Beef cattle-based farming pattern in dry land, Tanah Laut Regency, South Kalimantan

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Abstract. A cropping pattern is an effort to plant things on a plot of land by arranging the layout and order of plants for a certain period of time. Cropping patterns and intercropping can be done with the aim of utilizing resources optimally and to avoid the risk of crop failure and market risk. Diversified cropping patterns are farming diversification with the aim of increasing agricultural yields so that income is maintained. The purpose of this research is to determine the types of farming patterns based on beef cattle, the impact of farming patterns on business objectives, and the income generated from the Decent Living Needs (KHL) that applies on dry land. Decent Living Needs (KHL) is the standard of needs of a single worker/labor to be able to live physically decently in 1 month. KHL is also the basis for determining the Minimum Wage. The study was carried out in Takisung District, Tanah Laut Regency, South Kalimantan. A survey and focus group discussions were used as research methods. Income, livestock waste for fertilizer, agricultural waste for feed, utilization of agricultural land, forage area, and livestock weight gain are the business objectives that are determined and analyzed. The analysis used is analysis of variance (ANOVA), and the Duncan test will be used to determine the contribution of income to the KHL. The research found six dominant cattle-based farming patterns. Farming patterns have a significant impact on business objectives such as income, agricultural waste utilization for animal feed, and agricultural land utilization. The conclusion of this research is that there are 6 dominant farming patterns in the research location, namely paddy and cattle; paddy, rubber and cattle; paddy, rubber, soybeans and cattle; Paddy, soybeans and cattle; paddy, soybeans, peanut and cattle; paddy, corn and cattle. The pattern of business that produces the highest income is the pattern of rice, rubber and cattle and the second is rice, soybean, rubber and cattle. The recommended business is business diversification with several commodities so that the necessities of life can be achieved and sustainable.

1. Introduction

Farming is a science that analyzes how farmers effectively, efficiently, and continually manage inputs or production variables (labor, land, capital technology, fertilizers, seeds) to achieve high production and raise their farming revenue [1]. Farmers in this situation operate as managers to manage their farms, and they are expected to be as efficient as possible in order to optimize production and profitability [2].

A cropping pattern is an effort to plant things on a plot of land by arranging the layout and order of plants for a certain period of time [3]. According to [4] and [5] that cropping patterns and or
intercropping can be done with the aim of utilizing resources optimally and to avoid the risk of crop failure and market risk. According to [6], diversified cropping patterns are farming diversification with the aim of increasing agricultural yields so that income is maintained.

According to [7], business diversification offers the perpetrators a number of benefits, including reducing the chance of crop failure, gaining new sources of revenue, absorbing labor, and enhancing or conserving the environment. Farmers that perform food crop farming, particularly rice farming, must combine their activities with other commodities since food crop cultivation, particularly rice farming, has a lower level of economic feasibility than plantation farming [8].

The scarcity of productive land, which is shrinking due to population growth and land conversion, has shifted the focus to developing agriculture on dry land, which has a large potential in terms of total area [9]. However, the use of dry land as agricultural land faces technical, cultural, social, and economic problems [10]. Profitable farming patterns can be a solution to sustainable farming on dry land. Several studies have stated that the selected farming pattern must be based on the usual farming pattern carried out by farmers and be socially, economically, culturally and environmentally acceptable[11]–[13].

Because each location has different cultural, social, economic, and environmental features that affect farming patterns, studying beef cattle-based farming patterns for business objectives in dry land, Tanah Laut Regency, South Kalimantan, is highly essential. This research aims to: (1) identify farming patterns based on beef cattle on dry land; (2) determine the effect of farming patterns on business objectives; (3) Find out the income generated for the Decent Living Needs (KHL) that applies to dry land, Tanah Laut Regency.

2. Methods

2.1. Study Area
This research was conducted in Takisung District, Tanah Laut Regency, South Kalimantan, Indonesia. The survey was conducted from May to November 2018 and involved 110 respondents who own at least three units of beef cattle. Takisung District is one part of the Tanah Laut Regency, this sub-district is located at: 114,603o – 114,697 o East Longitude 3.72207 o – 3.99539o South Latitude. This sub-district is related to Kurau District (north), Pelaihari District (east), Java Sea (west), Panyipatan District (south). The altitude above sea level is 5 meters with an area of 343.00 km2. This sub-district has 12 villages. Takisung District is a coastal area with a beach length of: 30 Km so it is one of the tourist attractions in Tanah Laut [14]. Takisung sub-district is a dry land with a variety of commodities cultivated, namely rice, peanuts, soybeans, bananas, oil palm, rubber, and livestock.

