Distribution of agricultural gumption in various agroecosystem as a strategy to maintain farm household income sustainability

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Abstract. The research was conducted in Manggarai District, East Nusa Tenggara Province with the research objectives were to describe (i) existing farming system performance, (ii) planting calender, cropping pattern, and harvesting calender, and (iii) farmer’s strategies to manage their farm and income. The district has two agroecosystems, there are dry land and wet climate high land, and dry land and climate and low land. Data was collected from 12 subdistrict in Manggarai district, by using Focus Group Discussion and observation method. The research results showed that farmer’s strategies were (a) growing multy commodities, so agricultural gumption and income distributed along the year, (b) in certain months were household income was supported by several commodities, but in other months were supported by only one commodity even there is no income. In high land zone, there is a range of time that is supported by several commodities, and in the low land zone, there are two supports from several commodities. In the two zones, there are several months with low income, so it is needed to find the other activity such as off farm and nonfarm to get income. The various farming activities which is running by farmers have aims to distribute risks, food security and also maintain agriculture product stability.

1. Introduction

Manggarai District has special natural characteristics compare to other districts in Nusa Tenggara Timur (NTT) Province. Main characteristics are (a) high land and low land farming system, (b) high rainfall intensity, (c) various commodities, (d) high range of topography, from flat to mountainous [1].

The main crops, cultivated by farmers in Manggarai district, are rice, maize, and cassava. While, horticulture crops are vegetables, onion, chili and just introduced commodity is garlic. Estate crops are coffee, cacao, clove and cashew [2–4].

Major problems of farming system in this region are (a) lack of recommended good agricultural practices, which reduces in the crop productivity, (b) climate change which interrupts income distribution and household food security, (c) weak farming institutional, such as farmers group, farm-input supply, and financial system [1,4].

The objectives of the research were to describe (i) existing farming system performance, (ii) planting calender, cropping pattern, and harvesting calender, and (iii) farmer’s strategies to manage their farm and income.
2. Methodology
The research applied a survey method and data was collected using Focus Group Discussion (FGD) and observation techniques. The research was conducted in 12 sub districts in Manggarai District during September - November 2020. Data analysis using quantitative and qualitative descriptive statistic.

3. Results and discussion
3.1. Existing farming system
Existing farming system consists of existing commodities and farming performance. Existing commodities describes the planting area and distribution. Farming performance describes the use of varieties, labor, production, productivity, and allocation for sale and household consumption.

3.1.1. Existing commodities: Planting area and distribution. There are existing commodities in Manggarai district such as food crops, horticulture, and estate crops. The main food crops cultivated farmers are rice, lowland and upland rice, maize, beans (green bean, soy bean, rice bean). Horticulture are various vegetables and fruits and also estate crops like coffee, cacao, clove and cashew.

There are potential agriculture land, including lowland and upland, registered as functional land. It means the land is needed to be used intensively. The existing using land is lower than potential land (Figure 1).

In 2014 - 2019, unused low land registered 7880 ha or 63% out of total potential lowland. While in unused upland was 37% out of the potential or average unused land during 2014 - 2019 was 81,412.5 ha (Table 1).

![Figure 1. Potential and functional lowland (a) and upland (b) in Manggarai District](source)

Source: Agriculture Service of Manggarai Regency 2019

The total unused land indicates that there is an opportunity to increase planting area in both upland and lowland. Table 1 dan Figure 2 showed that there are decrease trend of unused land, upland and low land, (figure a). It describes that during 2014 to 2019, there were decline in unused land. From 2015 to 2016 was the most decline in unused land, but in 2018 - 2019 the decline was only in lowland, and there was not decline in upland (remain). It shows that in the last two years, increasing agriculture activities in low land higher than upland.

