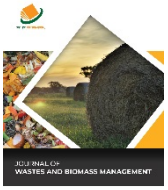
ZIBELINE INTERNATIONAL PUBLISHING

ISSN: 2710-6012 (Online)
CODEN: JWBMAO

Journal of Wastes and Biomass Management
(JWBM)

DOI: http://doi.org/10.26480/jwbm.02.2021.34.50



RESEARCH ARTICLE

POTENTIAL ANIMAL FEED RESOURCES BASED ON FOOD CROP WASTE SUPPORTS DEVELOPMENT OF BEEF CATTLE IN WEST SUMATERA, INDONESIA

Rahmi Wahyuni[a], Rizma Aldillah[b]

[a]Agricultural Technology Research Center of Sumatera Barat, Jalan Raya Padang-Solok km 40, Sukarami, Solok 27366
[b]Indonesia Center for Socio Economy and Policy Studies, Jl. Tentara Pelajar No.3B Cimanggu Bogor, Infonesia 16111
**Corresponding Author E-mail: rizmaaldillah@gmail.com; bundanayla26@gmail.com.*

ARTICLE DETAILS

Article History:

Received 16 February 2021
Accepted 24 March 2021
Available online 01 April 2021

ABSTRACT

The increase in the need for animal-based food consumption creates opportunities in the development of cattle farming in the future. But the problems in the field are a decrease in livestock productivity such as a decrease in livestock population and a decrease in livestock body weight, this is due to the lack of availability of sustainable animal feed. The solution offered is to use food crop waste as an alternative feed for livestock, so it is necessary to analyze the carrying capacity of food crop waste in an area. The purpose of this research is to analyze the potential resources of beef cattle feed based on food plant waste in West Sumatra Province and to analyze the nutritional content of food plant waste. The research was conducted in West Sumatra Province in January 2021. The method used was literature study and secondary data analysis. The data required consists of: (1) food crop production data, (2) beef cattle population data in West Sumatra Province. Data were analyzed by analyzing the carrying capacity of food plant waste. The results showed the availability of feed in West Sumatra Province 728,195.32 tonnes BKC / year, while the current total feed requirement is only 410,159.32 tonnes BKC / year. This shows the large potential for feed that has not been utilized, and this means that there is a large opportunity for Prov. West Sumatra in the future development of ruminants. The carrying capacity index of food plant waste (IDD) is 2.37, which means that it has a safe status where food plant waste is able to help support the needs of animal feed in West Sumatra Province. To increase the nutritional value of food plant waste, it can be overcome by giving a touch of waste processing technology innovations such as fermentation, silage, or ammonia. The results of this study are important as recommendations for the government regarding the sources of information on areas that have the potential to develop livestock business, which can be seen from the status of the area's carrying capacity index or the potential availability of abundant animal feed.

KEYWORDS

food crop, beef cattle, animal feed, livestock, development.

1. INTRODUCTION

In developing a beef cattle business in an area, there are several things of concern, including human resources, natural resources, and quality and sustainable animal feed resources. what is often an obstacle is the diminishing source of animal feed. In an area of livestock development, it often fails to increase the livestock population because it is less in analyzing the carrying capacity of the area such as the availability of space for livestock and the carrying capacity of the availability of animal feed. There are many inhibiting factors in the provision of food, including the climatic factors of an area that will affect forage growth such as in the dry season the amount of forage is much reduced compared to the rainy season. In addition, there is a change in land function which was previously land as a source of food, such as pasture changing functions as residential land industry and agricultural land to meet the food supply due to the increasing population (Moniaga, 2011).

At this time, the amount of intensification in the development of food crops in West Sumatra is an opportunity to overcome the lack of grass as a source of forage by utilizing agricultural waste from food crops. Syamsu states that the source of agricultural waste as an alternative source of feed for livestock is obtained from food plant commodities (Syamsu, 2011). Types of food crop waste that can be used as a source of feed are rice straw, corn straw, peanut straw, cassava shoots, soy straw, and sweet potato straw. Animal husbandry actors need to know the potential of food crop waste-based animal feed resources to support the development of beef cattle (Salami et al., 2019; Jabemat, 2018).

