CASSAVA CULTURAL PRACTICES

Proceedings of a workshop held in Salvador, Bahia, Brazil, 18 - 21 March 1980

Editors: Edward J. Weber, Julio Cesar Toro M., and Michael Graham

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Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)
Centro Internacional de Agricultura Tropical (CIAT)
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/IDRC publication/, /cassava/, /cultivation practices/ — /planting/, /plant production/, /crop yield/, /storage/, /soil fertility/, /fertilization/, /soil management/, /weed control/, /agricultural mechanization/, /agricultural research/, /recommendation/, /agricultural statistics, list of participants.


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Cassava Planting Systems in Asia

Sophon Sinthuprama

This paper is based on information obtained from India, Indonesia, Malaysia, and Thailand. It summarizes and compares the techniques and practices commonly used in Asia and the research that has been undertaken in Thailand. In most countries in South and Southeast Asia, cassava is grown as a sole crop. The crop can be planted any time of the year, except during heavy rains or in the dry seasons, if the distribution of rainfall is uniformly good. Cassava planted early in the rainy season has been found to give higher yield than cassava planted later.

Power for land preparation depends mainly on farm size and soil conditions and includes manual cultivation, animal-drawn tools, and tractors. The planting material is normally obtained from 7-18-month-old plants from the previous crop. Planting position varies depending on soil moisture, the method of operation, and tradition. Horizontal planting has been found to produce lower yields than vertical or inclined planting. Depth of planting had no effect when planting was either vertical or inclined. One stake is generally planted per hill in Asia, but there is a wide variation in row and plant spacing depending mainly on soil fertility.

Cassava is produced in nearly all countries of Asia. Indonesia is the principal cassava-producing country with an area of 1.36 million ha and production at 12.2 million tonnes in 1977. The other major producers in Asia are Thailand (10.6 million tonnes) and India (6.5 million tonnes). Thailand is the second in area and production but is the leading exporting country in the world.

Cassava is ranked as the third staple food, after rice and maize in Indonesia. In the Philippines it is primarily utilized as supplementary to the traditional staple food of rice and as livestock feed. In Malaysia cassava is not an important crop compared to rubber, oil palm, and coconut. In India as a whole, cassava is not a major crop. However, tapioca is widely served as a supplement to rice or even exclusively replaces it in the diet of the people in Kerala, which is the largest producer of tapioca in the country.

Cassava yield in Asian countries is considered low. Compared with a yield potential of 37 t/ha, the national average is about 15 t/ha in Thailand. Factors contributing to low yield of cassava are poor agronomic practices, low soil fertility, absence of fertilizer use, and probably use of low-yielding varieties.

Planting Time

Cassava can be planted throughout the year if the distribution of rainfall is uniformly good but not during heavy rains or in the dry season.

Planting is generally done at the start of the rainy season and toward the end of the rainy season. In Indonesia it is in October and in March–April; in Malaysia anytime, except in the east coast of Peninsular Malaysia where all agricultural operations could be interrupted by the heavy seasonal monsoon during November–December. In Thailand there are two major cassava areas; the Northeast with 64% of the cassava area followed by the East (29%). Soils in both regions are sandy loam to sandy, drought-prone, and low in available moisture and nutrients. In the Northeast, most of cassava is planted early in the rainy season, May–June. In the East rainfall commences earlier than in the Northeast. Plantings are done earlier in the rainy season (February–March) and in the late rainy season (November–December). In India it is in April–May.

A survey conducted in the growing area of

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1Head, Root Crop Branch, Field Crop Division, Department of Agriculture, Thailand.
Thailand in 1975 showed that 18.53% of the crop is planted in May followed by 14.99% and 14.61% in April and June, respectively (Fig. 1).

Research findings are that early rainy season (May–June) planting of cassava gives higher yield than later planting (Table 1). Reasons for planting cassava late in the rainy season (November–December) are minimizing heavy weed problems, higher prices because of higher starch content, and high demand from chipping factories that utilize the sun-drying method. Planting or harvesting cassava during February does not cause competition for labour with rice.

Land Preparation

On small farms and farmers' yards, where the area is less than 1 or 2 ha, as in Indonesia, the Philippines, Malaysia, and some parts of Thailand, land is usually prepared manually or by the use of animal power. Usually two plowings are conducted, followed by one harrowing at the beginning of the rainy season.

On large farms, as in Thailand, some parts of Malaysia, the Philippines, and Indonesia, land preparation is by tractor. In Thailand and in Malaysia custom services for tractor plowing are

Table 1. Effect of time of planting and age at harvest on yield (t/ha) of cassava (1976–78).

