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ECONOMIC VALUE OF MANAGEMENT FEEDLOT WASTE AND USE AS INPUT PRODUCTION FOR MAIZE FARMING SYSTEM IN THE DRYLAND FARMING – EAST NUSA TENGGARA – INDONESIA

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Abstract:
In regions where fertilizer subsidies for crucial elements like nitrogen, phosphorus, and potassium are severely limited for farmers, accessing necessary inputs for maize farming becomes a significant challenge. To address this, leveraging local resources such as feedlot waste emerges as a promising solution. This research uses a Random block design to implement this research within three replications. This research uses factorial treatments that are: 1) Without compost and biochar (control), 2) 10 ton/ha compost and biochar, 3) 10 ton/ha compost and biochar and one time application/week, 4) 10 ton/ha compost and biochar one time application/2 week. Replication of all the treatments in this research is three replications. This research aims to assess the economic value of feedlot waste, particularly in its conversion to compost, biochar, and biourine, serving as locally generated inputs for maize production in dryland farming systems. The objectives of this research are to know the economic value of feedlot waste that farmers save and to know the capability of input production from feedlot waste to produce maize in managing dryland farming systems. The result of this research is farmers can save their money for buying input production by managing the waste of feedlots to compost, biochar, and biourine and use it as quality input production.

Keywords: Economic Value, Feedlot Waste, Dryland Maize Farming

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INTRODUCTION

Maize crops in the dryland were developed to fulfill household food security. Usually, farmers develop in a dryland farming system. Many challenges of maize farming include climate, available input production, and soil fertility. Synthetic Input production especially fertilizer subsidies for nitrogen, phosphorus, and potassium are very limited for all farmers in this region. Providing fertilizer subsidies is unbalanced with farmers' needs. On the other hand, the price of fertilizer unsubsidies is higher. So, farmers face difficulties in getting the fertilizer to apply in the maize farming system.

Farmers in rural areas, besides developing maize farming systems, farmers develop cattle within feedlot systems. Farmers develop mini feedlots with some cows ranging from 1 – 5 units. The feedlot systems produce waste that is cattle feces, unintake feed, and urine. According to (Adijaya & Yasa, 2012) total waste of livestock systems up to 15-20 kg/unit/day and urine reaches 5,94 liter/unit/day. Utilization of feedlot waste optimal less and trending ignore so become as a polutan source in around feedlot place (Prambudi, 2020). That three-item waste of feedlot can be managed to become an organic fertilizer. Waste management from the feedlots can be done locally by farmers themselves through the assistance of agriculture extension workers to provide manure for applying to maize farming. Farmers did not purchase external fertilizer and only managed local resources as an organic fertilizer source to fulfill local needs. Farmers obtain Fertilizer from other sources that are available locally. Before using it as a fertilizer the manure is processed to compost, biochar, and biourine (liquid organic fertilizer).

Manure from feedlot is one potential that farmers can get and apply to maize farming. Feedlot waste contains some nutrients that the maize crop absorbs to support maize growth and yield. Nitrogen content in feedlot wastes up to 0.65%, phosphor up to 0.15 %, and potassium up to 0.30% (Las & Setyorini, 2010; Rosniawaty et al., 2015). That way, the waste of the feedlot can be made into an organic fertilizer source.

Apply compost, biochar, and biourine from the feedlot system using simple technology but with the highest impact. Compost and biochar are placed in the groove of planting before planting time, biourine is sprayed on the maize crop routine both one time/week and one time/2 week. It is applied to fulfill the nutrient needs of maize crops. Feedlot waste can be used as input production after processing it as compost to push maize growth and yield. Improving soil nutrient and physical to enhance maize production (Shah et al., 2023).

Feedlot waste had been ignored as long as synthetic fertilizer was gotten easily and cheaply of the price. Besides, waste from feedlots being ignored in management can cause environmental pollution. When farmers face constraints in providing synthetic fertilizers, and care environmentally friendly so managing local potential as an alternative fertilizer should be done to sufficiently need of fertilizer. Creating technology for increasing value added to local potentials, like feedlot waste, is very needed. Value-added feedlot waste should be done by the farmers themself by applying simple technology with the assistance of agricultural extension workers.

