



UDC 332

FACTORS DRIVING PRODUCTIVITY AND PROFITABILITY OF SORGHUM DEVELOPMENT IN EAST MANGGARAI REGENCY, INDONESIA

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ABSTRACT

Sorghum is starting to be developed continuously in East Manggarai because it is well adapted to the dry climate. Even though it was once cultivated, currently most people do not consume sorghum, even though sorghum has advantages compared to rice and corn. This study aims to describe the public's interest/perception towards sorghum, as well as list the driving factors for developing sorghum productivity and profitability. The study location was chosen deliberately with consideration of the sorghum planting area, and a location that is easily accessible. Melo Village, Nggolon Dari Village, and Compang Ndenjing Village were selected to represent the population in Manggarai Regency. A total of 47 households planted sorghum and all of them were used as samples (Saturated Samples). Collecting information through surveys, field observations, and guided discussions with informants from the Agriculture Service, data was analyzed descriptively and quantitatively. The results of the study found that public interest was quite interested in sorghum as a food ingredient. Several driving factors for the development of sorghum are the availability of land, labor, facilities and infrastructure, and government support. The profitability of sorghum can be seen from the revenue and cost ratio (RCR) of 1.82, which indicates that sorghum is worth developing.

KEY WORDS

Sorghum, productivity, profitability, public interest, revenue cost ratio.

One cereal commodity that has many benefits, apart from grain and corn, is sorghum. This plant is suitable for cultivation in dry climate areas (Irawan and Sutrisna, 2011; Pabendon et al, 2012). The benefits are many, apart from supporting food security and providing animal feed, through a fermentation process, sap and sorghum stalks can be made into bioethanol (Pabendon et al, 2012) and the product has economic value (Nuli, 2019). It is widely cultivated in East Java, NTB, and NTT (Nuli, 2019). Sorghum cultivation is relatively easy. Adapts well from lowland areas (<700 masl) to highland areas > (700 masl), including areas with semi-arid to wet climates.

In Nuli, (2019) it was stated that sorghum development was carried out in West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), and on the island of Java. NTT Province is considered a successful sorghum development considering that the region in NTT has a hot climate with longer sunshine (Nuli, 2019; Irawan and Sutrisna, 2011). Rahmawati (2020) emphasized that sorghum has high adaptability, especially on marginal land has high productivity compared to other types of plants, and is not very sensitive to pests and diseases. Sorghum cultivation in developing countries is not only a food source but also a producer of alcoholic beverages. Fermented and germinated sorghum seeds can produce beer. In developed countries, sugar and paper can be produced from sweet sorghum stalks. Sorghum seeds are a source of animal feed, and the stems are used as a medium for edible mushrooms.

Preparations for NTT as a province that produces sorghum were stated by Dina (2022) that breeding of sorghum seeds will begin in 2022. Planting in several locations in East Nusa Tenggara has begun to be encouraged, including in East Sumba Regency and Kupang Regency. Generally, the species planted is the Suri 4 variety. In 2023, sorghum planting in NTT is expected to reach 30 thousand hectares (Dina, 2022). The availability of sorghum seeds in situ requires adopting 6 principles in seeding such as variety, quality, quantity, time, location, and price to be achieved.



BPS data (2021, 2022, and 2023) for East Manggarai Regency has not yet explicitly recorded the area or production of sorghum, however in several sub-districts intensive sorghum planting has been carried out, such as in Borong sub-district. Initially, sorghum cultivation several decades ago was only as a side crop or barrier between field owners, especially on fields shaped like lingko (spider webs) Markur (2022). The development of sorghum is encouraged by the East Manggarai Regency government, through East Manggarai Regent Regulation Number 34 of 2021 concerning sorghum which is used as an alternative and functional food (Nuka, 2022). Alternative food is intended so that food offerings at the household level, as well as official government, cultural, and religious food offerings, are made from the basic ingredient sorghum. Apart from that, the development of sorghum in East Manggarai is also motivated by the ecological disaster in recent years (Nuka, 2022). The disasters that occurred had an impact on the socio-economic conditions of the community, such as crop failure, low agricultural production, malnutrition, and also the death of the livestock being raised, thus causing a food crisis.

