

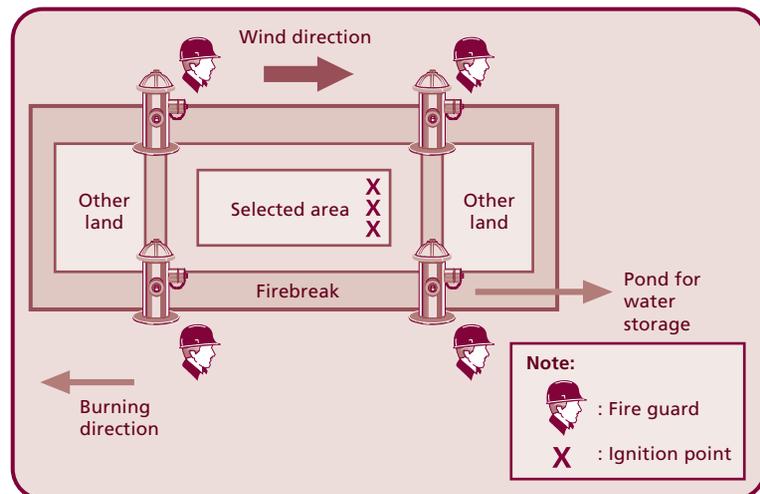
Figure 3. Flow chart of permanent agriculture practices in Sungai Selamat, Pontianak district, West Kalimantan

#### 4.1.2. Permanent agriculture practices in Rasau Jaya Umum village, Pontianak district, West Kalimantan

##### a. Land preparation

- Site selection: Land area with bushes and scrubs, with a flat topography and size of 1 - 2 ha.
- Slashing: Slashing shrubs and undergrowth and felling trees that have a diameter up to 10 cm using machete. Fuels produced from slashing are laid out evenly over the planting area. Slashing is usually conducted between July - August.
- Drying: Fuel drying process is conducted approximately in 10 days, depending on weather condition. The drier the weather, the faster the process of drying.

- Construction of firebreak: Firebreak of 1 - 2 m wide is constructed along the boundary of the planting area.
- Construction of ditch and water ponds: Ditch of 50 cm wide and about 60 cm deep is constructed to maintain the water table. Every 10 m, water pond with the size of 1 m x 1 m x 1 m is constructed to serve as a water reserve to water the plants during dry season.
- Burning: Burning is scheduled between 14:00 - 16:00 and usually conducted in August. Burning is conducted in stages, not simultaneously. If there is a 2 ha-land area to be burned, the area will be divided into four sections. Burning is conducted together with the other community members. Each group consists of  $\pm$  30 people.
- Hoeing: Area that has been burned is then hoed to loosen the soil clods. Hoeing is necessary for planting of aloe vera, pineapple and yams.
- Construction of beds: For planting purpose, beds with the size of 1.5 m x 10 m x 15 cm each are constructed.
- Dibbling: For corn planting, holes for the seeds are made using a dibble.
- Firing technique used is back firing as shown in the following figure.



**Figure 4. Controlled burning technique using back firing for peatland with canal**

b. Planting

- Corn seeds are planted in the holes that have been dibbled. Corn is harvested three times in a year.
- Seedlings of aloe vera, pineapple and yams are planted in the beds.

Flow chart of permanent agriculture practices for peatland in Rasau Jaya Umum village, Pontianak district, is shown as Figure 5.