2.2. Data and Material
The data collected is primary data and secondary data. Primary data was obtained from farmers through surveys and interviews using questionnaires and FGDs. Secondary data was obtained from related agencies such as BPS, Department of Animal Husbandry and Agricultural Extension Centre as well as other relevant agencies. The data collected was tabulated and analyzed. The analysis used is analysis of variance (ANOVA), and Duncan's test is used if there are differences in business patterns. The objectives set in the farming pattern are: income, livestock waste for fertilizer, agricultural waste produced, agricultural land use, forage area for animal feed (HMT), and increased body weight of livestock. Data was collected through interviews and literature study. Interviews were conducted to obtain primary data, while the research was to obtain secondary data by reading and citing theories derived from books and other writings relevant to the research. The research materials used were office stationery, newsprint for discussion, whiteboards and questionnaires.
2.3. Methods and Data Analysis
The first and second objectives set in the study were obtained by means of FGDs conducted on figures or stakeholders at the research site. After knowing the dominant farming pattern carried out by farmers in the research location, it was continued with surveys and interviews. Interviews used questionnaires to respondents who represented each farming pattern that had been obtained. Data obtained from respondents in the form of farmer characteristics and farming patterns in more detail (cultivation and business analysis). Decent Living Needs data was obtained from the local BPS.

The analysis utilized is analysis of variance (ANOVA), and Duncan's test is employed if there is a difference between the business patterns. The objectives set in the farming pattern are: income, livestock waste for fertilizer, agricultural waste produced, utilization of agricultural land, area of forage (HMT), and increase in the body weight of livestock. Data collection was done through interviews and literature study. Interviews were conducted to obtain primary data, while the study was to obtain secondary data by reading and citing theories derived from books and other writings relevant to the research.

According to [15], farmers' income is determined using the formula 1:

$$P_d = TR - TC$$  \hspace{1cm} (1)

Where:
- $P_d$ = Total Income
- $TR$ = Total receipts
- $TC$ = Total Cost

The R/C ratio is used to determine if farming is profitable/feasible for farmers. The formula 2 employed [16] is:

$$R/C = \frac{Total \, Receipts}{Total \, Cost}$$  \hspace{1cm} (2)

Furthermore, an analysis of the contribution of farm income to the cost of living was carried out, which refers to [17], which is 800 kg/capita/year (with the price of rice calculated in this study as Rp. World Bank on the poverty line, where the value of one US dollar for the calculation used is Rp. 13,750). The income contribution of farming patterns to the KHL is calculated by comparing the income of the KHL in a given year and multiplying it by 100 percent, as shown in the formula:

$$\left( \frac{P_i}{KHL_j} \right) \times 100\%$$  \hspace{1cm} (3)

Where:
- $P_i$ = Farming income
- $KHL_j$ = Decent Living Needs

3. Result and Discussion

3.1. Farming Patterns
According to the findings of the survey and Focus Group Discussion (FGD) with community leaders, there are several dominant beef cattle-based farming patterns in the study area. The dominant farming patterns are as follows: (1) Paddy and cattle, (2) Paddy, rubber and cattle, (3) Paddy, rubber, soybeans and cattle, (4) Paddy, soybeans and cattle, (5) Paddy, soybeans, peanut and cattle and (6) Paddy, corn and cattle. Table 1 lists the characteristics of farmers. Farmers are, on average, 51.3 years old, according to demographic data. This average is still in the productive age range, with lengthy farming experience (23.5 years), a land size of 2.52 ha per family, and fewer household members. Four people,
to be exact, with a 4.12 tail on the cattle business scale. The production of cultivated commodities is shown in Table 2.