Sorghum productivity in NTT is still relatively low compared to other provinces. For example, in Ramadi's (2023) study, it is stated that sorghum productivity ranges from 3-4 tones, lower than sorghum productivity in East Java which reaches 4-5 tones. Null's article (2019) notes that sorghum productivity in Demak reaches 8 to 9 tones. Based on this factual data, the synergy of all parties is needed to encourage increased sorghum productivity in the East Mangaria district. This study examines public interest/perceptions towards sorghum and inventories as the driving factors for developing sorghum productivity and profitability.

METHODS OF RESEARCH

Research locations: Melo, Golo Ndari, and Compang Ndejing villages of East Manggarai Regency. There are 47 households growing sorghum in the three villages, and all of them were sampled. Based on Sugiyono (2019), if the entire population is involved in the research, the sampling technique is called a saturated sampling technique. The research took place from March to August 2023.

The data needed is primary and secondary. Next, the data was analyzed descriptively and quantitatively; descriptively through calculation of mean, average, percentage, standard balance, and coefficient of variation. Public interest in sorghum was inventoried with four answer choices from a score of 1-4, the higher the score, the higher the public interest. The maximum score for all respondents is obtained by multiplying the highest score, the number of questions, and the number of respondents ($4 \times 10 \times 47$), which is the 4 highest score, 10 the number of questions, and 47 the number of respondents. The maximum score per respondent is obtained by multiplying the highest score and the number of questions ($4 \times 10 \times 1$), one is the number of respondents. Meanwhile, the maximum score for each question is the multiplication of the number of respondents in each score ($n(1) + n(2) + n(3) + n(4) \times 1$, n is the number of respondents, 1,2,3,4 are score, and 1 is the number of questions.

Furthermore, the classification of interest/interest is adjusted to the quartile theory where 0-25% falls into the category of low interest/interest, 26-50% lacks interest, 51-75% classification of sufficient interest/interest, and the interval 76%-100% high interest/interest. Sorghum profitability is estimated using the Revenue Cost Ratio. Sorghum is not worth developing if this ratio is smaller than one.

RESULTS AND DISCUSSION

The average area of land/household for planting sorghum is 0.69 ± 0.36 with a variation of 0.25- 2 ha, Table 1. Sorghum productivity is $1,042.84 \pm 807.33$ kg/household or 1,511.37 kg/ha. The productivity obtained is relatively low, generally planted after rice and corn have utilized the remaining water in the soil. Sorghum is not cultivated intensively, because there are other farming activities such as maintaining horticultural crops, livestock, and post-harvest handling of corn and rice.



The average age of farmers is 48.94 ± 9.97 , with the lowest age variation being 30 years and the oldest being 73 years. Overall, the productive workforce reached 91.49% of respondent farmers, and only 8.51% were of no longer productive age (≥ 65 years). The majority of farmers' education is $>65\%$ of farmers with elementary school education and illiteracy. At the education level up to high school, except at agricultural vocational schools, the material provided is not yet related to agriculture, so the material studied and applied by farmers is based on experience with their parents. Therefore, non-formal education through extension, plot demonstrations, and post-harvest handling of sorghum is very necessary.

The average number of family members is 6 - 7 people or 6.38 ± 1.58 with the number of productive age household members being 4.89 or 4 - 5 people. This figure indicates that the potential for labor available in the family is quite high, although looking at age, the portion of the workforce aged over 50 years is quite large. The availability of labor in the family is 76.89% productive labor. This means that the availability of productive labor for each household is sufficient to cultivate sorghum plants. The results of a study by Sutrisno, et al (2016), found that labor costs for sorghum farming in financial analysis calculations contributed 36.21% so the availability of sufficient family labor can reduce labor costs.