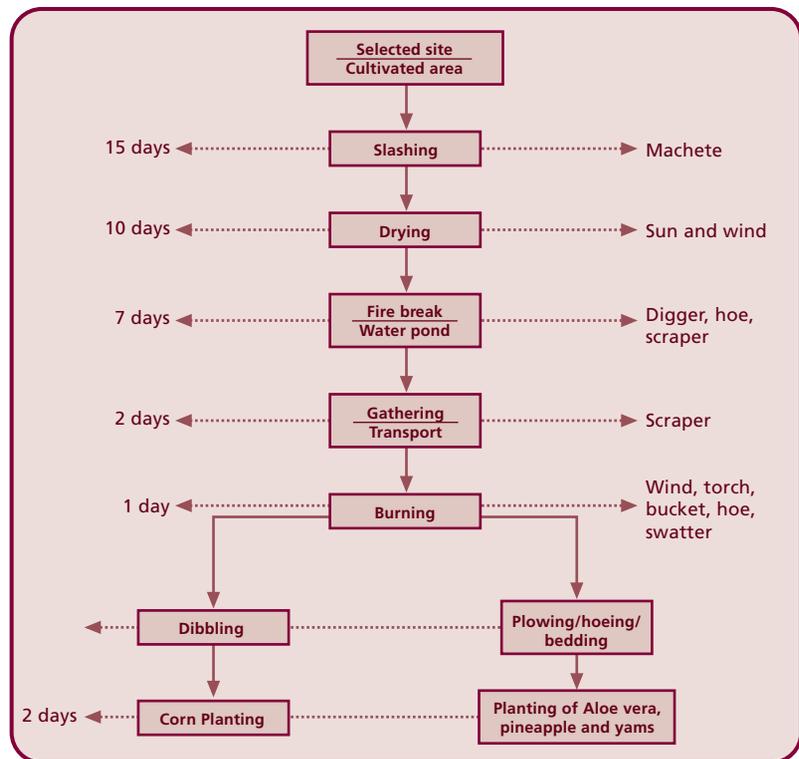


Figure 5. Flow chart of permanent agriculture practices for peatland in Rasau Jaya Umum village, Pontianak district, West Kalimantan