This is also in accordance with the statement from some study (Maryono and Romjali, 2007; Tafsin, 2018). that basically the main feed for beef cattle is in the form of forage amounting to 60-70% of the total daily need for animal feed, but in reality in the field that there are limitations in the fulfillment of forage, the solution is for the development of animal husbandry, namely by integrating in the form of optimizing the use of agricultural waste from food plants as animal feed. The purpose of this study is to analyze the potential resources of beef cattle feed based on food plant waste in Prov. West Sumatra and to analyze the nutritional content of food plant waste.

Quick Response Code	Access this article online	
	Website: www.jwbm.com.my	DOI: 10.26480/jwbm.02.2021.35.40

Cite the Article: Rahmi Wahyuni, Rizma Aldillah (2021). Potential Animal Feed Resources Based on Food Crop Waste Supports Development of Beef Cattle in West Sumatera, Indonesia. *Journal of Wastes and Biomass Management, 3(2): 35-40.*

2. METHODOLGY

2.1 Place and Time of Research

This research was conducted in West Sumatra Province in January 2021. The data used is a literature study from several literatures.

2.2 Research Methods

The method in this research is literature study method and secondary data analysis. The data required is secondary data from West Sumatra Regency / City statistical data, West Sumatra Province statistical data, especially in 2020, and other reading sources related to this research.

The secondary data needed is in the form of potential natural resources to see how much contribution and availability it will have as future ruminant feed. The data required consists of: (1) data on beef cattle population, (2) data on food crop production in West Sumatra Province.

2.3 Data Analysis

Data were analyzed by analyzing the carrying capacity of food plant waste. The carrying capacity in this study uses the calculations made by Sumanto and Juarini, 2006. Where the carrying capacity of the area can be seen from the status of the carrying capacity index (IDD), namely:

$$IDD = \frac{\text{Total Feed Availability in Digestible Dry}}{\text{Total Feed Requirements}}$$

Territory Capability (ST) = IDD x Total Population (ST)

Thus, to find out the IDD value, a series of calculations are needed as follows.

2.3.1 Feed from Food Crop Waste

The calculation of the amount of feed originating from food plant production is used in the format shown in table 3.

Table 1: Characterization of Food Crop Waste

No.	Jenis Limbah Tanaman Pangan	Produksi Tanaman (Ton/th) *	Produksi Limbah (Ton/th)	Daya Cerna	Produksi Limbah BKC Ton
(a)	(b)	(c)	(d)	(e)	(f)
1	Paddy fields	-	(c)	0,14	(d) x (e)
2		-	(c) x 2	0,14	(d) x (e)
3	Rice field	-	(c) x 2	0,15	(d) x (e)
4	Maize	-	(c) x 2	0,165	(d) x (e)
5	Soybeam	-	(c) x 2	0,137	(d) x (e)
6	Green beans	-	(c) x 2	0,137	(d) x (e)
7	Ground nut	-	(c) / 5	0,135	(d) x (e)
8	Sweet potato	-	(c) / 3	0,135	(d) x (e)
	Cassava				
Total					Total

Source: (Sumanto dan Juraini, 2006)

Information : * = Condition of the research area (Secondary Data)

The minimum requirement for ruminant forage uses the calculation, namely K = 2.5% x 250 x 50% x 365 = 1.14 tonnes BKC / year (Thahar and Mahyudin, 1993; Sumanto and Juraini, 2006).

2.3.2 Population and Feed Needs of Beef Cattle

To calculate the total population of beef cattle, the conversion value is used. In general, the standard number of livestock is expressed in livestock units (ST), by calculating the beef cattle population based on the population structure (tail) multiplied by the standard value of livestock units. The standard livestock unit in question is based on one cow that has entered adulthood or has begun to mate. To determine the conversion factor value of ruminants, the ST technical coefficient is used as follows:

Table 2: Calculation of Beef Cattle Based on Animal Units (ST).