Public interest in sorghum cultivation is quite high, as indicated by the increase in the number of farmers cultivating it every year. From the interview results, it can be seen that 2 farmers have planted sequentially in the last 3-5 years (4.26%). Furthermore, 40 farmers have planted 2 years in a row, or 85.11%. Then there were around 5 or 10.84% more farmers who were interested in planting sorghum in the last year. The results of calculating scores per question, and as a whole, are stated in Table 2. Based on Table 2, the conclusion is that the average public interest in sorghum is quite good in classification class 3 (51-75), namely 63.09.

The driving force for farmers to plant sorghum is generally to get additional income, said 97.87% of farmers, then 87.23% of farmers said the motivation to plant sorghum was to get additional food for the family and around 4.26% of farmers said that the motivation to plant sorghum Apart from improving the family's economy, adding food, sorghum stems can be used as feed.

The land is the main capital of farmers. Information from the location shows that the average ownership and control of land by farmers is 3.55 ± 1.53 plots. Of the areas of land controlled, 35.49% of them are wetlands; the remaining 64.51% are dry lands,

The average area of land owned by farmers is 1.24 ± 0.97 ha, of which 0.69 ha or 55.93% is planted with sorghum after rice and corn are harvested. This indicates that land is not a limiting factor in sorghum cultivation. The land potential is sufficient for the development of sorghum, whereas land extensification is still very possible for the expansion of sorghum cultivation. Ratulangi et al., (2019); Irawan and Sutrisna (2011) stated that land is one of the determining factors in the development of agricultural products. Apart from that, improving technology in sorghum cultivation is still possible to increase productivity on the use of the same land area.

Nationally, according to a study by Ariani, et al (2022); Pestarin, et al (2017) stated that sorghum development throughout Indonesia is still possible, considering that there is still marginal land of around 853,000 ha. If this land is cultivated by planting sorghum, it can produce 6 million – 10 million tons of sorghum/year; 75 million -100 million tons of sorghum stalks/year can produce around 40 million -60 million tons of sap/year. Nationally, the average sorghum production has only reached 4000 tons -6000 tons/year. This means that nationally, sorghum production will only reach 0.01 %/year of production if all marginal land in various regions is utilized optimally.

The results of data analysis show that the average household member is 6.36/ 6 – 7 people/family, Table 3. The large number of family members has two different paradigms. First, the large number of household members means that there is also a large supply of household labor. On the other hand, both family members indicated that the responsibility of the head of the family and the housewife was increasing to fulfill the basic needs of their family members.



Table 1 – Internal Conditions of Sorghum Farmer Households

Description	Value (Percentage)
Average sorghum planting area, ha	0.69
Productivity, tons/cultivated area	902.47
Productivity, ton/ha	1,307.92
Average age of Farmers, years	48.94
Education n = 47	-
No School/Illiterate, total (%)	2 (4.26)
Elementary School, total (%)	29 (61.70)
Secondary School, total (%)	7(14.89)
Senior High School, total (%)	8 (17.02)
University	1 (2.13)
Average household members, people	6.36

Source: Primary data, processed (2023). Note: The numbers in brackets are percentages.

Table 2 – Distribution of Respondent Household Animo/Interest Scores towards Sorghum

Nu.	Statement	Distribution Respondent Based on Score Category				Total Score	Percentage to Maximum Score	
		1	2	3	4			
1	Sorghum cultivation is easier than other food source commodities	12	28	2	5	94	50.00	
2	Sorghum processing is easier than other food source commodities	1	45	1	0	94	50.00	
3	Sorghum is more nutritious than other food sources	0	2	27	18	157	83.51	
4	Sorghum as a functional alternative food is better than other food source commodities	4	7	17	19	145	77.13	
5	Sorghum seeds are very difficult to find compared to seeds of other food source commodities	29	12	5	1	72	38.30	
6	The price of sorghum is cheaper than other food source commodities	0	25	2	20	136	72.34	
7	Sorghum is currently more difficult to obtain than other food source commodities	14	28	1	4	89	47.34	
8	Sorghum will be more expensive than other types of food commodities	1	45	1	0	94	50.00	
9	Willingness to plant sorghum	0	2	27	18	157	83.51	
10	Sorghum has better prospects as a functional food than other commodities	5	3	19	20	148	78.72	
n/n	Average per respondent	66	197	102	105	1186	63.09	
	Overall average	1186/1880=63.09						
	Category	Quite interested						

Note: 1880 is obtained from $4 \times 10 \times 47$, where 4 is the maximum score, 10 is the number of questions and 47 is the number of respondents.

