Cassava-Legumes inter-cropping: A potential food-feed system for dairy farmers

A Polthanee, S Wanapat, M Wanapat[*] and C Wachirapokorn*

Department of Agronomy, Faculty of Agriculture,Khon Kaen University, Khon Kaen 40002, Thailand
[*] Department of Animal Science, Faculty of Agriculture, Khon Kaen University

Abstract

When cassava is intercropped with legumes the cassava root yield generally decreases compared with when cassava is planted alone. This is due to the competition of the component crops for light, water and nutrients. However, cassava-legume intercropping systems usually increase the land use efficiency and economic return over solely cassava. Because of the current low market price for cassava roots, dual-purpose production of cassava for both root and fodder should be developed. Cassava hay is a good fodder for dairy cows, and legume crops, such as cowpea and peanut whose residues also provide good fodder for livestock, can be intercropped with cassava.

When cowpea was row and strip intercropped with cassava, it produced fodder yields of 1.7 to 2.4 tons/ha, depending on the cowpea cultivar. Cowpea seeds and young green pods are eaten by humans. A food-feed system based on cassava-cowpea strip intercropping has been successfully developed by dairy farmers in Mahasarakham province in Northeast Thailand. Peanuts and mungbean are also high-potential legume crops for food-feed systems for dairy farmers.

Key words: Cassava, inter-cropping, cowpea, forage yield

Introduction

The Northeast region of Thailand is considered to be the largest producer of cassava (*Manihot esculenta* Crantz) in the country. This crop has been recognized as one of the most important cash crops after sugarcane. A sole crop of cassava, which in this context may be considered a long-season crop, does not efficiently use the available light, water and nutrients during its early growth stages due to its slow initial development. Thus a short-duration second crop may be inter-planted to make more efficient use of these growth factors. The legume crops have been considered to be suitable crops for use in intercropping systems with cassava. They could possibly be used in improving soil fertility through their root nitrogen fixation and crop residues (Ashokan et al 1985). On the other hand, legumes can be used as fodder, where green material is used for grazing or, more commonly, cut and mixed with dry cereals for stall feeding (Tarawali et al 1997). This paper reviews cassava-legumes inter-cropping systems in the context of growth and yield, agronomic advantages for human food and fodder crops. Nutrient removal from soil, land use efficiency and economic returns are also discussed.

Climate and soil

Approximately 80 percent of the 20 million people in Northeast Thailand are engaged in agriculture, of which more than 80 percent are heavily dependent upon rain-fed agriculture. Although the region has an average annual rainfall greater than 1,200 mm, the seasonal distribution is poor, as almost all of the rainfall falls from April to October. The date of onset of the rainy season, and the quantity and continuity of rainfall at the beginning of the rainy season vary considerably from year to year, and the end of the rainy season also varies. In addition there is usually a dry period occurring in June or July (Polthanee and Marten 1986).

Another important constraint is soil quality. There are 35 different soil types in Northeast Thailand, but, with the exception of some upland limestone areas, they are derived from sandstone, shale or silt-stone and are therefore inherently low in phosphorus, calcium and magnesium and have extremely low organic matter and cation-exchange capacity (Craig and Pison 1988). Therefore, the lowest per capita income is found in this region of the country due to the instability in the rain-fed farming system, poor soil quality, and fluctuation in market demand and price for the major crops of rice, cassava, sugarcane, kenaf and maize.

Cassava and rice-based farming systems

Cassava adapts to a wide range of ecological conditions and is known for its tolerance to drought. It can grow in areas with as little as 750 mm rainfall per year and it survives in areas with dry periods of 5 to 6 months (Cock 1984). Cassava grows remarkably well on poor soils and will grow on extremely acid soils and give reasonable yields when most other crops would either fail or give very poor yields (Cock and Howeler 1978). The requirements for K, N and Ca are similar to those for growth of other crops, but when the supply to these nutrients is limited, growth is reduced less than in most crops (Edwards et al 1977). Therefore, cassava is usually suitable for growing in the unfavorable environments of Northeastern Thailand and other similar areas. The farmers usually say that cassava serves as the security crop in the farm. In addition, the period of planting, weeding and harvesting for cassava do not compete with rice cultivation, which is the most important crop in Northeast Thailand (Figure 1). This indicates that a rice-based farming system that includes cassava results in better household farm labor distribution.