There is a incline trend for the used land percentage from 2014 to 2019 (Table 1 and Figure 2). The highest increase of the used land percentage is in 2015 until 2016 in both, lowland and upland. From the data and figure describe that the used of upland is only 37% compare to lowland about 63%.

| Year  | Luas Potensial (Ha) | Luas fungsional (Ha) |
|-------|---------------------|----------------------|
| 2014  | 21,251              | 12,714               |
| 2015  | 12,714              | 12,714               |
| 2016  | 13,650              | 13,650               |
| 2017  | 13,650              | 13,650               |
| 2018  | 13,866              | 128,303              |
| 2019  | 13,866              | 128,303              |

Table 1. Area and percentage of unused and used land in Manggarai District
Year | Unused (ha) | Land Used (%) |
--- | --- | --- |
|  | lowland | upland | lowland | upland |
| 2014 | 8537 | 82,009 | 59.83 | 36.08 |
| 2015 | 8537 | 82,014 | 59.83 | 36.08 |
| 2016 | 7521 | 81,098 | 64.14 | 36.79 |
| 2017 | 7601 | 81,118 | 64.23 | 36.78 |
| 2018 | 7601 | 81,118 | 64.23 | 36.78 |
| 2019 | 7385 | 81,118 | 65.25 | 36.78 |

Average Manggarai | 7880.3 | 81,412.5 | 62.92 | 36.55 |

Source: Agriculture Service of Manggarai Regency 2019

Pasandaran (2019) stated that it is needed to analyse progress from time to time because there is a connectivity among natural resources [5]. The existing food crops which large enough cultivated by farmers in Manggarai are lowland rice, maize and soybean. Lowland rice occupies the highest area of food crops planting area, followed by maize and soybean (Table 2). All sub district in Manggarai have lowland rice and Satarmese sub district has the largest rice field area and Ruteng sub district is the second and followed by Reok Barat sub district, dan Wae Rii sub district.

The largest maize area is in Ruteng sub district, and the second one is Wae Rii sub district and followed by Reok sub district. While only Cibal sub district does not have maize are. It maybe too small maize area so it was not recorded.

Soybean is cultivated in some sub districts namely Reok Barat, Cibal, Rahong Utara, and Wae Rii. Soybean farming is a special program from government to introduce to farmers in Manggarai. Sustainability of the program is difficult to catch because it was a new commodity for farmers in the region. From FGD revealed that the soy bean had low germination, unsuitable to the existing environment. However from the growing terms the climate and soil in the region are suitable for soybean. From farmers experiences, mix-farming is needed to be applied based on local wisdom combine with new technologies [6].

**Table 2.** Planting area of the existing food crops by subdistrict in Manggarai District

| Sub District | Rice | Maize | Soybean |
|--------------|------|-------|---------|
| Langke Rembong | 735 | 58 | 0 |
| Wae Ri’i | 1180 | 355 | 0 |
| Cibal Barat | 520 | 0 | 0 |
| Cibal | 809 | 45 | 335 |
| Lelak | 826 | 275 | 0 |
Vegetables growing by farmers in Manggarai, mainly onion, various leaf vegetables, chili and garlic (Table 3). Priority horticulture commodity that is planned to grow in this region based on National Instruction (Keputusan Menteri Pertanian Republik Indonesia Nomor 472/Kpts/RC.040/6/2018) are onion, garlic, and chili. Various vegetables is the priority of Manggarai District’s Program, called SIMANTRI (Sistem Managemen Pertanian Terintegrasi/Integrated Farming System Management). The vegetables are growing in almost all sub district except Reok Barat sub district. Vegetable which is cultivated are leaf vegetables, fruit vegetables and tuber vegetables. This commodity is important to be supported in social economy development in NTT [2].

Table 3. Planting area of the horticultura crop by subdistrict in Manggarai District

| Sub District | Onion | Garlic | Chili | Vegetables |
|--------------|-------|--------|-------|------------|
| Langke Rembong | 0 | 12 | 13.6 | 39.5 |
| Wae Rii | 0 | 5 | 22 | 477 |
| Cibal Barat | 0 | 0 | 0 | 10 |
| Cibal | 0 | 0 | 10 | 26 |
| Lelak | 0 | 10 | 6 | 20 |
| Rahong Utara | 0 | 0 | 11 | 52 |
| Reok Barat | 0 | 0 | 0 | 0 |
| Reok | 250 | 0 | 2.5 | 13 |
| Ruteng | 0 | 12 | 20 | 71.5 |
| Satarmese Barat | 0 | 0 | 0 | 8.5 |
| Satarmese Utara | 0 | 2 | 5.5 | 4 |
| Satarmese | 5 | 1 | 2 | 13 |
| Manggarai | 255 | 42 | 92.6 | 756 |

Onion is only cultivated in Reok sub district with big enough planting area, 2505 ha in 2019. Chili is also cultivated in large enough area in some sub districts except Cibal Barat, Reok Barat, and Satarmese Barat.