*(a) Smoke produced through land preparation by burning*



*(b) Water pond*



*(c) Firebreak and canal*



*(d) Aloe vera grown on peatland in Rasau Jaya Umum, Pontianak, West Kalimantan*

**Figure 6.**

#### **4.1.3. Permanent agriculture practices in Rasau Jaya III village, Pontianak district, West Kalimantan**

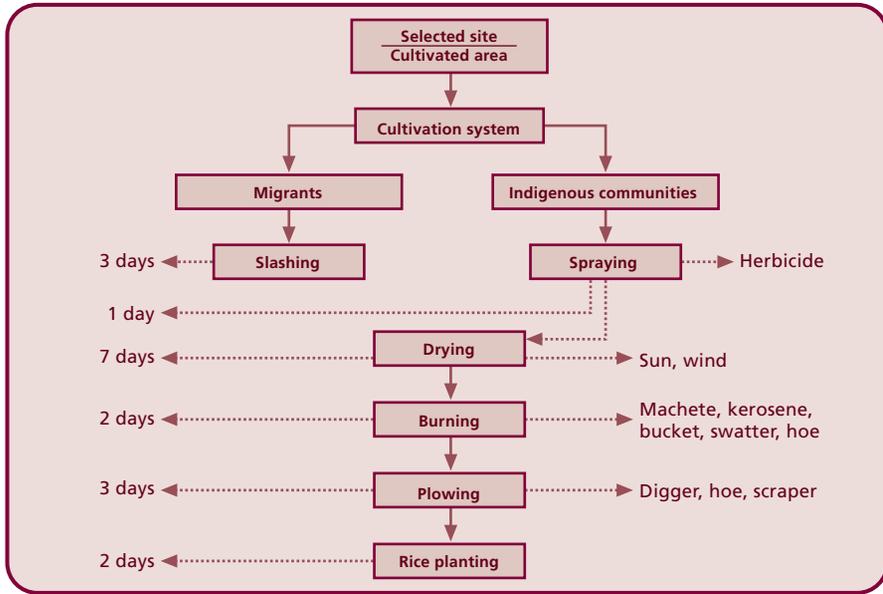
##### **a. Land preparation**

- Site selection: Land with bushes and scrubs, with a flat topography and size of 1 - 2 ha.
- Slashing: The migrants (from Java island) initiates land preparation by slashing shrubs and undergrowth and felling trees that have a diameter of up to  $\pm 10$  cm using machete. This process is conducted in  $\pm 3$  days. Fuels produced are spread over the planting area. This process is usually conducted in July - August.
- Herbicide application: Unlike the migrants, indigenous people apply herbicide (polaris and round-up) to clear the area from weeds.
- Fuel drying: Drying of fuels is conducted in  $\pm 10$  days, depending on weather condition. The drier the weather, the faster drying process.
- Construction of firebreak: Firebreak of 1 - 2 m wide is constructed along the boundary of the planting area.
- Construction of ditch and water ponds: Ditch of 50 cm wide and about 60 cm deep is made to maintain the water table. Every 10 m, water pond with the size of 1 m x 1 m x 1 m each is constructed as a water reserve to water the plants during the dry season.
- Burning: Burning is scheduled between 14:00 - 16:00 using backing firing technique as shown in Figure 3. Burning is conducted in August. Burning is conducted in stages, not simultaneously. If there is a 2 ha-land area to be burned, the area will divided into four sections. Burning is conducted together with the other members of the community. Each group consists of  $\pm 30$  people.
- Hoeing/plowing: The burn area is subsequently hoed/plowed to loosen soil clods.

##### **b. Planting**

- Rice seeds are planted in the seed holes. Planting is conducted once in a year.

Flow chart of permanent agriculture practices for peatland in Rasau Jaya III village, Pontianak district is shown below:



**Figure 7. Flow chart of permanent agriculture practices for peatland preparation in Rasau Jaya III village, Pontianak district, West Kalimantan**

**4.1.4. Controlled burning techniques on peatland originated from secondary forest in Pelalawan village, Riau province (Nurhayati, 2002)**

During the case study conducted in 2002, the following controlled burning techniques in secondary peat swamp forest were used:

- Site selection: Secondary peat swamp forest with a size of 0.04 - 1 ha.
- Slashing: Slashing shrubs and undergrowth and felling trees that had a diameter up to ± 10 cm using machete. Fuels produced from slashing were spread over the planting area.
- Tree felling: Cutting down trees that had a diameter of more than 10 cm. Trees with a diameter of > 15 cm were removed from the planting area so that they would not obstruct the burning process and could be used for other purposes.
- Drying: Drying of fuels took about 1 month, depending on weather condition. The drier the weather, the faster the drying process.
- Construction of ditch/canal: Ditch of 50 cm wide and 60 cm deep was constructed to maintain the water table and serve as a firebreak.

- **Burning:** A fire crew consisting of 4 torch people was needed to set the fires. Two people were positioned in one corner (C and D), where the other two (A and B) were positioned across C and D. Ignition started simultaneously under one command at the two different points. A and B moved in opposite direction while igniting fires along the perimeter. C and D also did the same thing. At the end, B and D would meet at one corner, while A and C would also meet at one corner across B and D. This technique is referred to as ring firing (Figure 8).

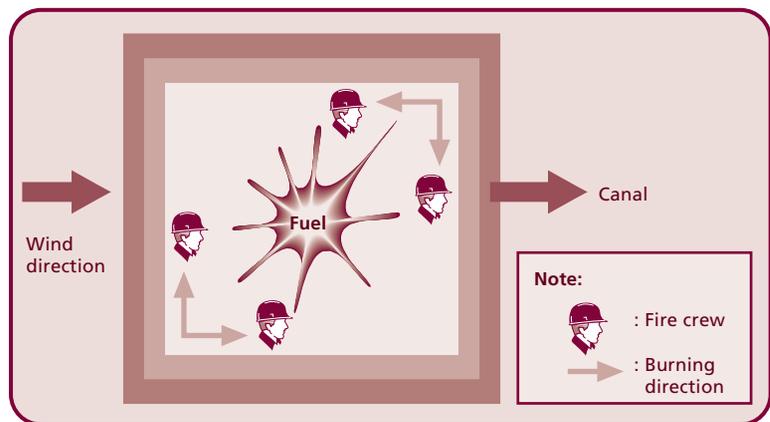


Figure 8. Controlled burning technique in secondary peat swamp forest in Pelalawan, Riau

#### 4.1.5. Burning method in Rantau Rasau village and Sungai Rambut village, Jambi (Otsuka et al., 1997)

##### a. Site selection

Rantau Rasau village and Sungai Rambut village are two villages bordering Berbak National Park, Jambi. The case study was conducted in canal 5, Dusun Rantau Rasau, which has relatively thick layers of peat. The size of burn area is normally 30 m x 10 m.