	Cattle		
Livestock Unit Satndar (ST)	Calf	Steer	Beef Cattle
	0,25	0,60	1

Souces: (Rauf, 2013)

The number of ruminant livestock population expressed in livestock units is obtained from the number of rumunant livestock populations in the study area multiplied by the conversion factor, where the conversion factor for cattle is obtained from the research result of 0.88. To find out the total feed requirement = livestock population (ST) x 1.14 tonnes BKC.

The IDD value of an area can be classified into 4 (four) criteria, namely:

1. Very critical areas, namely areas with IDD <1
2. Critical areas, namely areas with IDD <1 - 1.5
3. Vulnerable areas, namely areas with IDD = 2
4. Safe areas, namely areas with IDD> 2

Each IDD value has the following meanings:

a. Value <1 (The availability of feed for the minimum needs of livestock is not met).
b. Value = 1 (Livestock have no choice in utilizing resources).
c. Value 1- 2 (Minimum livestock needs are met and feed choices are limited).
d. Value> 2 (Livestock have the option of utilizing existing resources).

3. RESULT AND DISCUSSIONS

3.1 Geographical Condition of Research Area

West Sumatra Province is located between 0^0 54 North Latitude and 3^0 30 LT, with an area of 42.2 thousand km2. Located west of the island of Sumatra and at the same time directly adjacent to the Indonesian Ocean, Riau Province, Jambi Province, and North Sumatra Province. West Sumatra consists of 19 Regencies / Cities with Kab. The Mentawai Islands have the largest area, namely 6.01 thousand km2 or around 14.21% of the area of West Sumatra Province. Meanwhile, the city of Padang Panjang has the smallest area, which is 23.0 km2 (0.05%). West Sumatra Nature covers protected areas which account for around 45.17% of the total area. Meanwhile, the land that has been used for cultivation is only 23,190.11 km2 or around 54.83% of the total area.

3.2 Potential of Food Crop Waste as a Source of Animal Feed

Suherman and Kurniawan, basically in the development of an advanced and independent livestock area, it can be formed from the integration of each sector or integrated between the livestock, food crops, horticulture and plantation sectors, in terms of the use of by-products each subsector (Suherman and Kurniawan, 2017). This is in accordance with the opinion of Smith and Makka, this is a solution to overcome the problem of shortage of animal feed, plant waste can also be used as quality animal feed such as food crop waste (Smith, 2002; Makka 2004). Some researchers state that and to optimize the utilization of agricultural waste by increasing various nutritional contents by fermentation, supplementation, and making complete feed (Wahyono and Hardianto, 2004; Wina, 2005). Currently, ruminant livestock feed can utilize agricultural waste such as agricultural waste (food plants) which can be obtained from rice, corn, peanuts, sweet potatoes and cassava, soybeans, green beans. These food plants provide different contribution values from one another, as stipulated in the calculation, namely regarding the contribution of food plant waste as a source of cattle feed which can be calculated based on the results of harvest production to produce feed (Sumanto and Juarini, 2006). livestock based on digestible dry weight (BKC). To determine the potential for food from food plant waste, first we must know the production of food crop plants in West Sumatra Province.

Table 3: Production of food crops in West Sumatra Province 2020 (Ton/th).

