CHAPTER 7

DISCUSSION AND CONCLUSIONS

Results of field survey were indicated that there were major soybean varieties that were used by farmers, i.e., DT84, AK06, and Hoa Binh variety but their average yield was very low. The result was similar to the facts reported from sources, i.e., General Statistic Office (2000) and Hai *et al*., (1997). As explanation for this circumstance, varieties were not suitable to specific areas where occurred variation of mainly weather parameters such as temperature, radiation, and rainfall levels (Figure 5.2). It was found that areas had an advantage of growing soybean, as climate may be suitable for soybean growth and development in spring and summer. So if farmers have good soybean variety and proper farm practices, they can get more income from soybean production. Besides, soybean can benefit to improve soil quality for their field in next crops. . The conclusion was similar to results reported by Chinh *et al*., (2000).

Results of field experiment in Chiang Mai University indicated that all of soybean varieties in August planting date became shorter growing period than those in September planting date (Table 6.1). It proved that phenological events of soybean were affected by varied weather conditions; in particular, rainfall levels, day length and radiation. From rainfall data, it shows on August 2 sowing date, amount of rainfall is high so it will effect on emergence of soybean varieties. In addition, day length is a factor that related to photosynthesis of soybean. The less rainfall in filling pod and seed that give shorted growing period. The fact was similar to results reported by the Legume Research and Development Center, (2000) if delay-planting date to end of year, consequence, growing season less than 5 days as compare to summer season.

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Growth, yield and yield components parameters of all soybean varieties were achieved higher in August than those in September planting date (Table 6.5). In which, leaf plays an importance in photosynthesis, since it can accumulate parts of plant as stem, pod, and seed. These could be positive relationship between LAI and yield components if LAI less than 6 m^2 m^{-2} ground. Temperature (average 30°C, day length (12 hours) and rainfall in whole period in August planting date these adapted to growth and development of soybean. These are better than Sept. planting date when has lower weather indicators as compare to Aug. planting date. Similar results have been reported from Walter, (1983) and Wilson *et al.*, (1995). It was reported that yield and quality of soybean seed were reduced if delay sowing date.

Testing model was done for phenological events. In general, the model demonstrates good capability in phenological events for three of four soybean varieties, except CM60 due to Bragg (7) belong shortest growing period group but CM60 belong medium growing period group (more than 10 days) so when initial running that give some difficult with larger RMSE between observed and simulated data. In addition, experiment consisted of two planting dates, so the result was not satisfied due to limited in data supporting.

After that, the model done in phenological events testing, it changes testing in growth. However, plant phenological events are influence the growth as well as seed yield and yield components. So some parameters of CM60 were not satisfied such as: biomass, grain yield and pod weight (Table 6.14 and 5.15). Jintrawet (1991) reported that if phenological not satisfy result as growth parameters could be difficult for adjustment. Results were demonstrated that the model under- and over-estimated LAI in the middle duration in the growing seasons. Larger LAI difference occurred in duration from 36 to 84 dap for AK06, 48 – 84 dap for TN12, DT84 and CM60, respectively. It may be related to genotype and environment condition in field experiment that not yet to study.

The model estimated LAI_{max} satisfactorily for four soybean varieties. The agreement between simulated and observed was examined by squared-R; it was found the correlation coefficient changed from 0.45 to 0.75, in other words, the model

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estimated better than before. The consideration was also based on RMSE, it considered that most of RMSE were lower than this run with model Bragg (7) (1.26 to 0.54, 1.03 to 0.23, 1.63 to 0.4, 2.26 to 1.04 m^2 m^{-2} in respect to AK06, TN12, DT84 and CM60. It was concluded that parameter in genetic component have been adjusted acceptably in terms of prediction of LAImax.

The model overestimates the pod weight at harvest for all varieties across planting dates, except CM60. This is because, according to earlier analysis, CM60 was long duration variety as compared to other varieties used in the experiment, as well as Bragg (7) was considered as initial genetic coefficient, thus adjustment of coefficients such as PODUR, SPDV difficult to obtained the absolute accurate for this variety.

The model gave good agreement between simulated and observed above ground biomass; it was illustrated accurate level for DT84, and larger difference occurred for the remaining varieties. However, in which, for AK06, the match was also demonstrated accurately in PD2. Regarding the accumulation of biomass, the model predicted accurately the parameter in early growing season, while relative accurately in the remaining growing season of all varieties. This may be since in the late growing season, or the duration of strongest uptake nutrient from soil, soybean growth was affected by environmental conditions such as varied temperature and rainfall levels.

In regard with above ground biomass at harvest, based on linear regression analysis for correlation between simulated and observed the growth parameters, indicating that simulated value followed close the observed data (squared –R increased from 0.27 in Bragg (7) model up to 0.82 with the modified coefficients).

As comparison between observed field data and simulated results of grain yield at harvest, Bias indicators was in negative in all varieties, indicating that the model tend to overestimate for varieties, except for CM60, nevertheless, RMSEs of these comparison were relative not great, the least for AK06, (RMSE = 147 kg ha^{-1}, or

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10% of average grain yield through all varieties). It is revealing that the coefficients such as WTPSD, SFDUR, SDPDV, and PODUR were acceptable.

In overall, the model using modified genetic coefficient estimates better than model using genetic coefficients of Bragg (7). Therefore, genetic coefficients of all varieties are acceptable, except for CM60. Calibration of genetic coefficient of this variety was not successful due to above- mentioned reasons. The conclusion is from the best- fit analysis.

Running the CROPGRO-soybean model under soil and climatic conditions, results indicated that on the May 15th planting date, four varieties, namely AK06, TN12, DT84 and CM60 produced higher grain yields than other planting dates. In contrast, the lowest grain yield was found on January 15th planting date (Table 6.18). Because, weather conditions, i.e., rainfall, temperature, radiation these are effect on soybean growth. In particular, rainfall plays an importance role in this area where irrigation system is not existed.

In conclusion, under Hoa Binh conditions, farmers experience marked yield reduction when planting is delayed from June to monthly in end of year. But they did not know to grow soybean at May planting date, it would achieve the highest grain yield. This also proved that changing weather condition would affect strongly soybean's grain yield. These were reported by Curry and Feldman (1987), Boot *et al.*, (1998), and Egli and Bruening (1992). Furthermore, on-farm trial needs to undertake in Hoa Binh province, since then would have accuracy results, and finally recommend farmers who attended in soybean production. This agreed that variation in weather parameters (rainfall, temperature, radiation) were effected on phenological as well as yield and yield components. However, this result needs further study.

The CROGRO-Soybean model illustrated satisfactory simulation of phenological events and some growth parameters. This could help researchers in soybean varieties selection and improve farm management that will useful for farmers who can manage time schedule for crop management, i.e., fertilizer, planting date and pesticide. However, due to shortage of time and resource, the calibrated model was not

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validated in other sites with varied soil, weather, and farm management practices. The model needs further testing and validation in a wide range of environment before it can be considered fully validated.

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