##### b. Fuel preparation

Land preparation starts with slashing the existing shrubs and bushes in the selected area. Slashing is often combined with the application of herbicide.

c. Burning method

Burning method used in this village is quite simple (traditional). Burning is conducted shortly before the rainy season. Some farmers construct firebreaks prior to burning, while others do not. This second method has a greater risk as it may result in uncontrollable fires.

The firing technique used in the first method is backing fire. This technique is used so that weeds and litter can be burned completely. This will make planting and seeding easier. Burning is scheduled after 12:00 when the wind is blowing from the forest (prior to rainy season). Burning of 1 ha-land area takes less than one hour. After burning, the farmers check the flames by mop up to ensure that there is no smouldering material left. When using the technique, fires sometimes escaped to the buffer zone of the Berbak National Park and burned the trees. Firing technique against the wind direction (backing fire) in Rantau Rasau village, Berbak National Park, Jambi, is shown in Figure 9.

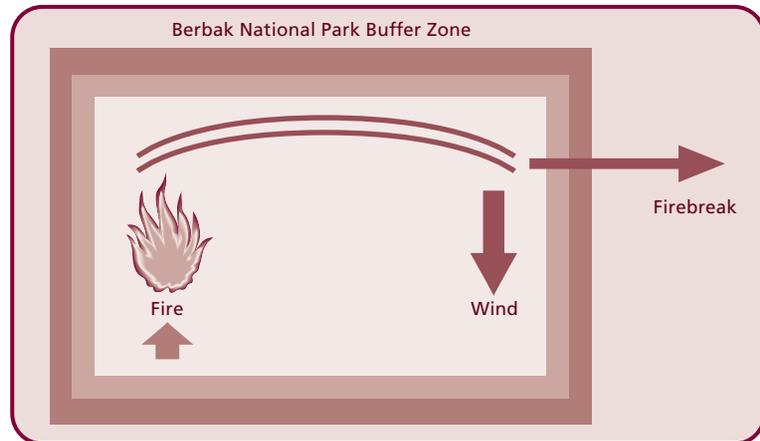
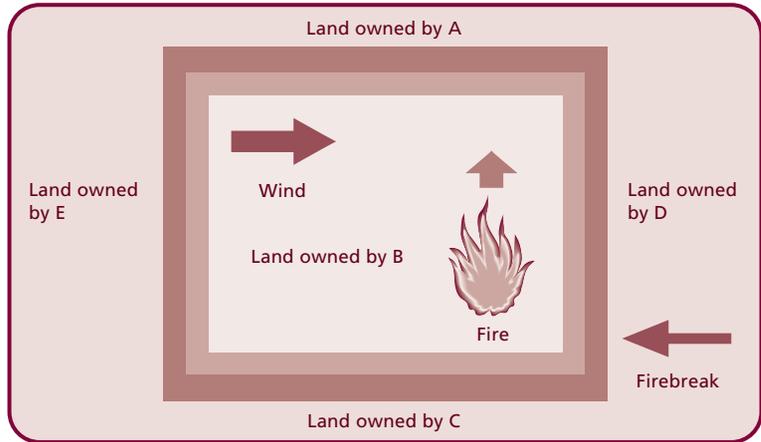


Figure 9. Burning technique against the wind (backing fire) in Rantau Rasau village, Jambi (Otsuka et al., 1997. Picture is modified by the author)

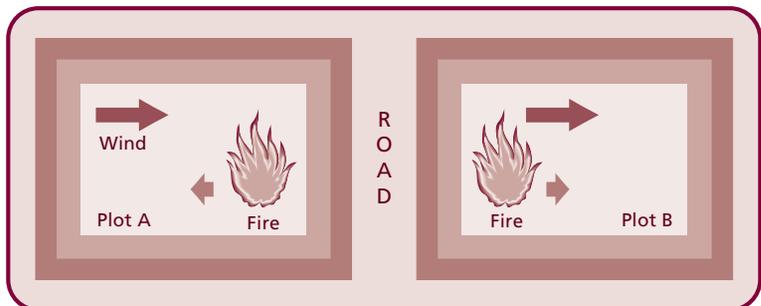
The firing technique used in the second burning method is backing fire. Ignition starts from one point and the fire is allowed to move perpendicular to the wind. This method is applied to potential cultivated areas that are connected. When one's land area (B) to be burned is located adjacent to the other land areas (A, C, D and E),

firebreak is constructed along the boundary of the area to be burned. This method works well due to cooperation among the land owners, i.e. by protecting their areas together during burning. This burning method is shown in Figure 10.