The objectives of this research are to know the economic value of feedlot waste that farmers save and to know the capability of input production from feedlot waste to produce maize in managing dryland farming systems.

METHOD

This research was conducted in Naibonat village – Kupang District, from September 2022 to February 2023. This research uses a Random block design to implement this research within three replications. This research uses factorial treatments that are: 1) Without compost and biochar (control), 2) 10 ton/ha compost and biochar, 3) 10 ton/ha compost and biochar

and one time application/week, 4) 10 ton/ha compost and biochar one time application/2 week. Replication of all the treatments in this research is three replications. It applies to soil and crops according to procedures better. Land preparation was perfect, and then the groove for laying the compost and biochar was suitable with the dose of each treatment. The distance of each planting groove is 80 cm. Material for this research is fertilizer consisting of compost, biochar, and biourine from the feedlot waste. Maize seed uses hybrid Pioneer 21. Planting maize was done manually using the stick to make holes. The distance of each hole is 20 cm. Each hole planted one seed. Biourine application had been made as long as maize growth, both one time per week or one time per 2 weeks up to the treatment design. Feedlot waste is processed to compost, biochar, and biourine, which can be used in maize farming as organic fertilizer and soil improver.

RESULT AND DISCUSSION

Site Location

This research was conducted in Naibonat village, Kupang District, which is very close to the district capital. Access to the synthetic input production source very easily. The conditions of Naibonat village and East Kupang Subdistrict (BPS Kabupaten Kupang, 2013) are described below.

Table 1. Site location and potential

Description	Amount
Total area	22,47 km^2
Sloping land (%)	< 15
Altitude (m a.s.l)	22
Distance to the Capital of the District (km)	5
Distance to the Capital of Subdistrict (km)	7
Population	12,371
Rice harvest area (ha)*	298.9
Maize harvest area (ha)*	1,138.5
Cows*	22,394
Pig*	23,047
Horse*	45
Goat*	9,876

Source : Kupang Timur Subdistrict in figure 2021.
*subdistrict data

The total area of Naibonat village is up to 22.47 km^2. Naibonat village has sloping land of < 15%. The total population in Naibonat village is up to 12,371 people. Farmers often run farming systems annually, both rice and maize. The total harvest area for rice is 298.5 ha, and maize is 1,138.5 ha. Productivity of rice up to 6 tons/ha and maize up to 4 tons/ha. Besides the agriculture sector, farmers have cows as a part of their business. The population of cows in the

Subdistrict of East Kupang is up to 22,394 units, buffalo 306 units, horses 45 units, pigs 23,047 units, sheep 85 units, and goats 9,867 units. The population of livestock supports the economy of households. By-products of livestock are waste, and it is a source of fertilizer for the agriculture sector.

Livestock System and The Waste

The cattle rearing system in this village is a moving fastening system, grazed in the meadow system during the day, and the other one is rearing at the simple feedlot that consists of 1 - 5 cows every feedlot. At a moving fastening system, livestock is delivered to the meadow in the morning and tied during the day. During the day, all of the cows eat the grass around each point area, and in the afternoon, all the cows are brought back to the cowshed and given water to fulfill their needs. Cows are grazed in the meadow system during the day. In this system, usually, each owner of a cow delivers it to the grass routinely every day. Cows are brought to the meadow in the morning and back to their cowshed in the afternoon. The other one is that cows stay at the feedlot permanently during periods of fattening. On the system, farmers have 1 - 5 cows in every feedlot and a care routine. For feeding the cows, farmers cut and carry forage from farming and then bring it to a feedlot for their needs. Cows in the feedlot need sufficient feed, both in the amount and quality of the feed. For This system, forage is always available each time. Farmers divide their time between running activities in the farming system and livestock management.

Each rearing system of livestock usually produces waste. Waste of the two-rearing system consists of feces and urine. The waste of cows in the moving fastening system and the cattle grassing system produces waste and leaves it in the meadow during the day, and the night can be collected in the cowshed. Waste of two systems is very difficult to collect during the day. The potential of waste is ignored, uncollected, and unused for farming. Waste of cows in the feedlot system is usually collected in the feedlot and height up to more than one meter. Usually, farmers apply it to the vegetable farm when the waste of the feedlot has matured without being processed but at least had been applied.

