beside that using tractor or cultivator for land preparation need more fuel. The plough were easy to carry out, but tractor and cultivator difficult to carry out because the weight more that 200 kg.

Key ward: plough, tractor, cultivator, rice field cultivate.

## INTRODUCTION

Land preparation of the rice field is one of the most important steps for paddy plantation. It is believed, that the task is considered the heaviest work compared with other activities. In doing that, plough is a tool used traditionally, by farmer for paddy plantation. The plough is animal draught tool (Sutjana & Widana 2005). The use of plough for land preparation for paddy plantation had been proved in maintaining the deep of rice field soil to be processed. Because of turn over upper soil, incorporated by the residue of crop into the soil makes the soil more porous (Jones, 2007; Roy, 2007). But, unfortunately, it needs longer time for land preparation. As tractor and cultivator had been introduced and widely marketed, they had also been used by farmer for land preparation. Farmer do not need to buy them, they just hired from some one who run the business for that. Of course, land preparation task performed in sorter time compared with using plough. But, there is disadvantage in using tractor or cultivator for land preparation. The side and corner parts of rice field can not be reached by tractor or cultivator, therefore, farmer need to hoe manually (Santosa, 2007). Due to Bali Island is conical type, most of rice field are in the terraced one, with small size. Another

disadvantage, after many time using tractor or cultivator for land preparation, the farmer feel the soil of their rice fields become shallow and the fertility of soil reduced.

In this study, it is reviewed the use of plough, tractor and cultivator for land preparation for paddy plantation.

## Subject and method

Subject : ten male Balinese farmers at Tabanan Regency who had experienced in soil cultivation for land preparation using plough, tractor and cultivator for paddy plantation, as subject of study. They joined the study voluntarily. The study was done on December 2006.

Method :
- interview technique was applied to farmer; data regarding to perception of farmer and the quality of land preparation resulted in using plough, tractor or cultivator
- observation was also conducted on land preparation using plough, tractor and cultivator
- measurement of time consumed for land preparation of 1 ha of rice field using plough or tractor or cultivator, and deep of soil reversed while using them were also conducted.

## RESULT AND DISCUSSION

The initial of soil cultivation for land preparation was the more important for paddy plantation. The tools usually use for land preparation were plough, tractor and cultivator. In the study there are interviewed 10 farmers which are had experiences to used plough, tractor or cultivator for land preparation for paddy plantation. The experiences all of farmers after using plough, tractor or cultivator for land preparation for paddy plantation was the same. Plough (Fig. 1) is used by the farmer since long-long ago for soil cultivation for preparation of land for paddy plantation. The pulling powers use two cows to pull the plough together and driven by the farmers. The use of plough more flexible, the way of plough can be moved to right or left side of rice field according to the soil needed to plough. The deep of soil reverse can be control, because the angle of ploughshare can be controlled up and down through putting of cord on the hollow at tile of plough handle. The design of plough is easy to install and open (knockdown) and easy to carry because the weight around 15 kg. But using plough for land preparation need more time, because the speed of ploughing is not so fast and take longer time process. For one hectare of rice field needs around more than 3 weeks for land preparation using plough. In using plough for land preparation there are steps as the following:

Phase 1: land reverse, and let it for two or tree days
Phase 2: reverse again so the soil more lose
Phase 3: land flattened

It needs 3 weeks or more for ready to plantation. It is due to that the farmer soil cultivate using plaough time work only 4-5 hour a days in the morning and in evening the cows must be rest. Beside that the farmer taboo ploughing on Thursday or a special days according Balinese calender.

As tractor had been produced as a substitute of plough for land preparation for paddy plantation it has been used also among farmer in Bali (Sutjana, 1999; 2002). The used of tractor for land preparation needs shorter time than plough. It is important to remember in case water is limited the land preparation should be finished soon. After two or three days of harvesting land preparation has already finished by using tractor. It is true that now, especially around the town, the use of tractor for land preparation is increasing from year to year. It is due to the fact that working animal (caw, buffalo) are limited in number and little bit difficult to find grass for animal feeding.

Plough

Weight : 15 kg
Long of handle: 280 cm
Wide : 20 cm
Power : two cows
Material : wood (local material)
Design : knockdown

Figure 1. Plough

TRACTOR.

Tractor as a product of the development of science and technology, there fore, the use of tractor for land preparation could not be avoided. According to the blade used there are two types of tractor. If the blade used like plough that is call tractor and if the blade use like a knife it is call cultivator.

The tractor specification as follow:

Tractor type BIMA : BM-1; BM-1L; BM-2 (Fig.2 ) :

Weight : 255 kg; 256 kg; 230 kg
Long : 2471 mm; 2633 mm; 2471 mm
Wide : 772 mm
Height : 772 mm
Engine : 6.5 HP / 8.5 HP/ 10.5 HP
Material : metal
Design : fix, but some equipments are be changeable

For land preparation using tractor there are 3 phase. The first phase the soil must be reversed. The second phase crusted the soil and the last phase the soil flattened. It can be

done in the same day. In one day the rice field is ready to plant. Deep of soil reversed can be adjusted according to the angle of the blade. But the blade can't be move to the right or left side. There fore, the land outside the tractor tires can't be reached. It must be hoed manually.

CULTIVATOR:

Like tractor cultivator use machine as the pulling power, but the blade use knife for crusting the soil.

