Factsheet

Kanoppi Phase 2

Land optimization using a tuber-based agroforestry system in Gunungkidul, Yogyakarta

1. Introduction

Private forests can contribute to farmers' livelihoods because of their ability to provide farmers' needs, which consist of short-term or daily needs (such as food and daily income), mid-term needs (such as school fees) and long-term needs (such as home renovation, savings, marriage expenditure).

Based on this, private forest planting patterns have changed from monocultural to polycultural patterns. The combination of several commodities in private forests can be seen as an attempt at land optimization. Alteration of planting patterns has occurred owing to the increasing demand of land for agriculture (Oktalina et al 2016). Agricultural land has become limited because of conversion to settlements, industrial areas etc. The Indonesian Central Statistics Agency stated that, in general, agricultural land area in 2015 in each province in Indonesia had decreased compared to previous years (BPS 2018), causing rice production to decline. The decrease of rice production is associated with an increase in the price of unhulled rice.

Food commodity price inflation has a strong relation with food security, especially viewed from the aspect of affordability and food prices (Nurhemi et al 2014). Food security itself is defined as a condition when the supply of food for a country is adequately distributed to individuals, in terms of amount, quality, safety, diversity, nutrition, equally, affordably, in line with the religions, beliefs and cultures of the citizens in order to maintain healthy, active, sustainable and productive lives (Anonim 2012).

One of the Government of Indonesia's programs for achieving food security is finding alternative crops to rice, such as carbohydrate-rich local crops, and the cultivation of arid land (BKP 2018).

Tubers grown by people in Gunungkidul in the Special Region of Yogyakarta include large yam ('gembolo'), yam ('gembili'), local sweet potato ('uwi'), arrowroot ('garut'), taro ('talas'), elephant foot yam ('suweg'), purple-arrowroot ('ganyong') and small potato ('kentang kleci') (Kandar 2016). These are minor tubers which are not considered a Government priority for development and utilization (Budoyo 2010 in Hatmi and Djafaar 2014), however, these tubers still

provide benefits as functional foods, as with major tubers, such as cassava and sweet potato.

In general, staple crops are cultivated in the open but tubers are able to grow under shade from 30% to 70% sunlight (Balitbangtan 2012, Rosmiah et al 2014, DBAKU 2013).

Research on optimization of land under trees is important in this context and that of food security. The tuber species that were cultivated in this research were arrowroot (*Maranta arundinacea* L), purple arrowroot (*Canna discolor* Lindl) and yam (*Dioscorea esculenta* L). These species have beenwere planted under teak (*Tectona grandis* Linn) at different age classes. The three types of tuber were proven to be able to grow in Gunungkidul area and also have functional value.

2. Objectives of the research

1. Design a system that includes management of planting patterns spatially and temporally as a reference for agroforestry land optimization in private forests for sustainable tuber production throughout the year.
2. Provide a scientific basis for private forest optimization to achieve high productivity and quality through selecting alternative under-tree crops that are oriented to the people's welfare and environmentally sustainable.

3. Methods

The study used randomly complete block design with varying sland types and tuber crops.

The treatments of land type were 1) open land (monoculture); and 2) teak-based agroforestry systems with teak age under 5 years with the same spacing of 2 x 3 m.

The tubers were arrowroot, purple arrowroot and yam. They were planted in alleys and in monoculture with spacing between tubers 50 x 50 cm. The plot size for each replication was 10 x 15 m with uniform tree spacing for each age class: 2 x 3 m.

4. Findings

The results showed that tuber growth until age of two months after planting was satisfactory. The average of height and diameter growth of arrowroot was 31.88 cm and 0.87 mm in open land (monoculture); 40.47 cm and 0.94 mm under teak with age of less than 5 years; and 47.50 cm and 0.88 mm under teak with age more than 5 years. The average of height and diameter growth of purple arrowroot was 28.95 cm and 1.24 mm on monoculture; 28.84 cm and 1.23 mm under teak with age less than 5 years; and 66.37 cm and 1.30 mm under teak with age more than 5 years. The average of height and diameter growth of yam was 63.19 cm and 0.22 mm on monoculture; 33.54 cm and 0.2 mm under teak with age less than 5 years; and 91.33 cm and 0.25 mm under teak with age more than 5 years.

5. Challenges

The major challenge of this researchstudy iswas to find a suitable combination of tubers and trees. Minor tubers are very necessary to be developed, because in addition to having functional benefits also asthey are an alternative source of food to maintain food security.

Dewi Maharani | Balai Penelitian Agroforestry (BPTA) Ciamis
maharanid858@gmail.com