Waste is usually valueless and often ignored in the management of cattle, even producing a smelly, sharp smell around the environment (Damasceno et al., 2020). Each person feels disgusted with the waste of livestock. Any person certainly avoids waste from their home or homestay by creating a clean environment. So, the waste of feedlots or waste from cowsheds can be managed better so that it becomes a product of high value and is value-added.

Until now, farmers in the dryland have used the waste of feedlots as a resource not yet used optimally in the farming system or ignored the benefit of the waste. Farmers use very little as input production in vegetable farming. Farmers observed that using manure from feedlots is better than farming not applying compost from feedlots. Farmers that manage dryland farming systems, particularly in the maize farming system, do not yet use optimality. Farmers ignore the potential of waste and are often washed away by the rainwater toward the sea.

Feedlot waste consists of feces, urine, and unintake feed. Changing waste, which is valueless, to high-quality resources through application innovation-friendly. Waste of feces is managed through the decomposition process. Waste is collected and fermented for two or four

weeks through the decomposition process to compost with high quality. Unintake feed is processed into Biochar through the burning process at a high temperature of about 400^0C. Then, the biochar is smoothed to create a wide surface that can hold water and fertilizer. The urine of cows can be processed into Biourine for use as organic fertilizer. Biourine can be made by fermentation using cow urine. Compost, biochar and biourine can be used as input production to maize farming system.

Content of Compost, Biochar, and Biourine.

Waste of feedlot was indirectly used as a resource fertilizer. It should be processed into other forms of material. Recycling waste of feedlots should be done to increase nutrient value. Feces are processed to compost, forage intake is processed to biochar, and urine can be processed to biourine. Compost, biochar, and biourine within the process need innovation to change the nutrient content of it. Innovation to process feedlot waste to compost, biochar and biourine were done with an environmentally friendly method by destroying pathogens. Each material has special characteristics. Compost form is a solid fertilizer, biochar is a soil improver and biourine is a liquid fertilizer (Fang et al., 2021). The third form of feedlot waste is used as an alternative fertilizer that can change synthetic fertilizer. Reducing nutrient losses within process manure can be developed with suitable practice technology. The results of the Laboratory analysis are below.

Table 2. Nutrient content in compost, biochar and biourine from the waste of feedlot

No.	Product of feedlot waste	Kandungan Hara				
		pH H_2O	C %	Ntotal %	P_2O_5 %	K_2O %
1.	Liquid Fertilizer (Biourine)	6,4	5,09	9,89	2,11	9,91
2.	A. Compost	7,9	6,47	4,10	9,55	1,24
3.	Biohcar	7,5	9,55	1,20	6,24	4,49

This table shows that compost, biochar and biourine have nutrient content for use in the farming system. The essential elements for maize crops are nitrogen, phosphate, and phosphorus. The third element are contained in the compost, biochar, and biourine. According to (Thomas et al., 2017), compost has a nutrient of phosphorus greater than nitrogen. Nutrient content in the urine of cows reaches 0,02 % N, 0.08 % P and 0.45 K (Adriani & Novra, 2017; Nuraini & Eka Asgianingrum, 2017). The nutrient content of feedlot waste was supportable to maize growth and yield. Compost, biochar, and biourine were replaceable with synthetic fertilizer for application to maize crops.

Input Production for Maize Farming System in The Dryland

The scarcity of synthetic fertilizers in rural areas is caused by limited availability. Therefore, local potential, like feedlot waste, was changed as an alternative organic fertilizer applied to maize crops. Organic fertilizers have contributed to the substitution of synthetic fertilizers in managing the sustainability of land, and farmers's income can be increased by using organic fertilizers (Fang et al., 2021). Applying local potential as a fertilizer to maize crops, particularly using compost, biochar, and biourine from the waste of feedlots, gives value

added to farmers. Farmers do not spend money to buy chemical fertilizers. The added value obtained by farmers due to the use of organic fertilizer from feedlot waste is very significant; farmers save a lot of money by using organic fertilizer from the waste of feedlot, which can be seen below.

Table 3. Farmers save by using feedlot waste as input production.