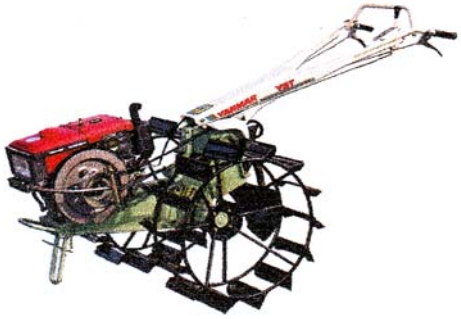

Figure 2 Tractor

Figure 3 Cultivator

Specification (fig.3):

| | |
|---|---|
| Weight | : 255 kg; 256 kg; 230 kg |
| Long | : 2471 mm; 2633 mm; 2471 mm |
| Wide | : 772 mm |
| Height | : 772 mm |
| Engine | : 70 HP; 8.5 HP; 10 HP |
| Material | : metal |
| Design | : the install were fix, not changeable |

Cultivator used for land preparation in terms of reversing the soil, crusting and flattening is done simultaneously. To do so, cultivator does faster than tractor. In the process the soil loosed and become mud, and precipitated. Deep of soil reversed not more than 15 cm because equally to the length of knife, and the knife can't be regularly adjusted up and down. The knife can't be turn to the right or left side, so it left soil at the side and corner side of rice field as in using tractor.

The results of comparison of rice field' land preparation using plough, tractor and cultivator, is shown on table 1. Table 1 shown that plough more flexible than tractor or cultivator so that the ways of plough can be turn to the right or left side so the driver can reverse the soil until the side of the rice field, while the tractor or cultivator can't do that. Plough or tractor blade can be moved up and down according to the deep of soil need to reverse, but the cultivator blade can't be move, so that the deep of soil can be reversed by use cultivator not more that 15 cm equal to long of the blade. The soil cultivate using cultivator quickly become mud and quickly too precipitated, so that the soil less porous than cultivated by plough or tractor. Tractor and cultivator too heavy for carried out by the farmer so very difficult to move from one sector to the other of rice field, while

plough very light so easy to carry out by the farmer. But the speeds of plough lower than tractor and cultivator. Based on the farmers experiences in using tractor & cultivator, it is wise to produce a lighter hand tractor and the blade of tractor could be moved to right side or left side like a plough function.

Table 1 Comparison between tractor and cultivator for land preparation of rice field for paddy plantation.

| NO | SUBJECT | PLOUGH | TRACTOR | CULTIVATOR |
|---|---|---|---|---|
| 1 | Phase of land preparation process | 3 phase:<br>- soil reversing<br>- soil loosing<br>- soil flattening | 3 phase :<br>- soil reversing<br>- soil crusting<br>- soil flattening | Soil loosing and mudding simultaneous |
| 2 | Time cost for finishing 1 ha of rice field | More than 3 weeks (4-5 hr a day, taboo work on Thursday or special days according to Bali calendar) | 22.07 hr | 16.15 hr. |
| 3 | Advantages | a. Paddy stalk didn't necessary to cut short<br>b. need view water during ploughing.<br>c. deep of soil reversed can be adjusted<br>d. ease to turn right or left so until side part of the rice field can be cultivate.<br>d. the equipment is knock-down, easy to install /open and easy to carry out and easy to move through the dike | a. paddy stalk don't necessary to cut short.<br>b. need view water to soak the rice field<br>c. need sorter time then plough for cultivate the soil<br>d. deep of soil reversed can be adjusted | a. short of work process because soil reverse, crusting and flatten were done simultaneous-ly, and ready to planting.<br>b. view fuel need |
| 4 | The disadvantages | a. land preparation need 3 phase and need more time<br>b. difficult to find cow for pulling the plough | a. Land preparation need 3 phase so need more time compared with cultivator<br>b. side part of the rice field can not be cultivated around a wide of out side tire.<br>c. difficult to move through the dike | a. rice field must be clean from paddy stalk<br>b. need more water<br>c. the deep of soil reverse not more than 15 cm<br>d. soil less porous<br>e. side part of rice field can not be cultivated.<br>f. difficult to move through the dike. |

## CONCLUSION

The using of plough, tractor and cultivator use by the farmer for preparation of the rice field for paddy plantation, the following conclusion are drown:

1. The plough more flexible and easy to carry out, the soil more porous and the deep of rice field soil more constant, but too slow in the processing.
2. Tractor too heavy to carry out, can't be turn to the right or left side, but the speed of work faster, the soil more porous.
3. Cultivator too heavy to carry out, the deep of soil reversed sallow, can't be turn to the right or left side, and needs a shorter time, soil less porous.

From the case studied, it is hope that in the future it is possible to design or producing the light tractor, with the blade can be turned to the right or left side and can move up and down according to the deep of rice field soil need to reverse and match to the physical capacity and limitation of the farmers. So the farmer can be planted the rice field with lower workload.

## REFFERENCES


Jones, A. 2007. A brief History of The Plough.Available from:http://www The%20Hindu%20Business%20Line%20%20Farm%20Policy%20must.Accessed on 13th July, 2007.

Roy, D.K.2007. Farm Policy Must Plough a New Furrow. Availbale from: http://www The%20Hindu%20Business%20Line%20%20Farm%20Policy%20must.Accessed on 21st July, 2007.

Sutjana, I D.P. 1999. Improvement of Sickle quality Through Participatory Ergonomic Approach at Batunya Village Tabanan Regency. J.Occup.Health. 41:131-135.

Sutjana, I D.P.2002. Balinese Agriculture in A Changing World. National-International Seminar Traditional Culture In a Changing World. Denpasar.March.22.

Sutjana, I D.P.; Widana, K. 2005. The Interaction Between Farmer and Cow during Ploughing The Rice Field. The 8th SEAES Conference and 12th IPS Congress, 15th Scientific Seminar. Denpasar 23-25 May.

Santosa, G. 2007. Use of Pull Plough Reduced Musculoskeletal Disorders and Increased the Farmer Productivity. Thesis. Postgraduate Ergonomic Program Udayana University. Denpasar.