

Chapter 3

MATERIAL AND METHOD

The study consists of two parts, field survey and field experiment.

3.1 Field survey

The informal and formal field survey were conducted in Bac Thai, Cao Bang and Lang Son provinces in the Mountainous area of the Northeast Viet Nam during March - May, 1992. The purpose of this survey is to gain the knowledge of environmental conditions and farmers' practices, perception with respects to soil conservation and crop management.

3.2 Field experiment

Field experiment was conducted on the Western side of the hill on the red-yellow soil with slope of 22.9 %. The area belongs to the experimental farm of Agricultural University No. 3 Bac Thai, Viet Nam . The experiment was conducted during March to December, 1992.

3.2.1 Treatments and design

Two factors were applied in the experiment. The first factor was alley cropping denoted as +H (with *T.candida* hedgerows) and -H

(without hedgerows). The second factor was cropping system coded 1 is peanut-corn sequential cropping; 2 is peanut-upland rice relay cropping; 3 is peanut-cassava intercropping; and 4 is peanut-corn relay cropping). The combination of treatments are shown in Table 3.

The design of split-plot was used with three replications. Main plots were alley cropping, subplots were cropping patterns (Appendix Figure 1). Each experimental unit occupied 68.4 m² area.

Table 3 Combination of factors in experiment

Factors				Combined treatment code
Alley cropping	Trt. code	Cropping systems	Trt. code	
With hedgerows (<i>T. candida</i>)	+H	- peanut - corn sequential cropping	1	+H1
"	+H	- peanut-upland rice relay cropping	2	+H2
"	+H	- peanut-cassava intercropping	3	+H3
"	+H	- peanut-corn relay cropping.	4	+H4
Without hedgerow	-H	- peanut - corn sequential cropping	1	-H1
"	-H	- peanut-upland Rice relay cropping	2	-H2
"	-H	- peanut-cassava intercropping	3	-H3
"	-H	- peanut-corn relay cropping	4	-H4

3.2.3 Cultural practices

T. candida was sown on March 23th, 1992 in two rows with an interval of 20 cm, interval between plants was about 2.0 cm. The space between the hedgerows was 7.0 m. The cropping calendar for the experiment is shown in Appendix Table 1.

The combined fertilizers of 60 kg N/ha, 60 kg P₂O₅/ha, 40 kg K₂O/ha, and 500 kg CaO/ha was applied to all treatments. These amounts were used in each treatment with suitable methods and times (Appendix Table 2). Fertilizer was not applied for *T. candida*. Mixed fertilizer (N+P₂O₅+K₂O) was incorporated along rows of crops, while CaO was broadcast over the whole experimental area.

Crop spacing and density applied were:

- + Upland rice : 40 cm x 15 cm with 5 seeds/hill
- + Peanut : 40 cm x 15 cm with 2 seeds/hill
- + Cassava : 120 cm x 80 cm with 1 stalk/hill
- + Corn : 80 cm x 30 cm with 1 seed/hill

Tree pruning of *T. candida* was done twice, first on July 22nd and then on October 2nd and then used as mulching material. Other cultivating methods, weeding and pest control were practiced at the optimum level.

3.3 Data collection

Climatic data including temperature, sunshine hours, rainfall were collected at Thai Nguyen meteorological station which is located about 3 km from the experimental site.

Soil nutrient analysis: Soil samples at 0-20 cm deep at the experimental plots were taken at two different times for analysis of pH, N, P, K, and organic matter. Three soil samples representing the feature of the soil in experimental plots at the beginning of the experiment were taken. After finishing the experiment, one soil sample for each plot was taken for analysis. Total nitrogen content was analyzed using the Kjeldahl method, potassium was determined by flame photometer, total phosphorus was determined with digestion HCL and NH_4F , pH was determined in 0.01 M CaCl_2 , and organic matter by oxidization to CO_2 and use of the Leco automatic carbon analyzer.

Soil loss: Staking technique was used to measure soil loss. In each plot, 18 stakes were set into the soil with 10 cm clear above soil surface. The total of 54 stakes per treatment was used. Height of each stake was recorded during rainy months, then weight of soil loss was calculated.

Crop data: Growth duration, plant height, yield and yield components of each crop were collected for every crop at harvesting (9 plants were randomly measured for each crop per plot).

Economic yield was measured in 9 m²/plot for peanut, 8.64 m²/plot (9 plants) for cassava and 6.48 m²/plot (27 plants) for corn.

Biomass of the above ground plant part of crops were measured every month. However, first sampling date was different among crops. The sample of 3 cassava plants, 6 corn plants, 9 peanut plants and 9 upland rice plants were taken each time.

Canopy cover percentage was measured for every crop and hedgerows every 30 days, starting from May 15th to October, 1992. A cord of 21 m, that was divided into 208 equally spaced knots was stretched diagonally across the rows, and then count number of knots which met the canopy was counted. A counted knot number against the 208 knots was converted into a percentage that was percentage of canopy to cover land surface. This procedure was repeated randomly five times on each plot. Percentage of canopy to land was be calculated to evaluate the land covering ability of various cropping systems. *T. candida* canopy was measured before and after cutting.

N, P, K content in seeds, stems and leaves were analyzed separately for every crop and hedgerow tree.

Economic data: Cost, return, gross margin, return to labor cost (RTL_C), and return to material cost (RTMC) were estimated for each treatment.