CHAPTER 7

CONCLUSIONS

The field survey was undertaken in the Namkha area of Houn district in the province of Oudomxay in northern Laos, during the period March to May 2002.

The results of climatic and edaphic characteristics of the area covered by the survey are suitable for cereal and legume based cropping systems under upland conditions. Maize-legume cropping systems production is second in importance only to upland rice based systems in the area, and the importance of maize-legume production systems is increasing as a basis to improving farm incomes throughout the area. Weed control in all wet-season upland cropping activities in the study area is usually undertaken manually with a range of traditional hand tools. In maize crops, hand weeding is usually undertaken 2-3 times during the growing season, while for soybean a single weeding is usually undertaken.

Almost all the labor required for weed control comes from within the families undertaking the cropping activities. The occasionally labor exchange within villages might be arranged as a basis for managing the weeding operations. Weeding is the most demanding single activity in the cropping cycle in relation to labor input. Often women and children provide much of this labor input. The timing of weeding in maize and soybean cropping in the study area is mainly as the V4 and V8 stages of vegetative growth for maize and the V4 vegetative stage for soybean. The peak period of labor input for weeding is June, July and August, depending to some degree on rainfall distribution, for periods of heavy rainfall early in the growing season can result in significant early weed growth and a need for increased labor inputs for weed control early in the cropping cycle.

Based on economic in the region is subsistence agriculture production systems. All household incomes came from agriculture production, particularly, there are rice, maize and some cash crops, for rice product was only consumption by their family by year to year. Moreover, almost family income was a maize product.

The results of the field experiment undertaken at Chiang Mai University indicated that there were significantly differences for weed population density, total dry matter of weed and labor use for weeding, within and between treatments examining the impact of time-of-weeding and for different combinations of maize-soybean cropping systems. As might be expected, the highest weed population density and total dry matter weight of weeds was associated with the no weeding treatments in all-cropping combinations. However, in the timing-of-weeding treatments, it was when weed control was delayed until the V8 stage of growth in the maize crop that the highest weed population density and weed yield were recorded. As might be expected, the total labor input for weeding was determined by the number of weedings undertaken. The highest labor input was associated with the weed-free treatments in all cropping combinations.

In an examination of the relationship of crop components and time-of-weeding, it was established that there were strong interactions for plant height for both maize and soybean, between time-of-weeding and cropping systems. These relationships between time-of-weeding and plant height were stronger in the sole crop situations then when the maize and soybean were intercropped in various combinations. It was also noted that when plant height of soybean increased due to competition for light under some intercropping combinations, this was associated with a reduction in branching of the soybean plants, leading to reductions in LAI, total dry matter yield and final grain yield.

Leaf area index was significantly different for timing of weeding and cropping treatments for both maize and soybean. In the case of maize, at some stages of growth there were also significantly different interactions between time-of-weeding and cropping treatments. The LAI in sole crops of maize and soybean was higher than for the intercropping treatments in all time-of-weeding treatments.

Light intensity and light interception were determined by time-of-weeding and cropping treatments. Light intensity and light interception obtain levels in the sole crop maize treatment was lower than maize in the intercropping treatments. However, Light intensity and light interception obtains level for sole soybean was highest when soybean was intercropped within each row of maize crop.

The total dry matter of maize and soybean differed significantly in response to different times of weeding in maize, and between cropping treatments for both maize and soybean. Only at harvest was the relationship of soybean TDM statistically significant between time-of-weeding and cropping treatments. As might be expected, the TDM for sole crop maize was consistently greater than for sole crop soybean.

Yield components for maize indicated there to be significant differences for number rows per ear, seed number per row and seed number per ear in relation to time-of-weeding treatments. In response to cropping treatments the significant responses were in relation to seed number per row, seed number per ear, and 1,000 seed weight. The interaction between time-of-weeding and cropping treatments was significant only for rows per ear and seeds per row.

The number of seeds per ear and 1,000 seed weight were consistently greater in the sole maize crop relative maize in the intercropping treatments, for all time-of-weeding treatments. Almost all yield components for maize were reduced as a result of intercropping, thereby resulting in reduce maize grain yield in these treatments, relative to the sole maize crop.