Garlic is just introduced in some sub districts through government intervention. Some districts which is in high land (≥ 1000 m above sea level) could be potential areas to grow garlic for the future. The sub districts are Langke Rembong, Wae Rii, Lelak, Ruteng, Satarmese, and Satarmese Utara.

Estate crops in Manggarai which in accordance with the national instruction are coffee, and clove. Coffee is a first priority of estate crops in Manggarai. All sub districts have coffee plants except Reok sub district and clove is the second one. Only three sub districts do not have clove plantation i.e. Langke Rembong, Reok Barat, and Reok sub district.

Coffee varieties cultivated by farmers in Manggarai are robusta which is called tuan coffee - this coffee introduced by missionary Chatolic long time ago and the missionaries were called tuan, so up to now farmers named robusta as coffee tuan -. New introduction variety is arabica variety. This Arabica Coffee Manggarai has had Indication Geografis Certificate (IG) which has specialty taste and exported to the other countries. This coffee has special name “Arabica Flores Manggarai (AFM) same as “Arabica Bajawa” from Ngada District [2].
The other estate crops cultivated by farmers in Manggarai are Cashew and Cacao. Cashew is in almost all sub districts, besides Langke Rembong, Cibal Barat, Lelak, Satarmese Barat, and Satarmese Utara. Cacao is only in Satarmese sub district (Table 4).

Table 4. Planting area of the estate crop by subdistrict in Manggarai District

| Sub District       | Coffee | Clove | Cashew | Cocoa |
|--------------------|--------|-------|--------|-------|
| Langke Rembong     | 351.7  | 0     | 0      | 0     |
| Wae Ri’i           | 110    | 126   | 0      | 0     |
| Cibal Barat        | 669    | 216.25| 0      | 0     |
| Cibal              | 406    | 158   | 83     | 0     |
| Lelak              | 648    | 287   | 0      | 0     |
| Rahong Utara       | 754    | 353   | 247    | 0     |
| Reok Barat         | 123    | 0     | 653    | 0     |
| Reok               | 0      | 0     | 1571   | 0     |
| Ruteng             | 1042   | 693.5 | 0      | 0     |
| Satarmese Barat    | 150    | 137   | 87     | 0     |
| Satarmese Utara    | 650    | 183   | 0      | 0     |
| Satarmese          | 835    | 509   | 819    | 473   |
| Manggarai          | 5738.7 | 2662.75| 3460   | 473   |

Clove varieties cultivated in Manggarai are Zanzibar, Sikotok, and Siputih. Zanzibar and Sikotok are the most varieties growing in Manggarai. In 2020, based on farmers experience, the price of clove decrease pretty low to Rp 50,000/kg. Usually, farmers ignore to harvest clove when the price is getting low because they can not effort to pay harvest laborers.

3.1.2. Farming performance. Lowland rice farming using good seed of land-race rice seed or improved rice seed. There are, at least, five land-race rice such as Roslin or Cikapundung variety, Longko Rembung variety, Woja Laka variety, Woja Galung variety, and Yellow land-race rice variety. While introduced improved varieties are IR 64, Ciherang, and Inpari (Table 5).

Table 5. The use of variety Paddi by sub district in Manggarai District

| Sub District       | Variety                                    |
|--------------------|--------------------------------------------|
| Langke Rembong     | Roslin/Cikapundung,Longko Rembung VUB: Inpari 28, Inpari 33, Ciherang, IR 64 |
| Wae Ri’i           | Longko Rembung, Roslin, Ciherang, Inpari 33 |
| Cibal Barat        | Longko Rembung, Roslin, Ciherang, Inpari 33 |
| Cibal              | Longko Rembung, Roslin, Ciherang, Inpari 33 |
| Lelak              | Longko Rembung, Roslin, Ciherang, Inpari 33 |
| Rahong Utara       | Longko Rembung, lokal Kuning, Inpari 32, 33 |
| Reok Barat         | Ciherang, Inpari 33                        |
| Reok               | Ciherang, Inpari 33                        |
| Ruteng             | Longko Rembung, Atomita/Roslin, Asahan, Inpari 13, 32, Ciherang, Pandan wangi |
Improved varieties are mainly distributed by government, and only few farmers look for them. The harvested improved varieties seed is stored to be used in the next planting season. However, most farmers using their land-race and improved rice varieties. Rice improved varieties will increase rice production and income [5,7].