	District/City	Paddy Fields	Maize	Soybeam	Green bean	Ground nut	Sweet potato	Cassava
1	Kep. Mentawai	2087,24	25,01	0	0	0	455	1927,61
2	Pesisir Selatan	200179,84	147080,77	8,98	37,09	385,82	48	11257,64
3	Solok	168452,01	3733,26	1,71	0	260,67	41349	4992,93
4	Sijunjung	50559,25	3806,51	278,09	5,45	67,84	0	1066,79
5	Tanah Datar	194266,51	42332,81	330,17	10,91	597,35	38756	19192,5
6	Padang Pariaman	155475,13	76820,3	69,14	5,45	82,25	0	11391,72
7	Agam	160888,26	130425,95	481,84	36	1136	34526	33105,46
8	50 Kota	135314,94	38839,8	46,51	0	370,32	3595	88999,23
9	Pasaman	149440,66	73063,38	831,49	30,55	227,08	856	1718,72
10	Solok Selatan	62326,8	94878,27	28,73	24	740,22	3732	5289,26
11	Dharmasraya	32927,12	15270,66	90,42	5,45	226,21	206	2677,66
12	Pasaman Barat	42546,23	364291	38,61	149,45	695,18	13270	7029,35
13	Padang	62877,24	0	12,57	0	15,85	209	1134,8
14	Solok	13737,85	351,23	5,12	0	3,47	39	445,95
15	Sawahlunto	6769,08	241,23	2,16	7,64	0,84	0	5244,56
16	Padang Panjang	4532,96	0	0	0	0	236	0
17	Bukittinggi	5266,31	37,36	0	0	0	789	318,68
18	Payakumbuh	19957,73	1759,58	0	0	0	0	6410,45
19	Pariaman	15390,85	204,08	0	0	0	0	967,69
	Total	1.482.996,01	993161,2	2225,54	311,99	4809,1	138066	203171

Source : Sumbar Dalam Angka, 2020.

From the table above, it can be seen that the potential for food plant waste in producing animal feed in West Sumatra Province is 728,195.32 tons BKC / year. Food plant waste as a source of animal feed is mostly produced from rice waste, amounting to 415,238.9 Ton BKC / year and the least amount coming from soybean waste, namely 734.42 Ton BKC / year. Districts / Cities that have the greatest potential for availability of food from food plant waste are Kab. West Pasaman (122,119,02Ton BKC / year) and Kab. Pesisir Selatan (100,801.31Ton BKC / year). However, the breeders' habit of using food crop waste as a source of cattle feed is underutilized by breeders in West Sumatra. This is because breeders are not used to providing food crop waste as a source of feed for cattle and in some areas the availability of forage from land is still sufficient as a source of animal feed.

3.3 Population and Feed Needs of Ruminants

The population and availability of ruminant feed in an area will affect the ability or capacity to increase the livestock population in that area for the future. Below is known the number of cattle commodity in each district / city, which will reflect the level of animal feed demand each year, in detail is shown in the table below:

Table 4: Livestock Population and Ruminant Feed Needs in Prov. West Sumatera

No.	District/City	Population of Cattle (tail)	Population of Beef Cattle (ST)	the average need for animal feed (Ton BKC/ST/Thn	Total feed requirements (Ton BKC/th)
1	Kepulauan Mentawai	1134	997,92	1,14	1137,629
2	Pesisir Selatan	83687	73644,56	1,14	83954,8
3	Solok	37074	32625,12	1,14	37192,64
4	Sijunjung	16454	14479,52	1,14	16506,65
5	Tanah Datar	34326	30206,88	1,14	34435,84
6	Padang Pariaman	41787	36772,56	1,14	41920,72
7	Agam	33361	29357,68	1,14	33467,76
8	Limapuluh Kota	42708	37583,04	1,14	42844,67
9	Pasaman	7162	6302,56	1,14	7184,918
10	Solok Selatan	10671	9390,48	1,14	10705,15
11	Dharmasraya	41505	36524,4	1,14	41637,82
12	Pasaman Barat	19291	16976,08	1,14	19352,73
13	Kota Padang	21978	19340,64	1,14	22048,33
14	Kota Solok	2304	2027,52	1,14	2311,373
15	Kota Sawahlunto	6705	5900,4	1,14	6726,456
16	Kota Padang Panjang	228	200,64	1,14	228,7296
17	Kota Bukittinggi	327	287,76	1,14	328,0464
18	Kota Payakumbuh	5830	5130,4	1,14	5848,656
19	Kota Pariaman	2319	2040,72	1,14	2326,421
	Total	408.851	359.788,9		410.159,3

Source : The result of data processing, 2020.

