CHAPTER III

RESEARCH METHODOLOGY

3.1 Research approach

This study consists of on farm survey and field experiment. Firstly, on farm survey aims to explore farmers' perception on intercropping *S. hamata* in mango based integrated farming system. Secondly, field experiment is set up to measure the effect of cutting frequency, weed control and fertilizer on growth, forage yield, quality and ground coverage of *S. hamata*. Three factors responding on weed infestation were measured and all common weed species were also simultaneously identified. The details of both parts are described as follows:

3.2 On-farm survey

The formal survey was conducted from December 1999 to April 2000, which thirty eight-selected mango growers who participated in the field day in October 1998 and March 1999 were interviewed by using questionnaire.

Mango grower informations related to the research sites were collected such as general farmers' information, weed management, forage crops and farmers' perception on intercropping *S. hamata* in mango-based integrated farming systems. Survey data were analyzed by descriptive methods. Preliminary results were also utilized to design and carry out the field experiment.

3.3 Field experiment

3.3.1 Experimental site and field history

An on-farm experiment was conducted in a three-year old mango orchard on farmer's field in the Chom Tong Land Reform Area of Yang Kram subdistrict, Doi Lor district. The area, with latitudes of 18° 28'N – 18° 35'N and longitudes of 98° 44'E – 98° 50'E latitudes, is located 39 km southwest of Chiang Mai city. *S. hamata* seeds with pods were sown between rows of mango trees at the rate of 18.8 kg/ha in early August 1998. The *S. hamata* field was then left until late April 2000 when the actual field experiment was started (Figure 3.1).

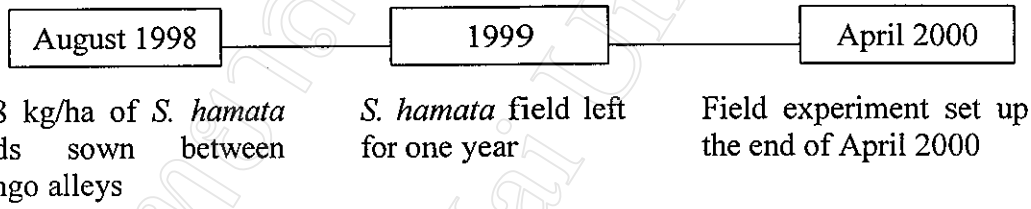

Figure 3.1 Field history of *S. hamata* in mango orchard

3.3.2 Design and treatments

The two-year-old established *S. hamata* cover crop between the rows of mango tree with 4 m x 4 m spacing and 24 permanent quadrats (quadrat = 1 m x 3 m experimental unit size) were selected. The experimental design was 2x2x2 factorial in randomized complete block design with three replications. The factors consisted of two forage cuttings (single cutting and double cuttings), two weedings (No weeding and single manual weeding) and two P-fertilizer (No fertilizer and fertilizer).

3.3.3 Field management

The similar populations of mature Verano stylo in each quadrat (1 m x 3 m) were selected at the end of April 2000. Superphosphate (P_2O_5) (0-46-0) was broadcast

on fertilizer treatments at the end of April 2000 at the rate of 170 kg/ha. All common weeds in weeding treatments were cut above the Verano stylo shoot at beginning of July in 2000. *S. hamata* were harvested after having a heavy leaf flush at 20 cm above the ground level. Two harvesting treatments were involved harvest of fodder at the end of August and October 2000. Single harvesting treatments were harvested at the end of October in 2000. The treatment combinations in this study were as follows (Table 3.1):

Table 3.1 The treatment combinations laid out on field experiment

Treatment	Management
T1	No Fertilizer + single cutting + No weeding
T2	No Fertilizer + single cutting + Weeding
T3	No Fertilizer + double cutting + No weeding
T4	No Fertilizer + double cutting + Weeding
T5	Fertilizer + single cutting + No weeding
T6	Fertilizer + single cutting + Weeding
T7	Fertilizer + double cutting + No weeding
T8	Fertilizer + double cutting + Weeding

3.3.4 Data collection

Data were collected starting from May to October 2000.