<table>
<thead>
<tr>
<th>Planting date</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>20.27</td>
<td>26.98</td>
<td>36.49</td>
<td>42.46</td>
<td>49.52</td>
<td>57.06</td>
<td>38.76</td>
</tr>
<tr>
<td>Jun</td>
<td>22.15</td>
<td>27.73</td>
<td>36.51</td>
<td>47.31</td>
<td>51.93</td>
<td>53.36</td>
<td>39.83</td>
</tr>
<tr>
<td>Jul</td>
<td>19.82</td>
<td>29.07</td>
<td>35.07</td>
<td>40.74</td>
<td>44.05</td>
<td>48.51</td>
<td>36.21</td>
</tr>
<tr>
<td>Aug</td>
<td>14.46</td>
<td>22.96</td>
<td>29.14</td>
<td>38.62</td>
<td>39.57</td>
<td>43.68</td>
<td>31.41</td>
</tr>
<tr>
<td>Sept</td>
<td>12.25</td>
<td>17.64</td>
<td>28.65</td>
<td>32.48</td>
<td>34.59</td>
<td>36.26</td>
<td>26.98</td>
</tr>
<tr>
<td>Oct</td>
<td>8.16</td>
<td>16.69</td>
<td>22.17</td>
<td>23.95</td>
<td>29.52</td>
<td>32.61</td>
<td>22.18</td>
</tr>
<tr>
<td>Avg</td>
<td>16.18</td>
<td>23.51</td>
<td>31.33</td>
<td>37.56</td>
<td>41.53</td>
<td>45.25</td>
<td></td>
</tr>
</tbody>
</table>

L.S.D. (0.05) for planting date × harvested ages = 4.92 (t/ha).
available. Usually the land is plowed once with a 3-5-disk plow followed by 7-disk plow once or twice. Sometimes it is plowed twice with a 5–7-disk plow because the soil is loamy sand or sandy. Plowing is done as soon as possible after the harvest of the previous crop. A major problem of land preparation is a lack of a sufficient number of tractors, which results in delayed planting.

Recommendation: plow 15–20 cm deep once or twice with a tractor to bury stems of previous crops, follow by harrowing once or twice. When the land is prepared this way, stakes can be planted directly in the soil without furrowing.

Stake Preparation

There is not much variation in the preparation of stakes throughout Asia. Planting material is obtained from the previous crop or from a neighbour's field free of charge. During the large expansion of cassava area in Thailand, new growers had to buy planting material. Stakes are usually taken from 10–12-month-old plants from a previous crop, which is usually harvested at 12 months in Thailand, 8–18-month-old plants in the Philippines, and 7–8-month-old plants in Indonesia.

At harvest, whole stalks are bundled and stacked upright or piled horizontally in the field under shade or in the open and sometimes covered with leaves until they are required for planting.

It is recommended that stakes be taken from 6–12-month-old plants so that survival rate is more than 90%. CIAT recommends that planting material be taken from plants ranging from 8 to 18 months of age. When a new cultivar is to be rapidly multiplied, the first stakes may be taken 6 months after planting and the subsequent ones every 6 months.

The period of storage of planting material is dependent on the receipt of rains for land preparation and ranges from 15 to 90 days, usually 30 days in Malaysia and Thailand, and 45–90 days in Indonesia.

Storage of no longer than 30 days is recommended so that survival rate is not less than 80% (Table 2). When the stakes are to be planted, the immature herbaceous part at the top and too-woody part at the base of the stalk are removed. Then stakes of desired length are prepared: Malaysia 15 cm; Indonesia 20–25 cm; Philippines 20–30 cm; Thailand 15–25 cm, more usually 10–20 cm.

Results from experiments conducted in Thailand in 1966 showed that yields are not significantly affected by length of the stake in the range of 10–30 cm even though shorter stakes give a lower survival percentage.

Stakes have between 3 and 7 nodes, but it is more usual to use 5–6-node stakes for planting in Thailand. Cutting is at an angle, which makes it easy to insert the stake into the soil. CIAT recommends stakes at least 20 cm long with 5–7 nodes that should have a pith diameter of not more than 50% of the diameter of the stem. Cutting at an angle is not recommended. Generally stakes are not treated in any of the countries in Asia. CIAT recommends insecticide and fungicide treatments.

Planting Techniques

In all countries in Asia, cassava planting is done either on flat ground or on ridges, depending upon rainfall, soil condition, weeds, ease of harvest, and tradition. Ridge planting is done when the soil is likely to be wet, when the weed problem is severe, and when ease of harvesting is important. Flat planting is easy to practice and is preferred in low-moisture soil and in areas with less-assured rainfall. In Malaysia and the Philippines both methods are practiced. In Indonesia, in good soil, flat-planted cassava is intercropped with other food crops while a sole crop of cassava is ridge planted. In India the pit method is most popular followed by the mound method. In Thailand the majority of farmers prefer flat planting. A furrow is opened by an animal-drawn plow. For ridge planting, the ridge is usually prepared by animal-drawn plow once or twice to make the ridge 15 cm high. Distance between ridges varies. It is 120–180 cm in Malaysia, 100