The need for a minimum of ruminant livestock in the form of forage per one livestock unit (ST) in Prov. West Sumatra, namely 1.14 tonnes BKC / ST / year, so that with a population of 359,788.9 ST with a total need for forage in the province. West Sumatra amounted to 410,159.3 tons of BCK / year. According to a study, in general, ruminants, especially cattle that are intensively maintained consist of forage and concentrate, for feed ingredients in the form of forages are given as much as 1% of body weight and feed in the form of forage is given as much as 10% of body weight (Sugeng, 2003). Concentrate is not only a source of energy that can increase the growth of livestock body weight, especially for cattle, besides that its function is to make it easier for livestock to digest the feed given (Adiwinart, 2011).

3.4 Regional Capabilities and Capacity of Addition of Cattle Based on the Bearing Capacity Index (IDD)

The ratio between the total feed availability and the total feed requirement shows the status of the value of the feed carrying capacity in an area known as IDD. Carrying capacity determines how many livestock units can be supported by an area based on the potential feed that an area can provide (Sumanto and Juarini, 2006). The carrying capacity will determine the area's ability to develop the cattle population in the future. Because the current condition of cattle farming in the study area only utilizes forage from the available land, while the potential for feed from food plant waste is not utilized, a breakdown of regional capabilities based on potential feed availability is carried out as shown in Table 5.

Table 5: Regional Capability and Livestock Addition Capacity (ST) Based on Potential Availability of Feed

No.	District/City	IDD	Total Feed Availabikity (Ton BKC/th)	Total Feed Requirements (Ton BKC)	Territory Capability (ST)	Ruminant Livestock Population (ST)
1	KEP.MENTAWAI	0,60	690,95765	1137,6288	303,0516009	997,92
2	PESISIR SELATAN	1,20	100801,3167	83954,7984	44211,10383	73644,56
3	SOLOK	1,33	49699,63353	37192,6368	21798,08488	32625,12
4	SIJUNJUNG	0,93	15458,39971	16506,6528	6779,999873	14479,52
5	TANAH DATAR	2,01	69280,15964	34435,8432	30386,03493	30206,88
6	PADANG PARIAMAN	1,60	67138,5998	41920,7184	29446,7543	36772,56
7	AGAM	2,60	87078,5807	33467,7552	38192,35996	29357,68
8	50 KOTA	1,25	53758,96953	42844,6656	23578,49541	37583,04
9	PASAMAN	8,93	64207,83552	7184,9184	28161,33137	6302,56
10	SOLOK SELATAN	4,34	46472,64288	10705,1472	20382,73811	9390,48
11	DHARMASRAYA	0,33	14020,16174	41637,816	6149,193746	36524,4
12	PASAMAN BARAT	6,31	122119,0251	19352,7312	53560,97591	16976,08
13	PADANG	0,80	17670,8272	22048,3296	7750,362807	19340,64
14	SOLOK	1,72	3975,72813	2311,3728	1743,740408	2027,52
15	SAWAHLUNTO	0,32	2206,75292	6726,456	967,8740877	5900,4
16	PADANG PANJANG	5,57	1275,6008	228,7296	559,4740351	200,64
17	BUKITTINGGI	4,63	1521,4184	328,0464	667,2887719	287,76
18	PAYAKUMBUH	1,09	6404,50865	5848,656	2808,995022	5130,4
19	PARIAMAN	1,89	4414,20805	2326,4208	1936,056162	2040,72
	Total	2,37	728.195,3267	410.159,32	319.383,91	359.788,88

Source: The result of data processing, 2020.