Almost in all sub-districts farmers grow rice using land-race and improved rice seed. Still, there are some farmers dedicated to grow land-race rice only because they argue that land-race rice is more adaptive to the existing climate and soil condition such as high land with cool temperature. Sub districts which have land-race rice are Langke Rembong, Ruteng, Lelak, Rahong Utara, Cibal, Cibal Barat, and Wae Rii. The response of farmers like this will be a way to convince farmers to adopt the new technology [2,8].

Fertilizers used in rice are urea and NPK compound which can be access through application of RDKK. The result of the Focus Group Discussion (FGD) indicates that farmers always have problem with fertilizer supply, especially incorrect timing. When rice needs to be fertilized, the fertilizer was not available. While pesticide was used if there are pest and diseases. Farmers usually get the pesticide from government project or from an agriculture store in each sub district. All farmers doing rice harvesting manually using sickle and then threshing using rice threshing machine. Furthermore, sun drying and store in the dry storage.

Human laborer is the main support system in rice cultivation in Manggarai beside animal and machines. There are two kind of human laborers they are male and female laborer which have different jobs and also in sometimes have the same job. Land preparation is done by male laborer in general, but for replanting job is done by both. However, female laborer has more skillful in doing replanting. Weeding job is mainly done by female and assisted by male laborer. Finally, harvesting, threshing, drying and storing is done by both together. In this stage, farmers keep using the old technologies due to lag of machine and capital [6,8].

Also labor can be divided into two kind of labor such as in-family laborer and out-family laborer. In some sub districts, the price for male and female laborer is different. Male laborer is priced higher than female laborer. Special jobs for male workers are land preparation, planting, weeding and harvesting.

While buffalo as animal worker is priced Rp. 175,000 per head per day but depend on the buffalo availability in the village. In the village with more number of buffalo, the price for renting buffalo workers is higher than the region with less number of buffalo. Buffalo workers are using mostly in the area with slope land or mountainous areas such as in Rahong Utara, Satarmese Barat, Satarmese Utara, and Lelak sub districts.

| Table 6. | Land preparation cost of lowland rice in Manggarai District |
|-----------|----------------------------------|
| Sub District | Wage (IDR/day) | Mechanization | Buffalo | Handtractor |
| | | | Rent Cost (Rp/animal/day) | Rent Cost (Rp/are) | Rent Cost (Rp/animal/day) | Rent Cost (Rp/are) |
| Langke Rembong | jockey: 100,000 | 5 | 100,000 | 20 | 50,000 |
| | Man: 80,000 | | | | |
| | Woman: 60,000 | | | | |
| Wae Ri’i | jockey: 100,000 | 0 | 100,000 | 29 | 50,000 |
| | man: 80,000 | | | | |
Hand-tractor is available in all sub districts. Almost all hand-tractors came from government’s projects and just few were bought by farmers. Some farmers that have hand-tractor also rent their tractor to other farmers, and the rent price is different among sub districts. Cost for renting the hand-tractor counted per acre or local unit called patok. The price is about Rp 12,000/acre until Rp 50,000/acre. Agriculture financial give big contribution to agriculture productivity [9,10].

The average of rice productivity in Manggarai is high enough. 4.57 ton/ha. The highest productivity is in Reok, Satarmese, and Reok Barat sub districts. The three sub districts are in low land. While the lowest productivity is in Rahong Utara and Langke Rembong with 3.99 ton/ha and 3.86 ton/ha consecutive. From Statistical data in 2019, Rice productivity in Manggarai (Table 7) is better that average rice productivity of NTT Province, 4.1 ton/ha.

Some sub districts produce rice just for household consumption or subsisten. Particularly, Cibal and Cibal Barat sub district hundred percent rice produced for household consumption because most farmers di not grow rice in large area and low productivity. There are 23 villages in Satarmese sub district, 3 villages in Satarmese Barat sub district, 4 villages in Ruteng sub district, 5 villages in Reok sub district, and 6 villages in Reok Barat sub district produce rice for commercial.