Treatment	Input Production	Volume (kg, Litre)	Cost /unit (Rp/kg, ltr)	Value /item (IDR/ha)	Total Value (IDR/ha)
1. Without compost, biochar and biourine	B. Compost (ton/ha)	0	0	0	
		0	0	0	0
	Biochar (ton/ha)	0	0	0	
	Biourine (ltr/ha)				
2. Compost and biochar 10 ton/ha	C. Compost (ton/ha)	10,000	500	5,000,000	
		10,000	500	5,000.000	10,000,000
	Biochar (ton/ha)				
	Biourine (ltr/ha)				
3. Compost and biochar 10 ton/ha + Apply Biourine 1 time/week	D. Compost (ton/ha)	10,000	500	5,000,000	
		10,000	500	5,000.000	10,900,000
	Biochar (ton/ha)	45	20.000	900.000	
	Biourine (ltr/ha)				
4. Compost and biochar 10 ton/ha + Apply Biourine 1 time/2 week	E. Compost (ton/ha)	10,000	500	5,000,000	
		10,000	500	5,000.000	10,500,000
	Biochar (ton/ha)	25	20.000	500.000	
	Biourine (ltr/ha)				

The table above describes the utilization of compost, biochar and biourine from the feedlot waste as input production to maize farming. The first treatment do not apply input from waste of feedlot. The second treatment applies compost and biochar. The third treatment applies Compost and biochar 10 ton/ha + Apply Biourine 1 time/week, and the fourth treatment applies Compost and biochar 10 ton/ha + Apply Biourine 1 time/2 week.

On the treatment, farmers use local potential particularly compost, biochar and biourine from feedlot waste. Farmers use their resources and do not purchase. Cattle biomass is like feedlot waste; it is as effective as synthetic products and more economical (Istiqomah & Kusumawati, 2022). Utilization of feedlot waste as input production is very efficient, both easily and available locally. The on-site operation and manure moisture content are two key parameters that can reduce biochar unit price and carbon footprint of manure management (Struhs et al., 2020). This research finds that farmers use their potential locally and save their money to buy one up to IDR 10.000.000.

Maize Production

Utilization of compost, biochar and biourine to the maize farming can enhance the productivity of maize farming. Animal manures have economic value as plant nutrient sources and as amendments for soils whose physical properties can be improved by adding organic

matter (Rizki et al., 2023). Production of maize that apply compost, biochar and biourine as follow below.

Table 4. Productivity of maize farming and value of input production to save.

No.	Input Production	Value of input production (IDR/ha)	Maize crop production (ton/ha)
1.	Without compost, biochar and biourine	0	2.852
2.	Compost and biochar 10 ton/ha	10,000,000	10.836
3.	F. Compost and biochar 10 ton/ha + Apply Biourine 1 time/week	10,900,000	13.069
4.	Compost and biochar 10 ton/ha + Apply Biourine 1 time/2 week	10,500,000	13.010

Based on the table, farmers do not save money at first treatment and only get maize production, only 2,852 tons/ha. That means no input production applies to maize farming. On the second treatment, apply compost and biochar and get maize production up to 10,836 tons/ha. Moreover, applying compost, biochar, and biourine as liquid fertilizer enhanced maize productivity up to 13,069 tons/ha and 10,01 tons/ha. Soil amendment with biochar increases productivity (Biederman & Harpole, 2013). Therefore, through this research, farmers can use local potential as input production for getting maize production.

CONCLUSION

The use of compost, biochar and biourine derived from feedlot waste has increased maize productivity. On land that does not use inputs from feedlot waste, maize farming only produces a fairly good yield of 2,852 tons/ha. However, utilizing local resources such as compost and biochar without the use of biourine significantly increases productivity, reaching 10,836 tonnes/ha. This rapid increase underscores the efficacy of these waste-derived inputs in increasing maize yields. In addition, the application of biourin further increased maize productivity, reaching as high as 13 tons/ha. Whether applied weekly or fortnightly, the incorporation of biourine into maize farming practices has demonstrated a remarkable capacity to increase yields, demonstrating the potential of these waste-derived components to significantly and sustainably increase agricultural yields.