For soybean, the yield components that responded to time-of-weeding treatments were number of pods per plant and number of filled pods per plant. However, in response to cropping treatments all yield components were affected – number of pods per plant, number of filled pods per plant, percent of unfilled pods and 100 seed. In relation to branch number per plant, higher branch numbers were associated with higher yields which, in turn, were associated with higher yield components, number pods per plant, filled-pods per plant, unfilled-pods per plant and 100 seeds weight. Almost all yields components associated with higher grain yield in the sole crop soybean were affected in the intercropping treatments; the only exception being the percent of unfilled pods per plant.

The highest number pods per plant and highest number filled pods per plant for sole crop soybean were found in the weeding treatment -V4+V8. The lowest of percent of unfilled pods per plant was also found in the sole crop of soybean.

The 100 seed weight for soybean was also higher in the sole crop soybean than when soybean was intercropped with maize. Most of soybean yield components associated with higher yield, were associated with the V4+V8 weeding treatment, indicating that at least two weedings were required to maximize soybean yield potential. The lowest levels for the soybean yield components were associated with the intercrop treatment of 1 row of maize and 1 row of soybean (M: SB 1:1).

Total grain yield for maize reflected the interactions between time-of-weeding and the intercrop treatments. For almost all the weeding treatments, the maize yield in the sole crop treatment exceeded the yield in both the intercrop treatments. The only exception was for the no weeding treatment when a slightly higher yield was obtained when a single row of maize was intercropped with two rows of soybean (M: SB 1:2).

As might be expected, the highest grain yield for maize was obtained in the weed free treatment. The lowest was recorded in the V8 weeding treatment when each row of maize was intercropped with a double row of soybean (M: SB 1:2) treatment.

The highest soybean grain yield was associated with the weeding treatment V4+V8+V12, while the lowest yield was recorded in the no-weeding treatment. However, soybean grain yield in the weed-free treatment was lower than the V4+V8+V12 treatment, but higher than in the time-of-weeding treatments V4, V8, V4+V8, and the no-weeding treatment. Among the cropping treatments, as might be expected; the highest soybean grain yield was came from sole cropping with soybean. Between the two intercrop treatments, higher soybean yields were obtained from double cropping 2 rows of soybean to one row of maize (M: SB 1:2).

The land equivalent ratio (LER) exceeded 1.0 for all time-of-weeding and intercropping treatments. This indicated that there was a definite yield advantage from intercropping. The highest LER was associated with the intercropping treatment of a single row of being intercropped with a double row of soybean (M: SB 1:2); this was reflected in all time-of-weeding treatments, with the highest LER of 1.69 being achieved in the V8 time-of-weeding treatment. In contrast, the lowest LER of 1.18 came from when a single row of maize was intercropped with a single row of soybean in the V8 time-of-weeding treatment.

The higher total grain yield and high LER from the intercropping treatments were, in term, reflected in the gross margins per unit area and per labor day input for weeding. These economic indicators were at a maximum in the no weeding treatment and were at their lowest in the weed free treatment. The highest gross margins per hectare were achieved from the V4 weeding treatment when each row of maize was intercropped with two rows of soybean (M: SB 1:2). The gross margin per ha in this treatment was Baht 18,156, while the gross margin per labor-day for weeding was Baht 380. In contrast, for the weeding treatment the V4+V8+V12 for the same intercropping combination, the gross margins dropped to Baht 13,369 per ha^{-1} and Baht 126 per labor-day used for weeding, respectively. The gross margins for the sole cropping situations were always less than for the intercrop treatments.

The results obtained in these studies help in providing additional knowledge, which can assist farmers in making decisions for maximizing yields and returns in various maize/soybean-intercropping systems. The optimum cropping combination for upland conditions would appear to be the intercropping of single rows of maize planted on a 75cm x 25cm row/hill spacing, with a single row of soybean planted on the basis of 37.5 cm x 25 cm row/hill spacing. However, it is also recognized that the results on which this recommendation is based were obtained under specific conditions in northern Thailand, and need to be tested under the conditions that prevail in northern Laos, of which the province of Oudomxay is regarded as being representative.