

A SURVEY ON SOURCE OF AGRICULTURAL PRODUCT AND BY-PRODUCT IN PHITSANULOK PROVINCE FOR UTILIZATION AS ROUGHAGE FOR RUMINANT

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ABSTRACT

The purposes of this research were to explore the source of product and by-product from agricultural and to evaluate chemical composition of agricultural by-product in Muang Phitsanulok (MP), Nern-Maprang (NM) and Nakhon-Thai (NT) districts, Phitsanulok Province. The purposive samples used by a questionnaire and surveying were 362 farmers. The data was statistically analysed by using a linear model that considered all factors as fixed effects. Least squares means for subclasses of each factor were estimated and they were compared using t-tests. In addition, the agricultural product and by-product were collected from surveying area and was analysed for chemical composition by AOAC method. The results revealed that cultivating area (CA), average yield (AY), and average by-product (AP) were affected by farm location-source of by-product ($p > 0.01$). Farmers from MP district had the higher CA, AY, and AP from rice than NT and NP districts, respectively, except for CA from NP and NT districts, respectively. In contrast farmers from NP district had higher AY, and AP from corn than NT and MP districts, respectively, except for CA from NT district. Chemical analysing results showed that the chemical composition of corn stover, corn foliage and rice straw consisted of dry matter 77.58%, 94.00%, and 97.20%; ash 7.40%, 14.05%, and 13.28%; crude protein 6.32%, 3.10%, and 5.06%; crude fat 1.82%, 2.15%, and 2.39%; and crude fiber 22.87%, 24.90%, and 34.09%, respectively. These results implied that the improvement of average yield and yield and quality of by-products from agricultural in different farm locations and sources require the different strategy.

Keywords: Agricultural by-product, roughage, ruminant

Điều tra sản phẩm và phụ phẩm nông nghiệp sử dụng làm nguồn chất xơ cho gia súc nhai lại tại tỉnh Phitsanulok, Thái Lan

TÓM TẮT

Mục đích của nghiên cứu này là khai thác và đánh giá giá trị dinh dưỡng các sản phẩm và phụ phẩm nông nghiệp thuộc các huyện MuangPhitsanulok (MP), Nern-Maprang (NM) và Nakhon-Thai (NT), tỉnh Phitsanulok. Các mẫu câu hỏi và mẫu thức ăn được thu thập ở 362 trang trại. Các số liệu được phân tích thống kê sử dụng mô hình tuyến tính. Bình phương nhỏ được ước lượng và so sánh bằng T-test. Thành phần hóa học của thức ăn được phân tích bằng phương pháp AOAC. Kết quả cho thấy diện tích trồng (CA), năng suất trung bình (AY) và năng suất phụ phẩm (AP) bị ảnh hưởng bởi vị trí trang trại-nguồn gốc của sản phẩm phụ ($p > 0,01$). Huyện MP có CA, AY và AP cao hơn so với các huyện NT và NP, ngoại trừ CA của huyện NP và NT. Thành phần hóa học của thân cây ngô, lá ngô và rơm có vật chất khô lần lượt là 77,58%, 94,00% và 97,20%; khoáng tổng số 7,40%, 14,05% và 13,28%; protein thô 6,32%, 3,10%, và 5,06%; mỡ thô 1,82%, 2,15%, 2,39% và chất xơ thô lần lượt là 22,87%, 24,90% và 34,09%. Như vậy, kết quả chỉ ra rằng để nâng cao năng suất trung bình và chất lượng của các phụ phẩm nông nghiệp ở các trang trại có vị trí khác nhau cần có các chiến lược cụ thể cho từng khu vực.

Từ khóa: Động vật nhai lại, phụ phẩm nông nghiệp, thức ăn thô.