REFERENCES

Adijaya, I. N., & Yasa, I. M. R. (2012). Hubungan konsumsi pakan dengan potensi limbah pada sapi bali untuk pupuk organik padat dan cair. Prosiding Seminar Inovasi Teknologi Pertanian Spesifik Lokasi Mendukung Empat Sukses Kementerian Pertanian Di Provinsi Bengkulu. Bengkulu. Balai Pengkajian Teknologi Pertanian Bengkulu.

Adriani, A., & Novra, A. (2017). Peningkatan Kualitas Biourin Dari Ternak Sapi Yang Mendapat Perlakuan Trychoderma harzianum The Increase of Biourine Quality From Cow Treated With Trychoderma harzianum. Jurnal Ilmiah Ilmu-Ilmu Peternakan, 20(2), 77– 84.

Biederman, L. A., & Harpole, W. S. (2013). Biochar and its effects on plant productivity and nutrient cycling: a meta-analysis. GCB Bioenergy, 5(2), 202–214.

Damasceno, F. A., Monge, J. L., Nascimento, J. A. C., Andrade, R. R., Barbari, M., Saraz, J.

A. O., & Ferraz, G. A. S. (2020). Estimate of manure present in compost dairy barn systems for sizing of manure storage.

Fang, P., Abler, D., Lin, G., Sher, A., & Quan, Q. (2021). Substituting organic fertilizer for chemical fertilizer: Evidence from apple growers in china. Land, 10(8). https://doi.org/10.3390/land10080858

Istiqomah, I., & Kusumawati, D. E. (2022). Buku Ajar Pertanian Terpadu Berbasis Bebas Limbah. Duta Media Publishing.

Kupang, B. K. (2013). Data Kecamatan Kupang Timur dalam Angka.

Las, I., & Setyorini, D. (2010). Kondisi lahan, teknologi, arah, dan pengembangan pupuk majemuk NPK dan pupuk organik. Prosiding Semnas PerananPupuk NPK Dan Organik Dalam Meningkatkan Produksi Dan Swasembada Beras Berkelanjutan.

Nuraini, Y., & Eka Asgianingrum, R. (2017). Peningkatan Kualitas Biourin Sapi dengan Penambahan Pupuk Hayati dan Molase serta Pengaruhnya terhadap Pertumbuhan dan Produktivitas Pakchoy. Jurnal Hortikultura Indonesia, 8(3), 183–191.

Prambudi, S. B. F. (2020). Potensi Pemanfaatan Limbah Peternakan Sapi Pedaging di SPR (Sekolah Peternakan Rakyat) Ngudi Rejeki, Kabupaten Kediri. Jurnal Pusat Inovasi Masyarakat (PIM), 2(3), 343–347.

Rizki, W. A., Hasim, Z., Firdaus, M. M., Azegap, S., Mulyati, S. N., Julina, B. S. D., Pramesti, L. C. N., Septiantari, S., Makiyah, H., & Nurjihad, N. (2023). Pemanfaatan Limbah Ternak Sebagai Pupuk Kompos Di Desa Leming Kecamatan Terara Kabupaten Lombok Timur Oleh Kkn Desa Leming 2022/2023. Prosiding Seminar Nasional Gelar Wicara, 1, 209–212.

Rosniawaty, S., Sudirja, R., & Afrianto, H. (2015). Pemanfaatan urin kelinci dan urin sapi sebagai alternatif pupuk organik cairpada pembibitan kakao (Theobroma cacao L.). Kultivasi, 14(1).

Shah, M. N., Wright, D. L., Hussain, S., Koutroubas, S. D., Seepaul, R., George, S., Ali, S., Naveed, M., Khan, M., & Altaf, M. T. (2023). Organic fertilizer sources improve the yield and quality attributes of maize (Zea mays L.) hybrids by improving soil properties and nutrient uptake under drought stress. Journal of King Saud University-Science, 35(4), 102570.

Struhs, E., Mirkouei, A., You, Y., & Mohajeri, A. (2020). Techno-economic and environmental assessments for nutrient-rich biochar production from cattle manure: A case study in Idaho, USA. Applied Energy, 279, 115782.

Thomas, B. W., Luo, Y., Li, C., & Hao, X. (2017). Utilizing Composted Beef Cattle Manure and Slaughterhouse Waste as Nitrogen and Phosphorus Fertilizers for Calcareous Soil. Compost Science and Utilization, 25(2), 102–111.

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