From Table 6, it can be seen that the total feed availability of West Sumatra Province is 728,195,3267 tons of BKC / year, while the current total feed needs are 410,159.32Ton BKC / year. This data reflects that Prov. West Sumatra has an excess of feed availability for the future, which comes from food plant waste. The ability of the area to accommodate ruminants based on the total availability of feed in Prov. West Sumatra is 319,383.91 ST, with an IDD value of 2.37, this figure shows that Prov. West Sumatra has a safe status. This shows the large potential for feed that has not been utilized, and this means that there is a large opportunity for Prov. West Sumatra in the future development of ruminants.

3.5 Nutritional Content of Food Plant Waste as Animal Feed

The availability of abundant food crop waste is a great potential for livestock development in the future (Samadi et al., 2010). But on the other hand, food plant waste generally has a fairly low nutritional quality, with a high content of crude fiber and low content of nitrogen, calcium and phosphorus resulting in limited digestibility of food plant waste and consumption, but still potential as a source of animal feed. One of the efforts to increase the useful value of food plant waste as animal feed by adding 4% urea to rice straw, fermentation with microbial starter starbio, aspergillus niger or tricoderm can substitute the use of ruput by 20% (Sukaryani and Mulyono, 2019; Yamin and Syamsu, 2020; Nguyen and Dang, 2020). The main objectives of the innovation in plant waste treatment technology are a). increase the nutritional content and digestibility, b). stabilize the deficiency of straw by adding nitrogen or minerals c). increasing consumption by improving palatability; d). reduce the nature of amba from food crop waste and e). increase energy availability (Syamsu, 2018).

To increase the nutritional value of food crop waste, it is necessary to innovate plant waste processing technology for animal feed (Pomolango, 2016). Waste treatment technologies include physical, chemical, and biological processing such as boiling, chopping, milling, soaking, making pellets and gamma irradiation. This is done with the aim of breaking down the skin layers such as lignin and expanding the surface of the food particles so that microorganisms can digest cellulose. so that food retention time decreases, fermentation speed will increase, and feed consumption increases. Chemical processing, using chemicals such as ammonium hydroxide, ureaammonia, sodium carbonate, sodium chloride, chlorine gas, sulfur dioxide, alkaline solutions can reduce hydrogen bonds between molecules cellulose. Meanwhile, biological processing is carried out by adding enzymes, growing fungi and bacteria, and anaerobic fermentation (Rauf, 2013; Rauf and Rasbawati, 2015). There are several technological innovations in waste treatment in the form of ammonition, fermentation, and silica in rice straw or corn straw. Processing like this is a process of cutting chain bonds and freeing cellulose and hemicellulose so that they can be used by the body of the livestock. In this table, there is an average nutrient content of food plant waste from the proximate analysis process.

Table 6: Average Quality of Food Crop Waste

Nutritional Content (%)	Food Crop Waste						
	Paddy Straw	Maize Straw	Cassava Straw	Sweet Potato Straw	Ground Nut Straw	Soybeam Straw	Green Bean Straw
Dry matter	86,82	86,53	84,44	80,34	86,98	85,88	87,16
Crude protein	5,08	6,63	18,32	11,05	12,40	8,27	6,24
Crude fat	2,71	3,01	6,25	3,96	2,34	2,87	4,08
Crude fiber	32,53	30,85	21,98	26,98	30,14	30,90	32,68
BETN	41,80	49,75	43,20	45,33	41,44	49,46	47,90
Ash	17,90	9,76	10,27	12,68	13,68	8,51	9,11
TDN	42,54	53,11	58,43	53,09	51,42	54,69	52,90

Source: (Rauf, 2013).

The table above explains that the dry matter of each food plant waste is quite high and the protein content is quite diverse, namely the lowest is 5.08% in rice straw and the highest is cassava shoots of 18.32%. For crude protein, each food plant waste is classified as high with an average of above 30%. The highest crude fiber content is green bean straw and rice straw, which is 32.68% and 32.53%, while the lowest is sweet potato shoots. wood 21.98%. To increase the nutritional value of food plant waste, it can be overcome by giving a touch of waste processing technology innovations such as fermentation, silage, or ammonia (Soetanto, 2001; Syamsu, 2003). According to research by Elihasridas et al. (2018), ammonia rice straw with a protein content of 20% and an energy content of 70% TDN can provide good performance for simental cows. Other research shows that by giving 50% straw fermentation as a source of fiber and giving corn silage, corn silage can provide good performance when compared to 100% straw (Nazli et al., 2018). According to a study, giving straw fermentation can replace 2/3 of the use of forage in beef cattle (Nguyen and Dang, 2020).