3.3.4.1 *Stylosanthes hamata*

1. Growth

The heights of ten newly germinated and mature plants in each quadrat (1m x 3m) were measured at the intervals of 15 days.

2. *Phenology*

Phenological growth stages of newly germinated and mature plants were monitored every 15 days.

3. *Density*

Populations of both newly germinated and mature plants were randomly counted by using a single sampling quadrat (1/4 m^2) in each treatment every month.

4. *Percent coverage*

The coverage of *S. hamata* was expressed as a percentage in each plot at the intervals of 15 days by visual estimation.

5. *Dry matter (DM)*

Whole plants of both newly germinated and mature plants *S. hamata* excluded roots were harvested by using a single randomly quadrat in each plot at the end of August and October in 2000. Dry matter of *S. hamata* samples was obtained by using hot air oven at 65 ^{o}C, for 48 hrs.

6. *Quality*

The quality of *S. hamata* was measured at the end of August and the end of October in 2000. Young plant samples (upper parts over 20 cm. above ground level) of *S. hamata* were taken to analyze the chemical compositions, crude protein (CP) was measured by Kjeldahl method. Acid-detergent fiber (ADF) and neutral detergent fiber (NDF) were measured by using Van Soest System (Udomprasert and Sawasdiphanich, 1995).

3.3.4.2 Broadleaved and grass weeds

1. Species

The common weed species were collected, identified and ranked at the end of April, August and October in 2000 by using Summed Dominance Ratio (SDR) (Radanachaless, 1990; Radanachaless and Maxwell, 1997).

2. Phenology

Phenological growth stages of the predominant weed species were monitored every 15 days, starting from the end of April until the end of October in 2000.

3. *Dry matter (DM)*

Whole plants of all weed species were measured twice from a single sampling quadrat (1/4 m^2). Each species was separated and dried by using hot air oven at the end of August and October in 2000.

4. Percent coverage

Percent coverage of broadleaved and grass weeds in each plot was measured by using visual estimation at the intervals of 15 days for 6 months.

5. *Density*

Broadleaved and grass weed populations were counted by using a single randomly quadrat in each plot every month from May to October in 2000.

3.3.5 Soil data

Soil samples were taken from the depth of 1-30 cm before the lay out of the experimental plots. Soil nutrients i.e. nitrogen (N), available phosphorus (P) and available potassium (K), organic matter (OM), cation exchange capacity (C.E.C.), electrical conductance (E.C.), pH and soil texture were analyzed. The total N and available P percentage were determined by using Kjeldahl method and Bray II respectively. Available K in ammonium acetate extract was measured by flame photometer. O.M., pH and soil texture were estimated by Black and Walkley method, pH-meter and hydrometer respectively. C.E.C. and E.C. were determined by ammonium acetate extract and a conductant bridge respectively (Jackson, 1960).

3.3.6 Climatic data

Air temperature and rainfall in year 2000 were recorded by Starlog Model 6004A/B Revision 20 Firmware, which was set at the Chom Tong Land Reform area.

3.3.7 Data analysis

Descriptive method with tables, figures and charts was used to interpret the demanded objectives. The data were analyzed and briefly discussed as follows:

To achieve the first objective which is aiming at the assessment of the farmers' perception on intercropping *S. hamata* in mango based integrated farming system. The interviewing results from the mango growers were analyzed by using descriptive statistics. Percentage, mean and standard error were used for analysis information regarding land use and weed management in farming systems.

To achieve the second objective which is aiming at measuring the effect of cutting frequency, weeds control and fertilizer on growth, forage yield, quality and ground coverage of *S. hamata* and weeds infestation. The results from field experiment were analyzed by using two statistic programs including Statistix version 4.1. Descriptive statistics, analysis of variance (general AOV/AOVC), coefficient of variation, least significant difference (LSD) and comparisons of means were used for the analysis information on growth, forage yield, quality and ground coverage of *S. hamata* as well as weed infestation.

To achieve the third objective which is aiming at identifying weed species, and the important value of weeds in the integrated farming system by using relative density, relative frequency and relative dry weight including Summed Dominance Ratio (SDR) (Radanachaless, 1990; Radanachaless and Maxwell, 1997).