**Table 1.** Respondent farmer characteristics in each planting pattern in Tanah Laut District, South Kalimantan.

| No | Farming Patterns                                      | Age (Year) | Farming Experience (Year) | Average land area (ha) | Household members (people) | Cattle (ST) |
|----|-------------------------------------------------------|------------|---------------------------|------------------------|---------------------------|-------------|
| 1  | Paddy and cattle                                      | 52.1       | 25.5                      | 1.45                   | 4                         | 3.60        |
| 2  | Paddy, rubber and cattle                              | 49.8       | 25.15                     | 3.06                   | 3                         | 4.08        |
| 3  | Paddy, rubber, soybeans and cattle                    | 50.4       | 19.2                      | 3.50                   | 5                         | 4.02        |
| 4  | Paddy, soybeans and cattle                            | 54.3       | 26.11                     | 2.49                   | 4                         | 3.96        |
| 5  | Paddy, soybeans, peanut and cattle                    | 50.8       | 21.77                     | 2.35                   | 5                         | 3.88        |
| 6  | Paddy, maize and cattle                               | 50.5       | 23.7                      | 3.13                   | 3                         | 5.15        |
|    | **Total**                                             | **307.9**  | **141.43**                | **15.98**              | **24**                    | **24.69**   |
|    | **Average**                                           | **51.32**  | **23.57**                 | **2.66**               | **4.00**                  | **4.12**    |

Source: Primary Data

Farmers carry many commodities in their business to maximize income, according to the FGD, because there are several dangers they encounter, including pests and diseases, as well as price swings. Furthermore, farmers have developed habits like cultivating rice and raising cattle, with rice being used primarily for home food and cattle being utilized for family savings. Rubber plantations are another commodity that has been grown for a long time, while other commodities such as soybeans, peanuts, and sweet corn experience ups and downs based on demand and prices.

Observations of farming patterns reveal that there is commodity diversification and integration, particularly with cattle. Agricultural waste is utilized as feed for crops, and livestock excrement is used as organic fertilizer. According to [18], crop and livestock integration has a mutually beneficial connection and can boost food security. Farmers who diversify their crops get various benefits, including increased efficiency and suitability for places with limited land [19].

**Table 2.** Performance of agricultural production at the research site.

| No | Commodity                  | Productivity          |
|----|----------------------------|-----------------------|
| 1  | Local Paddy (Milled dry grain) | 1,962 kg/ha         |
| 2  | Soybeans                   | 1,147 kg/ha          |
| 3  | Peanut (berkulit)          | 128.88 blek/ha       |
| 4  | Maize                      | 123.76 sack/ha       |
| 5  | Rubber                     | 2,277 kg/ha/year     |

Source: Primary data

Table 2 displays the production/yield obtained from farmer-cultivated commodities. Local paddy types such as Siam Banjar, Siam Unus, and Siam Mayang. Farmer’s plant local paddy because they enjoy it, and the crop is intended for their personal consumption (not for sale). The harvest unit for peanuts is still skinned and sold as Blek (canned crackers), whereas the harvest unit for maize is a sack (not counting the number of cobs).

Local cattle breeds, such as Bali cattle and Ongole Peranakan cattle, are commonly kept for cattle commodities (PO). In general, maintenance is done semi-intensively and intensively, with cattle kept intensively free between 7:00 and 10:00 a.m. to get sunshine and walk around. Meanwhile, semi-intensively kept cows are released for a longer amount of time, from morning to evening, and the area
for releasing cows is empty land such as fields or harvested rice fields. If agricultural waste such as rice straw and maize waste is provided during the harvest season, the feed is largely grass with the occasional legumes (one once a week). Occasionally, extra food, like bran, is given, especially to "pemacek" (males) and pregnant mothers. Farmers use livestock waste from intensively reared cattle to fertilize grass, vegetables, and sweet corn. Cow dung, according [20], is a source of organic fertilizer for plants that can save money if used.

3.2. Goals and The Impact of Farming Patterns
Raising income, using livestock waste for fertilizer, using agricultural waste produced, utilizing agricultural land, forage area for forage (HMT), and increasing animal body weight are the goals of the farming pattern implemented. Table 3 shows the findings of the analysis of variance in relation to the goals to be met. The findings reveal that diverse farming practices have a considerable impact on revenue, agricultural waste utilization for animal feed, and agricultural land utilization. Differences in farming methods have little effect on the purpose of using animal waste, pasture land acreage, or livestock productivity. Duncan's test was also used to check if there were any differences in farming practices.