1. INTRODUCTION

The main problem of beef cattle farmers is a lack of roughage in dry season. Due to they always raise cattle in nature pasture, and nature pasture is limited with low nutrients, low digestibility and low voluntary intake. It's also important to realize that tropical grass mature declines more rapidly than temperate grass. Therefore, tropical grass may not meet the requirement of cattle. Accordingly, nature grass may fail to provide enough quality and quantity for suitable cattle production. But it is a widely known fact that Phitsanulok province has the large scale of agricultural area (5,102.83 km², Phitsanulok province agriculture extension office, 2014). Almost of plantation is agronomy (1772.82 km²). Therefore, the high volume of agricultural by-products could be alternative roughage in Thailand because of the lower price of these by-products. Many researchers reported that crop residue can be used for cattle production. A simple crop residue in Phitsanulok province is rice straw., because rice production is the main farming activity of Thailand. After harvesting rice in field, rice straw is left over from this harvest (around a third). But adequate nutrients and low digestibility of raw rice straw result in low productivity of cattle. Moreover, by-products from corn production (corn stover, corn cob and ear corn) are interesting. Bal et al. (1997) showed the result milk production was highest when fed dairy cattle with corn silage at the two-thirds milkline stage. Sugarcane is concentrated in the central and lower northern in Thailand. Common sugarcane residue is bagasse trash and green leaves which have potential for feeding ruminant. Although the kind of agricultural by-products in Thailand was shown, amount and period of crop residue in Phitsanulok province is limited. Hence, this study explored the source of product and by-product and evaluated chemical composition of agricultural by-products from agriculture in Phitsanulok Province.

2. MATERIALS AND METHODS

2.1. Farms and data

The survey was carried out from February to May 2014 in Phitsanulok province, lower northern Thailand. Three districts namely, Muang Phitsanulok, Nern-Maprang and Nakhon-Thai were selected purposively based on geography (plain, plateau and piedmont plateaus). The survey focused on the kind, amount and harvesting period of agricultural products and their residues. A dataset with 362 records about kind of plant, seed time, harvesting period, crops and their crop residue collected from farmers by using a semi-structured questionnaire. The studied traits composed of cultivating area (1,600 m²), average yield (Ton/1,600 m²) and average by-product (Ton/1,600 m²). Farm identification number that created by the farmers was used for the analyses and also to link all related information. District of the individual farms was considered for farm location, which could be classified as Muang Phitsanulok (MP), Nern-Maprang (NM), and Nakhon-Thai (NT). Source of product from of farmers were used to define as rice and corn.

2.2. Data analysis

Farm location-source of agricultural product of farmers were tested for their effect on cultivating area, average yield of product, and average by-product in SAS software (SAS, 2004). Least square means of the studied traits were estimated for the considering factors, and then were compared using t-test. Significant level for the comparison was considered at $\alpha = 0.05$.

2.3. Chemical composition analysis

The samples from agricultural by-product (corn stover, corn foliage and rice straw) were thawed at 4°C for 24 h before chemical analysis. Moisture, crude protein and ether extract were analyzed according to AOAC (2001).

3. RESULTS AND DISCUSSIONS

The results from this study showed that the majority of farmers in this population depended on horticulture or agronomy such as rice, corn, cassava, and soy bean etc. These results were similar to those reported in literatures (Thumrong et al., 2005; Phitsanulok rice research center, 2014; Phitsanulok provincial agricultural extension office, 2015b). Farmers from MP district had the highest ($P > 0.01$) cultivating area of rice (30.23 ± 2.09 1,600 m²), followed by farmers from NP district (23.89 ± 1.53 1,600 m²) and NT district (13.33 ± 1.68 1,600 m²), respectively. In contrast, farmers from NT district had the highest cultivating area from corn (23.76 ± 2.09 1,600 m²), followed

by farmers from NP district (15.98 ± 1.53 1,600 m²) and MP district (7.28 ± 1.68 1,600 m²), respectively (Figure 1). This result was similar to the reported by Phitsanulok provincial agricultural extension office (2015b). This report confirmed that the ratio of land for cultivating area from rice and corn in 3 districts were 55.12% and 0.07% of MP district, 28.02% and 18.19% of NP district, and 16.86% and 81.74% of NT district, respectively. Moreover, these results agreed with Phitsanulok provincial agricultural extension office (2015a) reported that information of cultivating area for agricultural in Muang Phitsanulok, Nern-Maprang and Nakhon-Thai districts at Phitsanulok Province as showed in figure 2.