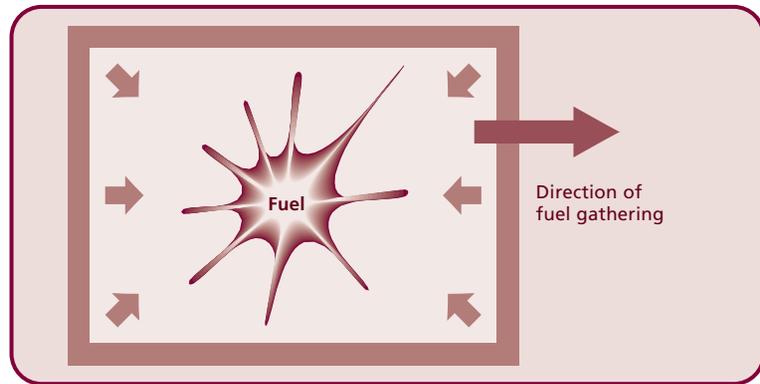
**Figure 10.** Burning pattern on an area connected to other areas in Rantau Rasau village, Jambi (Otsuka et al., 1997. Picture is modified by the author)

For an area separated by a small lane/road, the ignition starts from the side of the road, and the fire crew moves toward both sides of the area. The burning is conducted simultaneously. Fire moves from the side of the road towards plot A and plot B. There is a risk of uncontrollable fires using this method, unless firebreak is constructed (Figure 11).



**Figure 11.** Burning pattern on areas divided by road in Rantau Rasau village (Otsuka et al., 1997)

Other burning method is pile burning or stack burning as shown in Figure 12. Prior to burning, dried fuels are collected into one or several piles at the centre of the selected area. The piles will be burned after they are completely stacked. Burning using this method is concentrated only at the centre of the selected area, so that the fire will not spread out of control. The method is relatively safe and effective, although burning takes longer compared with other techniques. It also requires more people to collect the fuels. This technique is used by farmers in Dusun Sungai Palas, which is part of Rantau Rasau village.



**Figure 12.** Burning pattern proceeded by piling the fuels at the centre of the selected area (pile burning) (Otsuka et al., 1997)

## **4.2 Dry land farming/land cultivation system**

### **4.2.1. Land cultivation by Dayak Kanayank tribe in Pahauman village, Landak district, West Kalimantan**

#### **a. Land preparation**

- Site selection: The sites selected as potential cultivated areas are primary forest and secondary forest located at the slope and flat landscape.
- Size of cultivated area: The size of forest area to be cultivated is at least 8 gentangs (1.28 ha) and at most 15 gentangs (2.4 ha).
- Slashing and tree felling: Slashing of shrubs and felling of trees are conducted in July. Ten people are involved in this process.

- Drying: Drying of fuels takes about 1 month for old forest, and 2 - 3 weeks for young forest.
- Burning: Before burning, firebreak is constructed around the selected area. The width of firebreak is  $\pm 5$  meter. The firebreak is then bordered by trees (intermediate trees), such as rubber and jack fruit. Burning is scheduled at 15:00. Fire is ignited by 1 torch person. Burning usually takes place in August. Burning at the slope starts from the upper to the lower side. However, after half of the area has been burned, burning starts again from the lower side. This burning method is shown in Figure 13. The village head will give a penalty if fires spread out of the selected area. The penalty could be in the form of a fine of Rp 5,000 per crop. The total amount depends on the area burned by the uncontrollable fires and at the discretion of the owner of the burnt area.