Table 3. ANOVA from farming patterns to goals.

| No | Goals                              | Sig F | Result       |
|----|------------------------------------|-------|--------------|
| 1  | Income (Rp)                        | 0.000 | Significant difference |
| 2  | Utilization of livestock waste (ton/year) | 0.971 | No Significant difference |
| 3  | Utilization of agricultural waste (kg/year) | 0.030 | Significant difference |
| 4  | Agricultural land use (ha/year)     | 0.001 | Significant difference |
| 5  | HMT land area (ha/year)            | 0.899 | No Significant difference |
| 6  | Livestock production (kg/day)       | 1.000 | No Significant difference |

Duncan's additional test results, shown in Table 4, show a similar pattern of the influence of farming patterns on income goals, agricultural waste utilization for animal feed, and agricultural land use, with pattern 2 (paddy, rubber, and cattle) and pattern 3 (paddy, soybean, rubber, and cattle) being the best farming patterns compared to the other 4 patterns with the highest average.

Table 4. Duncan's further test was to see the differences in income, utilization of agricultural waste and use of agricultural land between farming patterns.

| Farming patterns | Income (Rp) | Utilization of agricultural waste for feed | Agricultural land use |
|------------------|-------------|-------------------------------------------|-----------------------|
| Patterns1        | 9,589,6383a | 1176.0a                                   | 0.7712a               |
| Patterns 4       | 12,953,583a | 1410.8a                                   | 1.3628ab              |
| Patterns 5       | 15,249,350a | 1614.3a                                   | 1.4250ab              |
| Patterns 6       | 17,739,500a | 1649.2a                                   | 2.1458b               |
| Patterns 3       | 35,599,786b | 2620.8a                                   | 2.3646c               |
| Patterns 2       | 39,133,167b | 5631.3b                                   | 2.7357c               |

Note: Numbers followed by the same letter in the same column show no significant difference.

Farming income generated varies between farming patterns carried out by respondent farmers. Total farm income is the sum of several commodities that are cultivated. Farming patterns 2 and 3 have rubber commodities that have good production and selling value. Besides that, rubber does not require a lot of maintenance costs, so it can reduce production costs.
Because animal feed is scarce during the dry season, reducing the amount of agricultural waste produced is a critical goal. Rice straw is the type of waste that is used. Cattle farming, according to [21], is the best way to use agricultural waste as feed. Farmers who follow agricultural patterns 2 have more time on their hands because their activities are limited to rice, rubber, and cattle. Farmers use this free time to repurpose agricultural waste from the land after the harvest. Farmers with high activity levels, on the whole, don't have time to undertake other, less critical tasks.

The use of this agricultural land is determined by the amount of land held, the availability of family labor, capital, and the farmer's age. Because their abilities have decreased and their families' needs are limited, older farmers choose to cultivate with little variety.

Other objectives that have no real impact are the utilization of livestock waste, the use of land areas for forage and livestock production (PBBH). The utilization of livestock waste is not optimal. It is still limited to forage for animal feed, vegetables, and maize fertilization. Chemical fertilizers are still preferred by farmers for soybeans, peanuts, and rubber because they are more practical, and they are also easier to obtain or purchase when research is conducted, whereas manure must be treated first, which takes time. If farmers can use organic fertilizer to its full potential, they can lower fertilization costs, enhance soil quality, and increase profitability [22].

The use of land areas for feed is still inefficient; there is still land that is not used for forage, owing to low body weight gain, which ranges from 0.10-0.50 kg/head/day for Bali cattle and 0.3-0.7 kg/head/day for PO cattle, depending on sex, age, and rearing management. This is because, with the exception of bulls, the business of raising cattle is mostly for development/getting tillers. Therefore, the PBBH is not an aim.

Table 5. Feasibility of commodity business in each farming pattern.

| Patterns | Paddy | Rubber | Soybean | Peanut | Maize | Community |
|----------|-------|--------|---------|--------|-------|-----------|
| 1        | 5.48  | -      | -       | -      | -     | 1.54      |
| 2        | 4.48  | 10.22  | -       | -      | -     | 1.54      |
| 3        | 3.14  | 6.39   | 2.4     | -      | -     | 1.35      |
| 4        | 3.75  | -      | 2.27    | -      | -     | 1.38      |
| 5        | 4.16  | -      | 2.30    | 2.86   | -     | 1.28      |
| 6        | 5.63  | -      | -       | -      | 2.51  | 1.40      |

Furthermore, the R/C ratio was determined to determine the feasibility of the business; as shown in Table 5, all commodities are viable to cultivate because the R/C number is greater than 1. Rubber is the most profitable commodity, followed by indigenous rice products. This is owing to low operating costs, particularly for fertilizers and medications, as well as favorable sales prices. As a result, farming patterns 2 and 3 are more profitable than others. Previous research found that food crop-based farming (rice, corn, and soybeans) and animal husbandry in Grobogan are profitable and practicable, with an R/C ratio of greater than 1 [23]. Furthermore, when compared to the pattern of food and cattle farming in Tanah Laut, the pattern of food, plantation, and livestock farming has the highest average income [24].