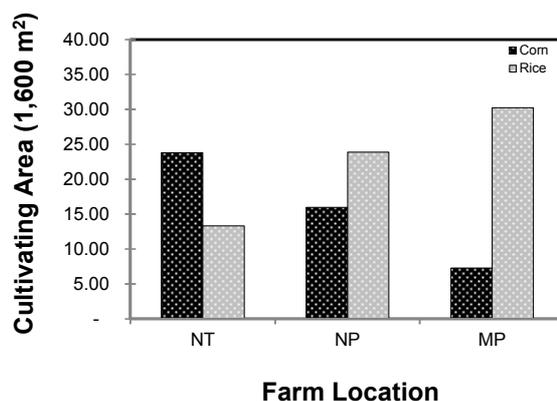


Figure 1. Least squares means of cultivating area by farm location and source of agricultural production

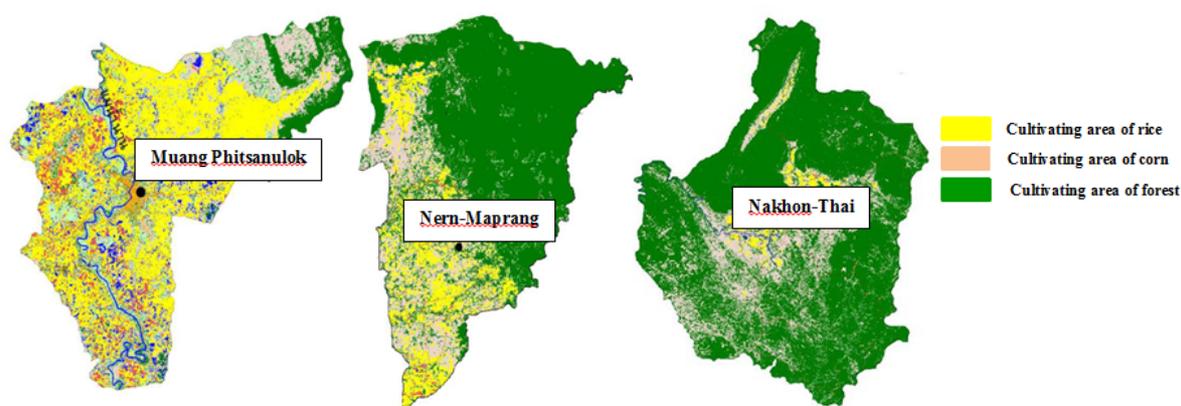


Figure 2. Information of cultivating area for agricultural in Muang Phitsanulok, Nern-Maprang and Nakhon-Thai district at Phitsanulok Province

Source: Phitsanulok provincial agricultural extension office (2015a)

The pattern of farm location - source of agricultural production Least Squares Means for average yield from rice and corn was similar to that for average by-product from rice and corn. Farmers from MP district produced higher average yield and average by-product from rice (23.76 ± 3.90 and 1.51 ± 0.02 Ton/1,600 m²; $P > 0.01$) than farmers from NT district (12.11 ± 2.18 and 1.08 ± 0.05 Ton/1,600 m²) and NP district (9.76 ± 3.11 and 0.91 ± 0.06 Ton/1,600 m²), respectively. On the other hand, farmers from MP district (6.07 ± 1.22 and 0.45 ± 0.33 Ton/1,600 m²; $P > 0.01$) produced less average yield and average by-product from corn than farmers from

NT district (16.55 ± 2.75 and 1.16 ± 0.05 Ton/1,600 m²) and NP district (18.70 ± 2.32 and 1.34 ± 0.08 Ton/1,600 m²), respectively (Figure 3 and 4). Average by-product from rice and corn patterns across farm location - source of agricultural production subclass was related to average yield from rice and corn. A similar pattern of average yield from rice and corn are in agreement with the works of Phitsanulok provincial agricultural extension office (2015b) who found that the ratio of land for average yield from rice and corn in 3 districts were 37.51% and 20.22% of MP district, 30.76% and 40.15% of NP district, and 31.73% and 39.61% of NT district.

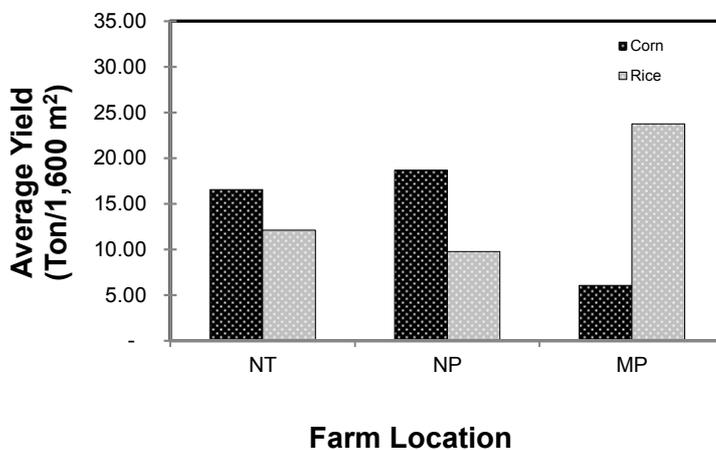


Figure 3. Leastsquares means of average yield by farm location and source of agricultural production