Table 7. Productivity and rice production orientation by sub district in Manggarai District

| Sub District     | Productivity (t/ha) | Consumption (%) | Sale (%) | Number of village |
|------------------|---------------------|-----------------|---------|------------------|
| Langke Rembong   | 3.86                | 90              | 10      | 20               |
| Wae Ri’i         | 4.48                | 83.3            | 16.7    | 17               |
| Cibal Barat      | 4.50                | 100             | 0       | 10               |

Notes: 1) Jockey is Water-buffalo rider in land preparation, 2) Man is male labor from planting to harvesting who gaint different wage rate with female labor, 3) Woman is female labor from planting to harvesting who gaint different wage rate with male labor, and 4) Labor is male and female labor from planting to harvesting at the same wage rate.
Other strategy to increase rice productivity is changing farmers orientation in producing rice from subsisten to combination of commercial and subsisten. The money from selling rice can be used for household needs. The other problem is running out of consumption rice stock so farmers should buy rice in the market. This phenomenon indicates how each household deal with their income [11,12].

Two estate crops which have important economic values, as household income and regional income are coffee and clove. Clone Arabica coffee in Manggarai are SA 35, Yellow Catura, Juria, S795, dan Komasti (Table 8).

| Sub District  | Variety                               |
|---------------|---------------------------------------|
| Langke Rembong| Arabica: SA 35, Yellow catura, Juria, S795, Komasti |
| Wae Ri’i      | Arabica, Robusta                      |
| Cibal Barat   | Arabica, Robusta                      |
| Cibal         | Arabica, Robusta                      |
| Lelak         | Arabica, Robusta                      |
| Rahong Utara  | Arabica, Robusta                      |
| Reok Barat    | Arabica, Robusta                      |
| Reok          | Arabica, Robusta                      |
| Ruteng        | Arabica, Robusta                      |
| Satarmese Barat| Arabica, Robusta                     |
| Satarmese Utara| Arabica, Robusta                     |
| Satarmese     | Arabica, Robusta                      |

Productivity of coffee in Manggarai is about 0.34 ton per ha and productivity of clove is about 0.12 ton/ha. The low productivity of coffee and clove in Manggarai is caused by poor application of GAP (Good Agriculture Practices). One of the improvement technology in coffee cultivation is plantation rejuvenation and rehabilitation. The renovation action by doing plant rejuvenation and rehabilitation will improve agronomy performance and farming financial benefit [2,12].

3.2. Planting calender and cropping pattern
Farmers use their own resources for utilizing land and other production factors in order to be survive along the year [12]. Planting calender for food crops and various vegetables (horticulture) spread throughout the year. Planting area and frequency based on local conditions. Food crops are the main crop in the planting calender in Manggarai District, i.e. rice and maize.

First planting season is in November with main commodity is rice and maize. Second planting season is started from April or May, and it is usually just rice. Harvest from first planting season will occur in
March and April, and harvest in second planting season is in August until November, depends on raining fall condition. Food crops planting season shows on Figure 3.

| Month | Nov | Dec | Jan | Feb | Mar | Apr | Mei | Jun | Jul | Agt | Sep | Okt |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| First Planting (MT I: rice + maize) | Harvest MT I (rice + maize) |
| Harvest MT II | Bali beans |
| Harvest MT II (rice) |
| Vegetables |

**Figure 3.** Planting and harvest calendar of rice, maize and Bali beans in Manggarai District

Planting pattern depends on each agro ecosystem. The planting pattern was result of internalization of experiences and resources [2]. Below is three different planting pattern based on different agroecosystem:

a. Lowland agroecosystem:
- paddy - paddy - paddy
- paddy - paddy - fallow
- paddy – maize and beans
- various vegetables or onion or garlic

b. Upland agroecosystem with food crops and horticulture base:
- maize + rice bean + casava - fallow
- various vegetables or onion or garlic

c. Upland agroecosystem with estate crops base:
- coffee + other crops (clove, banana, areca nut, and betel)
- clove + other crops (coffee, banana, areca nut, and betel)
- cashew + other crops (coconut + banana)
- cacao + other crops (coconut + banana)

There are four sub districts that have IP 200, they are Satarmese Barat, Satarmese Utara and Langke Rembong. Sub districts that grow once rice (IP 100) are Reok Barat, Cibal, Wae Rii, Reok and Ruteng. The low of IP in the regions because of shortage of water availability so farmers convert their rice field to grow various vegetables or fallow.