Table 6. Contribution of farm income to Decent Living Needs.

| Patterns | Income (Rp) | ART (individual) | Sinukaban (2007) | World Bank (1$/capita/day) |
|----------|-------------|------------------|------------------|---------------------------|
|          |             |                  | Rp               | %                        |
| 1        | 9,589,637.50| 4                | 25,600,000.00    | 37.46                    |
| 2        | 39,133,166.67| 3                | 19,200,000.00    | 203.82                   |
| 3        | 35,599,785.71| 5                | 32,000,000.00    | 111.25                   |
| 4        | 12,953,583.33| 4                | 25,600,000.00    | 50.60                    |

|          |             |                  | Rp               | %                        |
| 1        |             |                  | 20,075,000.00    | 47.77                    |
| 2        |             |                  | 15,056,250.00    | 259.91                   |
| 3        |             |                  | 25,093,750.00    | 141.87                   |
| 4        |             |                  | 20,075,000.00    | 64.53                    |
The total income of rice farming patterns 2 and 3 has exceeded the KHL of Sinukaban (2007), which is 800 kg/capita/year (with the price of rice measured in this study at Rp. 8,000/kg) and the World Bank's suggested poverty line of $1/capita/day (the value of $1 is equivalent to Rp. 13,750) (when the study was conducted). Table 6 shows the percentage of income earned by each agricultural design from the World Bank and the KHL [25]. Patterns 2 and 3 have exceeded the KHL using either the Sinukaban [25] or the World Bank approaches, although the World Bank method still meets the KHL for the 6 farming patterns (paddy, maize, and cattle), but the other three farming patterns have not been fulfilled.

Pattern 1, namely paddy and cattle, is a farming pattern with the lowest income generated and the ability to fulfill KHL is still far away, so it can be said that farmers with pattern 1 are still below the poverty line. Other farming patterns, namely patterns 4 and 5, are also under the KHL with both methods. Although farming patterns 1, 4, and 5 do not meet the KHL used in this study, farmers continue to farm because other sources of income exist, such as trading, construction work, or other non-agricultural jobs.

4. Conclusion
The recommended business to be carried out is business diversification with several commodities so that the needs of decent living can be achieved and are sustainable. Two farming patterns that provide the highest income, the first is the pattern of paddy, rubber and cattle and the second is paddy, soybean, rubber and cattle.

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References
[1] Rahim A 2007 Usahatani (Wholefarm). Ekonomika Pertanian. Jakarta. 2007.
[2] Aryani D, Oktarina S, and Malini H 2014 Pola Usahatani, Pendapatan dan Ketahanan Pangan Rumah Tangga Petani Padi Lahan Rawa Lebak di Sumatera Selatan in Prosiding Seminar Nasional Lahan Sub Optimal. 462–471
[3] Nuryanti D M and Kasim N N 2017 Analisis Komperatif Pendapatan Petani Dengan Berbagai Pola Rotasi Tanaman. Unpublisher Paper
[4] Sari M D 2017 Pola Tanam http://sumsel.litbang.pertanian.go.id/BPTPSUMSEL/berita-pengertian-dan-jenis-pola-tanam.html#ixzz4zslDxbI3 [accessed Mei 17, 2021]
[5] Hermawati D T 2016 Kajian Ekonomi Antara Pola Tanam Monokultur dan Tumpang Sari Tanaman Jagung Kubis dan Bayam J. Inov. 18 (1) 66–72
[6] Junaidi Y and Yamin M 2010 Faktor-faktor yang mempengaruhi adopsi pola usahatani diversifikasi dan hubungannya dengan pendapatan usahatani kopi di Sumatera Selatan J. Pembang. Mns. (Kesehatan, Pendidikan, Ekon. 4 (12) 283–291
[7] Budhi G. S 2010 Dilema kebijakan dan tantangan pengembangan diversifikasi usahatani tanaman pangan Anal. Kebijak. Pertan. VIII (3) 241–258
[8] Hamzah U 2011 Model Pengembangan Perkebunan Karet Berkelanjutan pada Kawasan Transmigrasi Batumarta. Dissertation. Institut Pertanian Bogor. Bogor
[9] Dariah A and Heryani N 2014 Pemberdayaan Lahan Kering Suboptimal untuk Mendukung