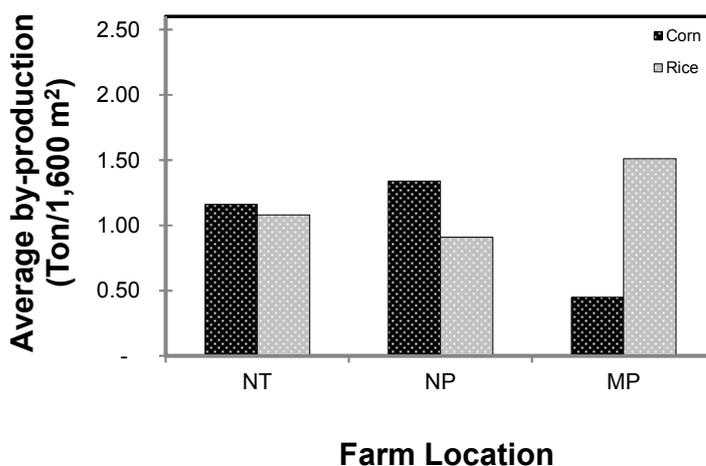


Figure 4. Leastsquares means of average by-product by farm location and source of agricultural production

Corn stover contained dry matter (DM) 77.58%, ash 7.40%, crude protein (CP) 6.32%, crude fat (CF) 1.82%, and crude fiber (CF) 22.87%. Corn foliage consists of dry matter (DM) 94.00%, ash 14.05%, crude protein (CP) 3.10%, crude fat (CF) 2.15%, and crude fiber (CF) 24.90%. Rice straw consists of dry matter (DM) 97.20%, ash 13.28%, crude protein (CP) 5.06%, crude fat (CF) 2.39%, and crude fiber (CF) 34.09%. A similar result was found by Sarnklong et al. (2010) which reported that rice straw had 96.30% DM and 6% CP. These values were close to those reported in other studies (e.g., Boonlom et al., 1999; Saowaluck et al., 1999; 2000). The results were in agreement with that reported by Li et al. (2014) who found that whole corn stover had 93.38% of DM (% of air-dry basis), 4.05% of CP, 1.31% of EE, 71.93% of NDF, 41.36% of ADF and 6.26% of ADL, respectively. While its leaves (corn foliage) had 92.88% of DM, 9.95% of CP, 1.49% of EE, 62.28% of NDF, 31.12% of ADF and 4.43% of ADL, respectively. The composition of rice straw was indicated by Department of Livestock Development, Thailand (2004) that DM, CP, CF and EE are approximately 90.16%, 5.23%, 0.93% and 29.78%, respectively. Feeding ruminants with these by-product without any supplementation of the other required nutrient sources or improving the quality might result in poor performance of ruminants. The agricultural by-products from Thailand had higher crude fiber and lower crude protein than mediteranian roughage, due to the temperature and climate that directly affect chemical composition of forage crops.

However, most sources of agricultural product and by product or wastes in Thailand used for utilization as roughage for feeding beef cattle, dairy cattle, and buffalo were derived from economic crops such as rice, corn, sugar cane, pineapple, and cassava. These agricultural products and by products were sufficient in quantities for ruminant feeding due to their large production. These contribu to solve feed deficiency in the feed shortage seasons. Therefore, to use in ruminants feeds

farmers must process or improve their qualities (Sompong et al., 2007; Vatsana, 2008; Chirawat et al., 2009; Sarnklong et al., 2010).

4. CONCLUSION

In conclusion this study confirmed that farm location-source of products from agriculture of farmers was an important factor ($P > 0.01$) for cultivating area, average yield, and average by-product. Farmers in MP district had higher cultivating area, average yield, and average by-product from rice than corn, except for farmers from NP, and NT districts. The chemical composition of corn stover, corn foliage and rice straw consists of 6.32%, 3.10%, and 5.06% of crude protein, respectively. These findings suggested that cultivating area, average yield, and average by-product from agricultural for utilization as roughage for ruminant livestock are different among farm location and source of product.

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