Conclusion

Beef cattle development areas often experience failure in increasing the livestock population due to lack of analysis of the carrying capacity of the availability of animal feed. The results showed that the availability of feed for the Province of West Sumatra was 728,195.32 tons of BKC / year, while the current total feed requirement was only 410,159.32 tons BKC / th. This shows the large potential for feed that has not been utilized, and this means that there is a large opportunity for Prov. West Sumatra in the future development of ruminants. The carrying capacity index of food plant waste (IDD) is 2.37, which means that it has a safe status where food plant waste is able to help support the need for animal feed in West Sumatra Province in addition to feed sourced from forage land. This shows the large potential for unutilized feed, and this means that magnitude of opportunities for Prov. West Sumatra in the future development of ruminants. To increase the nutritional value of food plant waste, it can be overcome by giving a touch of waste processing technology innovations such as fermentation, silage, or ammonia.

References

Adiwinarti, R., Fariha, U.R., Lestari, C.M.S., 2011. Pertumbuhan sapi jawa yang diberi pakan jerami padi dan konsentrat dengan level protein berbeda. Jurnal Ilmu Ternak dan Veteriner. Pusat Penelitian dan Pengembangan Peternakan, 16 (4), Pp. 260-265.

Elihasridas, M., Zain., Y., Marlida, Andri, 2019. Effect of the Level of Energy and Dietary Protein of Ammoniated Rice Straw on the Productivity of Male Simmental Cattle in a Tropical Area. Pak. J. Nutr., 18 (1), Pp. 60-66.

Jehemat, A., 2018. Daya Dukung Limbah Pertanian Terhadap Ketersediaan Pakan Ternak Dalam Penerapan Sistem Pertanian Terpadu Berbasis Tanaman Dan Ternak Sapi Di Desa Fatuknutu Kecamatan Amabi Oefeto Kabupaten Kupang. Partner Vol. 23 No. 1. Politeknik Pertanian Negeri Kupang.

Makka, J., 2004. Prospek Pengembangan Sistem Integrasi Peternakan yang Berdaya Saing. Prosiding Seminar Nasional Sistem Integrasi Tanaman Ternak. Denpasar, Bali.

Maryono dan Romjali, E., 2007. Petunjuk Teknis Teknologi Inovasi Pakan Murah Untuk Usaha Pembibitan Sapi Potong. PT. RemajaRosdakarya, Bandung.

Moniaga, V.R.B., 2011. Analisis Daya Dukung Lahan Pertanian. Jurnal ASE., 7 (2), Pp. 61-68.

Nazli, M.H., Halim, R.A., Abdullah, A.M., Hussin, G., Samsudin, A.A., 2018. Potential of feeding beef cattle with whole corn crop silage and rice straw in Malaysia. Tropical Animal Health and Production, 50, Pp. 1119-1124.

Nguyen, D.V., Dang, L.H., 2020. Fresh Rice Straw Silage Affected by Ensiling Additives and Durations and its Utilisation in Beef Cattle Diets. Asian J. Anim. Sci., 14 (1), Pp. 16-24.

Pomolango, R., 2016. Analisis Produksi Limbah Tanaman Pangan Sebagai Pakan Ternak Sapi Di Kabupaten Bolaang Mongondow Utara. Jurnal Zootek, 36, (2), Pp. 302-311.

Rauf, J., 2013. Potensi Limbah Tanaman Pangan Sebagai Sumber Pakan Dalam Pengembangan Ternak Sapi Potong. Tesis.

