CHAPTER I
BACKGROUND

1.1 Introduction

Beef cattle are ideal domestic animals, having superb nutritional quality because it of an abundance of protein, vitamins and minerals. Beef keep all the essential amino acids in about the same proportions as required by humans (Chowdhury and Ørskov, 1997; Saucier, 1999; Padre et al., 2006). Recently, the population of cattle in the South-East Asia was estimated about 430 million head, producing 1.23 million tons of meat (FAO, 2010). In Thailand, the cattle population has shown an increase from 4.60 million head in 2000 to 8.59 million head in 2009 and meat production increased from 0.17 million tons in 2000 to 0.24 million tons in 2009 (DLD, 2010). Nevertheless, current meat production does not meet the demand for human consumption, which has increased more rapidly. Therefore, managing beef cattle to meet consumer demands is urgently required to maintain a profitable and sustainable beef industry. In tropical regions, most cattle are raised by smallholder subsistence farmers and the feeding system for beef cattle relies on low quality roughage, crop residues and natural pasture, which are deficient in metabolizable energy and crude protein (Ash, 1990), resulting in depressed animal performance (Sugimoto et al., 2004; Patra, 2009). Due to the elevated costs related to planned feeding, the accomplishment of intensive production systems depends on the sufficiency of the nutrients provided to meet animal requirements.

Energy is the primary constraint of feed cost for beef industry and the energy supply is generally the first limiting factor on ruminal microbial protein synthesis (AFRC, 1993; Nocek and Russell, 1988). The energy requirement for maintenance accounts for 60-70% of total energy expenditure (Ferrell, 1988). Likewise, Moe and Tyrrell (1973) suggest that the energy requirement for maintenance and for growth of ruminants is approximately 70-80% and 40-60% of total energy costs, respectively. Thus, the energy requirement for maintenance is the main part of energy production, and it is necessary to have a thorough understanding of energy requirements in order to utilize energy feed resources with maximum efficiency. However, energy requirements for beef cattle have not been well defined, but are currently being followed widely in Thailand. The NRC (2000) and AFRC (1993) guidelines are generally used all around the world to formulate diets under diverse conditions (Chizzotti et al., 2008; Tedeschi et al., 2002). But nutrient needs of beef cattle fed under humid tropical conditions possibly differ from those recommended in the feeding standard of European breeds fed under temperate conditions, because of differences in genetics, mature size, quality of feed, climatic conditions and nutrient utilization (Ferrell and Jenkins, 1998; NRC, 2000; Paul et al. 2003). Ferrell and Jenkins (1998) and Ferrell et al. (2006) have suggested that *Bos indicus* cattle can consume and utilize low quality forage more efficiently than *Bos taurus* cattle in nutritionally limiting environments and energetic efficiency for maintenance of *Bos indicus* is higher than *Bos taurus* cattle. These are in good agreement with the report of NRC (2000) which indicates that *Bos indicus* breeds require about 10% less net energy requirement for maintenance than beef breeds of *Bos taurus*. In contrast, however, is the report of Ledger (1977) and Leal de Araujo et al. (1998), who indicated that energy requirement for maintenance of *Bos indicus* is about 5% higher than that for British cattle. In tropical feeding recommendations, Kearl (1982) suggested that the energy requirement for maintenance of beef cattle is 493 KJ/kgBW$^{0.75}$/d, while recommendation for beef cattle in temperate zone set by NRC (1976) is 540 KJ/kgBW$^{0.75}$/d.

For the last decade, many studies have attempted to quantify the nutrient requirement of beef cattle in Thailand. In previous studies, the nutrient requirement research focused on the Thai native breed, which represents over 70% of the total national beef herd (DLD, 2009). These cattle have been raised under more extensive conditions and considered to be well adapted to heat stress, disease and low quality feeds of the humid tropical zone. Kawashima et al. (2000) studied energy requirement of Thai native cattle via the face-mask respiration calorimetry method, arriving at a result of 245 KJ/kgBW$^{0.75}$/d. This is at variance with the energy recommendation for Thai native cattle by WTSR (2008), of 484 KJ/kgBW$^{0.75}$/d, the result from report of Nitipot et al. (2009) (509 KJ/kgBW$^{0.75}$/d) and the report of Tangjitwattanachai et al. (unpublished data) (532 KJ/kgBW$^{0.75}$/d). However, the nutrient requirements of beef cattle in Thailand remain inconclusive. More clarification of the nutrient requirement and nutrient utilization of local beef cattle is required so that the animal feed resources can be used with greatest effectiveness.

The lack of knowledge on beef cattle requirements is the main constraint of feed formulation in the beef industry, and it may possibly be limiting efficiency of utilization of feed resource and be decreasing farm incomes. Therefore, the establishment of feeding guidelines for beef cattle is imperative for progress toward the sustainable development of beef production in Thailand. More research in nutrient requirements are needed to clarify established feeding guidelines for local beef cattle in the region. For these reasons, this current study focused on determining of the metabolizable energy requirements for maintenance, the metabolizable energy requirements for gain, and investigated the effects of metabolizable energy intake on growth performance, digestibility, blood metabolites, rumen fermentation, carcass quantity and quality of Thai native cattle.

1.2 Objectives

1.2.1 To determine metabolizable energy requirements for maintenance and growth of Thai native cattle.

1.2.2 To investigate the effects of metabolizable energy intake on growth performance, digestibility, blood metabolites and rumen fermentation of Thai native cattle.

1.2.3 To investigate the effects of metabolizable energy in diets on carcass quantity and quality of Thai native cattle.

1.3 Anticipated Outcome

1.3.1 To obtain metabolizable energy requirements for maintenance and for gain of Thai native cattle.

1.3.2 To realize the effects of metabolizable intake on growth performance, digestibility, blood metabolites and rumen fermentation of Thai native cattle.

1.3.3 To realize the effects of metabolizable energy intake on carcass quantity and quality of Thai native cattle.