<table>
<thead>
<tr>
<th>Storage (days)</th>
<th>Under shade</th>
<th>Open</th>
<th>Covered with leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>95.61</td>
<td>95.31</td>
<td>96.50</td>
</tr>
<tr>
<td>15</td>
<td>93.47</td>
<td>93.38</td>
<td>91.60</td>
</tr>
<tr>
<td>30</td>
<td>83.39</td>
<td>84.28</td>
<td>87.89</td>
</tr>
<tr>
<td>45</td>
<td>80.02</td>
<td>55.98</td>
<td>58.36</td>
</tr>
<tr>
<td>60</td>
<td>57.50</td>
<td>48.86</td>
<td>50.03</td>
</tr>
<tr>
<td>75</td>
<td>49.23</td>
<td>31.96</td>
<td>43.11</td>
</tr>
<tr>
<td>90</td>
<td>44.90</td>
<td>28.94</td>
<td>35.87</td>
</tr>
<tr>
<td>105</td>
<td>43.19</td>
<td>21.03</td>
<td>22.09</td>
</tr>
</tbody>
</table>
in Thailand and the Philippines. Results from experiments in Thailand showed no difference in yield between the methods (Table 3).

Planting position varies depending on the moisture in the soil, ease of operation, and tradition. In Malaysia, horizontal planting is preferred because it takes less labour. In the Philippines, also, planting is usually horizontal. In India and Indonesia, vertical planting is preferred, whereas in Thailand, horizontal planting is practiced by those who plant very early or late in the rainy season when rainfall is uncertain. Vertical and inclined planting are more commonly practiced in Thailand. The major reasons are greater ease of harvest and less damage by weeds than with horizontal planting.

Depth of planting is variable. With horizontal planting, depth is about 3–5 cm, but in vertical planting it is about 10 cm. Results from experiments conducted in Thailand in 1977–78 showed that root yields were not different for cassava planted on ridge, flat, or flat followed by earthing up 30 days after planting. Horizontal planting gave lower yields than vertical mainly due to lower survival rates (Table 3). Vertical or inclined plantings were not different in survival percentages or yields (Table 3). Depth of plantings (5, 10, 15 cm) had no effect when plantings were either vertical or inclined (Table 3). Deeper plantings in the horizontal position resulted in delayed emergence of the sprouts.

One stake is generally planted per hill in all the Asian countries except in India where more than one stake is planted and thinned down to two shoots at 2 months.

There is a wide variation in row widths of cassava mainly because of the differences in soil fertility. It is 70–90 cm in India, 120–180 cm in Malaysia, and 75–100 cm in the Philippines and Thailand.

Plant-to-plant distance is 60–90 cm in Malaysia, 60–100 cm in Thailand depending upon soil fertility, 75–100 cm in the Philippines, and 75–90 cm in India. Results from an experiment conducted in Thailand in 1967–68 showed that yield is nearly invariant from 60 x 60 cm to 120 x 120 cm spacing. The normally recommended spacing is 100 x 100 cm; and in low-fertility soils and on slopes 80 x 100 cm is suggested.

Planting in the rainy season gives a high survival rate of 80–90% in Thailand and 90% in Indonesia, but planting late in the rainy season in Thailand decreases the survival rate to as low as 50%. Gap filling, if done, is usually within 30 days of planting. Replanting is done if survival is less than 50%.

The author is grateful to Chan Seak Khen, Research Officer, MARDI, Malaysia, to J. Wargiono, CRIA Root and Tuber Crops Coordinator, Indonesia, and to the staff of the Field Crop Experiment Stations in Thailand for making their data and experience available during the preparation of this paper.

### Table 3. Yield of cassava roots (t/ha) with different methods, positions, and depths of planting.

<table>
<thead>
<tr>
<th>Depths of planting (cm)</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridge</td>
<td>27.73</td>
<td>29.37</td>
<td>28.60</td>
<td>28.57</td>
</tr>
<tr>
<td>Flat</td>
<td>30.81</td>
<td>31.08</td>
<td>29.10</td>
<td>30.33</td>
</tr>
<tr>
<td>Flat, later earthed up</td>
<td>30.60</td>
<td>27.33</td>
<td>26.79</td>
<td>28.24</td>
</tr>
<tr>
<td>Vertical</td>
<td>30.88</td>
<td>31.12</td>
<td>30.37</td>
<td>30.79</td>
</tr>
<tr>
<td>Inclined</td>
<td>30.67</td>
<td>29.00</td>
<td>27.96</td>
<td>29.21</td>
</tr>
<tr>
<td>Horizontal</td>
<td>27.60</td>
<td>27.67</td>
<td>26.17</td>
<td>27.14</td>
</tr>
<tr>
<td>Avg</td>
<td>29.71</td>
<td>29.26</td>
<td>28.17</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** No interaction between methods, positions, and depths of planting.