Rauf, J., Rasbawati. 2015. Kajian Potensi Limbah Pertanian Sebagai Pakan Ternak Sapi Potong di Kota Pare-Pare. Jurnal Galung Tropika, 4 (3), Pp. 173-178.

Salami, S., Luciano, G., Grady, M., 2019. Sustainability of feeding plant by-products: A review of the implications for ruminant meat production. Animal feed science and technology, 251. https://doi.org/10.1016/j.anifeedsci.2019.02.006.

Samadi., Y., Usman, Delima, M., 2010. Evaluation of the potency of agricultural by product as ruminant animal feed in aceh besar regency. Jurnal Agripet, 10 (2), Pp. 45-53.

Smith, T., 2002. Some tools to combat dry season nutritional stress in ruminants under African conditions. In: Development and Field Evaluation of Animal Feed Supplementation Packages. Iaea-Tecdoc, 1294, Pp. 145-152.

Soetanto, H., 2001. Teknologi dan strategi penyediaan pakan dalam pengembangan industri peternakan. Makalah Workshop Strategi Pengembangan Industri Peternakan, Makassar 29-30 Mei 2001. Fakultas Peternakan UNHAS dan Puslitbang Bioteknologi LIPI, Makassar.

Sugeng, Y.B., 2003. Sapi Potong. Penebar Swadaya, Jakarta.

Suherman, Kurniawan, E., 2017. Manajemen Pengelolaan Ternak Kambing di Desa Batu Mila Sebagai Pendapatan Tambahan Petani Lahan Kering. Jurnal Dedikasi Masyarakat, 1 (1), Pp. 7–13.

Sukaryani, S., Mulyono, A.M.W., 2019. The Performance of Beef Cattle with Feed Based on The Rice Straw Fermentation. Earth and Environmental Science, 379, Pp. 012011.

Sumanto, Juarini, E., 2006. Pedoman Identifikasi Potensi Wilayah. Balai Penelitian Ternak Ciawi-Bogor, Bogor.

Syamsu, J.A., 2003. Daya Dukung Limbah Pertanian sebagai Sumber Pakan Ternak Ruminansia di Indonesia. Wartazoa, 13, Pp. 1.

Syamsu, J.A., 2006. Analisis Potensi Limbah Tanaman Pangan Sebagai Sumber Pakan Ternak Ruminansia Di Sulawesi Selatan. Disertasi.Bogor: Pascasarjana Institut Pertanian Bogor.

Syamsu, J.A., 2018. Optimalisasi Pemanfaatan Limbah Pertanian Sebagai Pakan Sapi Potong di Peternakan Rakyat. Prosiding Seminar Nasional Inovasi Teknologi Peternakan dalam Mendukung Terwujudnya Ketahanan Pangan Nasional. Fakultas Peternakan Universitas Halu Oleo, Kendari, 17 November 2018. Pp. 1-10.

Tafsin, M., 2018. Potency and strategy of cattle development based on feed resources in Tanjungbalai North Sumatera Regency. IOP Conference Series: Earth and Environmental Science 260, international Conference on agriculture, environment, and food security 2018 24-25 October 2018, Medan.Indonesia.

Wahyono, D.E., Hardianto, R., 2004. Pemanfaatan sumber daya pakan lokal untuk pengembangan usaha sapi potong. Makalah disampaikan pada Lokakarya Nasional SapiPotong 2004. Pusat Penelitian dan Pengembangan Peternakan, Bogor. hlm. Pp. 66.

Wina, E., 2005. Teknologi pemanfaatan mikroorganisme dalam pakan untuk meningkatkan produktivitas ternak ruminansia di Indonesia: Sebuah review. Wartazoa, l5 (4), Pp. 173.

Yamin, Y., Syamsu, J., 2020. Crop Residue as Beef Cattle Feed Sources in Sidenreng Rappang Regency. Jurnal Peternakan Sriwijaya, 9 (1), Pp. 26-34.