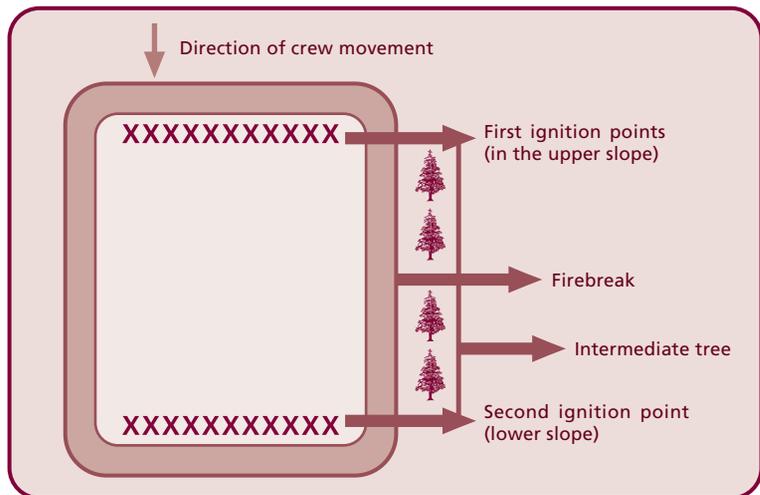


Figure 13. Burning method at the slopes of Pelalawan village, Landak district, West Kalimantan (picture is modified by author)

b. Planting

- Dayak Kanayank tribe in Pahauman village has a good knowledge of various crops cultivation. Main crops cultivated include among others rice, vegetables, cucumber and *keladi* (*Colocasia* sp.). Farming tool normally used is dibbles. Planting is usually conducted in October.



*(a) Burn area to be used for farming*



*(b) Ex-shifting cultivation in hilly area in Landak district, West Kalimantan*

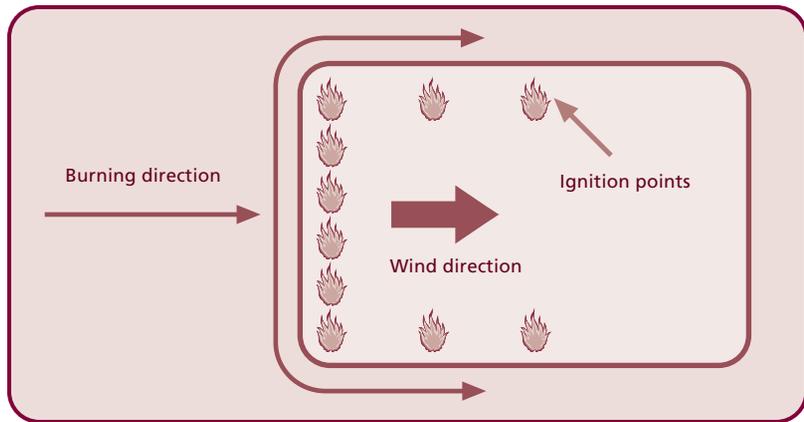
**Figure 14.**

#### **4.2.2. Land cultivation by Dayak Kantu tribe in West Kalimantan (Dove, 1998)**

##### **a. Land preparation**

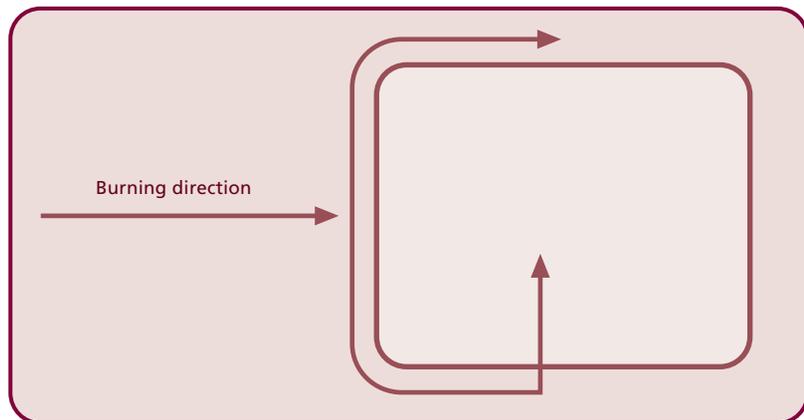
- **Site selection:** Sites selected are mostly close to the river and normally are not too near from the long house. The selected sites are primary forest and secondary forest. During the case study, the size of the selected area originated from primary forest was approximately 3.43 ha, while the size of the selected area originated from secondary forest was approximately 2.63 ha.