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|   | Income (Rp) | Percentage | Total Income (Rp) | Percentage |
|---|-------------|------------|-------------------|------------|
| 5 | 15,249,350.00 | 47.65 | 25,093,750.00 | 60.77 |
| 6 | 17,739,500.08 | 92.39 | 15,056,250.00 | 117.82 |

Source: Primary Data
Kebijakan Diversifikasi dan Ketahanan Pangan *J. Sumberd. Lahan Ed. Khusus* 1–16

[10] Abdurachman A, Dariah A, and Mulyani A 2008 Strategi dan Teknologi Pengelolaan Lahan Kering mendukung Pengadaan Pangan Nasional *J. Litbang Pertan.* 27 (2) 43–49

[11] Kasijadi F and Dwistutti R 1986 Produktivitas sumberdaya beberapa pola tanam di lahan kering *J. Forum Penelit. Agro Ekon.* 4 (2) 23–44

[12] Noer H 2011 Pola Usahatani Komoditas Tanaman Pangan Pada Lahan Kering Di Kabupaten Morowali Provinsi Sulawesi Tengah *J. Agribisnis dan Pengemb. Wil.* 2 (2) 65–72

[13] Dyah P A 2017 Manajemen Usahatani Pada Lahan Kering di Kabupaten Gunung Kidul Daerah Istimewa Yogyakarta in Prosiding Interdisciplinary Postgraduate Student Conference 3 rd Program Pascasarjana Universitas Muhammadiyah Yogyakarta 274–278

[14] Badan Pusat Statistik Kabupaten Tanah Laut. 2019. Kecamatan Takisung Dalam Angka 2019. BPS Kabupaten Tanah Laut.

[15] Soekartawi 2002 *Prinsip Dasar Ekonomi Pertanian Teori dan Aplikasi* PT. Raja Grafindo. Jakarta

[16] Rahim A and R R D Hastuti 2007 Ekonomika Pertanian, Pengantar Teori dan Kasus. Penebar Swadaya. Jakarta.

[17] Sinukaban N 2007 Membangun pertanian menjadi industri yang lestari dengan pertanian konversi. Dalam Sinukaban (ed). Konservasi Tanah dan Air Kunci Pembangunan Berkelanjutan. Direktorat Jenderal RLPS, Departemen Kehutanan

[18] Kariyasa K 2005 Sistem Integrasi Tanaman Ternak dalam Perspektif Reorientasi Kebijakan Subsidi Pupuk dan Peningkatan Pendapatan petani *Anal. Kebijak. Pangan* 3 (1)

[19] Basuni R, Muladno C, Kusmana, and Suryahadi 2010 Sistem Integrasi Padi-Sapi Potong di Lahan Sawah *Iptek Tanam. Pangan.* 5 (1) 31–48.

[20] Siswati L and Nizar R 2012 Model Pertanian Terpadu Tanaman Hortikultura dan Ternak Sapi untuk Meningkatkan Pendapatan Petani *J. Peternak. Indones.* 14 (2) 379–387

[21] Howara D 2011 Optimalisasi pengembangan usahatani tanaman padi dan ternak sapi secara terpadu di kabupaten Majalengka *J. Agrol.* 18 (1) 43 49

[22] Hutabarar T S P N 20021 *Pendekatan Kawasan dalam Pembangunan Peternakan.* Direktorat Jenderal Bina Produksi Peternakan, Departemen Pertanian. Jakarta

[23] Wisudawati S R, Mukson, and Roessali W 2019 Analisis pendapatan pola usahatani berbasis tanaman pangan dan peternakan di Kabupaten Grobogan *J. Agrol.* 26 (2) 123–136

[24] Rohaeni E S 2013 Analisis Usahatani Berbasis Padi dan Ternak Sapi serta Kontribusi Pendapatan Terhadap Kebutuhan Hidup Layak di Lahan Kering (Studi Kasus di Desa Sumber Makmur, Kecamatan Takisung, Tanah Laut) in *Seminar Nasional Inovasi Teknologi Pertanian,* 564–574

[25] Sinukaban N 2007 Dinamika Kwalitas Tanah, Erosi, dan Pendapatan Petani Akibat Alih Guna Lahan Hutan Menjadi Lahan Kakao Di DAS Nopu Sulawesi Tengah 31 (3)