**Table 9.** Area in each planting season (MT) rice in Manggarai District

| Sub District       | Planting Area of Rice (ha) |
|--------------------|-----------------------------|
|                    | MT I | MT II | MT III | IP |
| Langke Rembong     | 735  | 168.7 | 0      | 185.60 |
| Wae Rii’i          | 1180 | 645  | 0      | 154.66 |
| Cibal Barat        | 520  | 292  | 31     | 162.12 |
| Cibal              | 809  | 310  | 20     | 140.80 |
| Lelak              | 826  | 689  | 0      | 183.41 |
| Rahong Utara       | 680  | 323  | 102    | 163.00 |
| Reok Barat         | 1322 | 0    | 17     | 157.29 |
| Reok               | 549  | 298  | 0      | 100.00 |
| Ruteng             | 1718 | 985  | 0      | 157.33 |
| Satarmese Barat    | 1765 | 90   | 0      | 200.00 |
| Satarmese Utara    | 411  | 411  | 0      | 200.00 |
| Satarmese          | 3285 | 3260 | 0      | 199.24 |
| Manggarai          | 13800| 7933 | 170    | 166.82 |
From 13,800 ha rice field in first planting season (MT I) becomes only half (52.5%) growing rice in second planting season (MT II) and only 1% in third planting season (MT III) (Figure 4).

![Figure 4. Rice field area in each planting season in Manggarai District](image)

Main factor caused reducing in planting area in MT II and MT III is limit water such as decrease in water availability or water position.

### 3.3. Harvesting calendar and strategy to sustainability

From all agriculture activities in Manggarai, it can be divided into two main harvesting calendar namely high land harvesting calendar and low land harvesting calendar.

Harvesting calendar indicates the time where farmers doing harvest activities and get income from it. Harvesting time distribution in a year indicates the household security rate including food security and household economy security. The higher frequency and harvesting items the stronger household food security and economy security.

In high land, food security and economic endurance pillar come from food crops estate crops and vegetables in the middle of the year increase household income. Mid year is the best period for increasing food security and income endurance.

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| durian | maize | rice | arabica coffee | robusta coffee | candlenut | clove | ginger | vegetables | betel | durian |

**Figure 5.** Harvesting calendar of high land in Manggarai District (example of Lelak sub District)

In early and late months in a year, food security and economic endurance of high land farmers are not good enough. It is caused by reducing of fruit, vegetables and betel production so it would interfere household income.

Some strategies can be done to strengthen food security and economic endurance are (a) improve household income management by managing money spending and saving, so high production and income in the mid years can be distributed during the year, (b) raise poultry to get daily base income, (c) working on off and non farm sectors.
Farmer households in low land have problem of food security and economic endurance in early months in a year. So the farmer’s strategy in high land can be used for farmers in low land. Farmers used the existing technology combine with capital and social web will create social institutional to perform existing agriculture [2,6].

4. Conclusion
It can be concluded from discussion that:
1. Farmers in Manggarai District are growing food crops, horticulture, and estate crops and also animals. They used low farm inputs and limited support systems. However, the rice productivity is good enough, but the productivity of other crops is relatively low. The existing farming system can be divided into high land and low land farming system.
2. In the some high land areas, there are only one peak farmer’s income, in a year, from some commodities but in some low land areas, there are two peaks in a year. However, in the two areas there are, in some months, farmers income is low so farmers need to have strategies to cope the problem like doing off farm and non-farm activities. The various on-farms, off-farm and non-farm activities intends to distribute the risk, the food security and household income along a year.
3. In deal with the problems and obstacles, farmers apply some strategies such as: (a) growing muti-commodities, so the agriculture gumption and income are distributed throughout the year, (b) there are some months household income are supported by certain some commodities but in in the other months be supported by only one commodity.

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| Jan | Feb | Mar | Apr | Mei | Jun | Jul | Ago | Sep | Okt | Nov | Dec |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| candle nut | rice | robusta coffee | rice | maize | arabica coffee | clove | tobacco | cashew | vegetables | betel |

Figure 6. Harvesting calender of low land in Manggarai District (example of Satarmese sub District)
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