- Fuel preparation: Clearing of the selected site starts with slashing and tree felling. Tool used for slashing is machete, while the tool used for felling trees is Dayak axe called *beliyong*. The following stage is cutting the branches and tree stems into smaller parts (called *ngaredak*). Dayak Kantu people usually cut branches from the main stems if the selected area is originated from secondary forest. If the selected area is originated from primary forest, such cutting is often not required, because big branches frequently are broken to pieces after tree felling. Duration of drying period in a selected area originated from secondary forest is an average of 38.6 days, while drying period in a selected area originated from primary forest is about 87.3 days.
- Firing technique: Firing technique used in the area of Kulit Tuba (West Kalimantan) is head firing. This firing technique is shown in Figure 15. Torch is used to ignite fires. One tract of land is burned by one torch person or a group of up to 4 torch people, who usually are neighbours. After everything is ready, the fire crew light the torches and walk along the perimeter of the selected area. They ignite fires every several meters using their torches. The forward movement of the fire crew is determined by wind direction. Dayak Kantu people always start the burning from the side of the land where the wind is blowing. Firstly, they ignite the whole side, and then they burn the two sides which are in the same direction to the wind. This technique is called *ngerantai* by Dayak Kantu people. The fire crew should always check the wind direction because wind direction will significantly affect fire spread and determine success of the burning. Burning in Kulit Tuba area is usually conducted at noon between 11:30 - 12:30, and each burning can be completed within one hour. The advantage of burning at noon compared with burning in the morning is the fuels have been dried enough due to sunlight exposure of 5 - 6 hours since the morning time. Besides, at noon, the wind starts to blow, and this will help increase the fire spread and the chance of burning success (Dove, 1998).



**Figure 15. Burning pattern of *ngerantai* used by Dayak Kantu tribe in West Kalimantan (Dove, 1998. Picture is modified by the author)**

A modification of this technique is called *ngelayang*. One fire crew moves away from one side of the selected area and walks towards the centre while igniting the fuels. The purpose is to minimise the maximum distance of the fire spread and to ensure that fire burns all parts of the selected area. *Ngelayang* is carried out if there is a change in the wind direction (Figure 16).



**Figure 16. *Ngelayang* burning pattern used by Dayak Kantu tribe in West Kalimantan (Dove, 1998, picture is modified by the author)**

b. Planting

- The kinds of crops usually planted in the cultivated areas of Dayak Kantu tribe are rice as main staple, squash, watermelon and cucumber.
- Rice seeds are soaked in water prior to planting to accelerate the growth of seedlings. To make it more efficient, the rice seeds are mixed with other seeds (squash, watermelon and cucumber).
- Planting consists of two steps, i.e. dibbling (making holes in the ground with a dibble), and putting in the seeds to the holes. Dibbling is conducted in lines by making holes of 5 - 7 cm deep and an average distance of 37 cm between the holes. Seed planting is also conducted in lines with a distance of 2 - 4 m. The quantity of seeds planted is 7 holes per m<sup>2</sup> at the average.

**4.2.3. Burning method in Gemawang, South Sumatera (Rohasan, 1998)**

a. Site selection

The sites selected for cultivation can be secondary forest, old garden, or bush land. Local farmers are not accustomed to opening a cultivation area in more than one location. The size of the selected area is generally around 2.5 - 4 ha (usually the sites are far from each other).

b. Fuel preparation

Land clearing starts with slashing undergrowth, shrubs, bushes and felling trees using machete. Trees with a large diameter are cut with axe. Slashing and felling take place in 1 - 3 weeks. This will allow the fuels to dry. Trees with a diameter of more than 50 cm are removed to be further processed into sawn timber. There is no slicing of fuels as only the ends and twigs are cut. This process usually takes place during dry season in August - September when the rainfall is low. Drying of fuels takes place in 30 - 40 days.