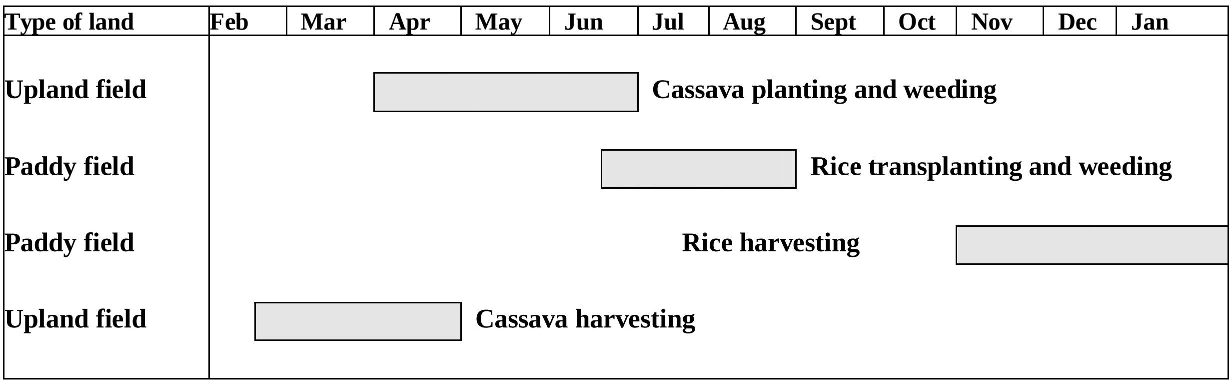

Figure 1. Seasonal distribution of labor for a farmer cultivating upland and paddy fields

Cassava and soil fertility

Cassava cultivation for several years usually results in a decline in soil fertility. This is due to (1) wide spacing, slow development of soil cover in the first three to four months, traditional soil tillage and clean weeding practices at the onset of the rainy season, which can result in high soil losses, (2) the above-ground part of the plant is not reincorporated into the soil (as the stem is used for planting material), (3) no-root residues remain in the soil (the root is removed and sold), (4) short turn around time for soil recovery (long growth duration) and (5) farmers apply small amounts of fertilizer.

Polthanee et al (1998) determined nutrient balances for the cassava system under farmer management using a crop-cut study procedure. The results show that N balances were slightly negative, P balances slightly positive, but K balances were highly negative (Table 1).

Inter-cropping systems

Table 6. Cassava yield and yield components as influenced by peanut inter-cropping

Cropping system	**Root yield (t/ha)**	**Roots per plant (no.)**	**Fresh weight per root (g)**
Sole cassava	22.3[a]	11.2	197.3[b]
Cassava (100x 100cm) + P1	25.2[a]	12.4	203.2[a]
Cassava (100x50cm) + P2	18.8[b]	9.8	191.8[b]
Cassava (200x50 cm) + P3	15.7[b]	9.5	169.5[c]
F-test	**	Ns	*

** = significant at 5%; ** = significant at 1%; NS = not significantP1= peanut 1 row (plant density ; 87,500 plants/ha); P2= peanut 2 row (plant density ; 37,500 plants/ha); P3= peanut 3 row (plant density ; 37,500 plants/ha)*

Peanut seed yield and pod number per plant were affected by cassava inter-cropping. The highest seed yield was obtained with cassava inter-cropped with 1 row of peanuts at the highest plant density.

Table 7. Peanut seed yield and yield components as influenced by cassava-peanut intercropping

Cropping system	**Seed yield (t/ha)**	**Pods / plant (no.)**	**Seeds / pod (no.)**
Sole peanut	1.96[a]	21.8[a]	1.80
Cassava (100x100) +P1	1.66[a]	16.9[b]	1.73
Cassava (200x50) + P2	1.13[b]	20.9[a]	1.73
Cassava (200x50) +P3	1.18[b]	20.9[a]	1.70
F-Test	*	*	NS

** = Significant at 5%; NS = not significant; P1 = Peanut 1 row; P2 = Peanut 2 rows; P3 = Peanut 3 rows*