Table 3 – Labor within and outside the family and the amount of work in sorghum farming at the research location

Types of Labor	Average	
	Workers in the family	Workers in the family
Male		
• Average Labor, people	1.41 (1-2)	12,21 (12 – 13)
• Average working hours/day	4.70	3,27
• Average Working Days/MT	32.07	2,47
Number of Work Overflows (HOK)*	30.36	14,09
Female		
• Average Labor, people	1.13 (1-2)	7.35 (7 – 8)
• Average working hours/day	4.02	2.06
• Average Working Days/MT	25.81	2.17
Number of Work Overflows (HOK)*	19.74	4.69
Children		
• Average Labor, people	0.67 (1)	-
• Average working hours/day	1.5	-
• Average Working Days/MT	16.65	-
Number of Work Overflows (HOK)**	0.92	-
Total Workflow (M+F+C), HOK; %	51.02(73.09)	18.78 (26.91)
Total Workflow (TKDK +TKLK), HOK (%)	69.80 (100.00)	

Source: Primary data, processed (2023).

Notes: *) = $(a \times b \times c) / 7$; **) $(a \times b \times c) / 14$. TKDK = Workers in the family; TKLK = Workers outside the family; HOK= People working days.



The results of the analysis show that the number of productive workers in the family is 4.89 people or 4 -5 people/family or 76.89% of the total family members. This fact indicates that sufficient family labor is available for sorghum farming. Apart from that, various literature indicates that sorghum cultivation is not as complicated as rice cultivation so productive labor in the family can be used as well as possible.

Overall, the average amount of work in sorghum farming is 48.16 HOK/cultivated area or per household. The average amount of work per hectare is 69.80 HOK/ha, of which 51.02 HOK (73.09%) is from within the family and 18.78 HOK (26.91%) is labor outside the family. The amount of work in sorghum farming is smaller than that in lowland rice farming. A study by Lestari, et al (2022) found that the amount of work for rice farming was 188.11 HOK/ha. Study by Amheka, et al (2020) The amount of work in lowland rice farming is 323.74 HOK/Ha. A study by Suek, et al (2022) found that the amount of work in lowland rice farming was 127 HOK/ha. The large amount of work involved in each study is thought to be due to the different types of soil, cultural factors, and habits at each study location.

Labor is a crucial production factor. Scarcity of labor will result in delays in planting time, especially in areas with semi-arid climates (the rainy season is shorter than the dry season), and it will impact plant growth, where when plants need water, the water is reduced so that the consequence is the quality of the product. decreased and low plant productivity.

Nationally, there is synergy between the Director of Agricultural Financing, the Directorate General of Agricultural Infrastructure and Facilities (Kementan), and the Ministry of Public Works and Housing (PUPR) in providing assistance with agricultural equipment and ensuring water supply. The synergy carried out aims to support and ensure the success of sorghum development in NTT. Apart from that, various assistance through the Director General of Natural Resources and the Ministry of PUPR for the preparation of groundwater irrigation networks by providing drilled wells and dug wells to ensure the success of sorghum development in NTT.

Assistance with agricultural equipment by various agencies is of two types depending on the fragmentation of the land or whether it is in a compact area. If it is located on one stretch, the type of tool provided is a two- or four-wheeled puller to assist in the planting process. Farmers also receive assistance with watering tools, namely sprinklers and drones. Meanwhile, for harvesting, a combine harvester is provided which has three functions at once, namely harvester, stem cutter, and sheller. For land that is fragmented and located in hilly and mountainous areas, a stalk cutter can be used for harvesting.

On a large scale, sorghum cultivation requires sufficient equipment, facilities, and infrastructure for sorghum development to strengthen national food security. The government's efforts to support sorghum development in research locations have been quite good. One of the government's assistance to the Sorghum Farmers group in Mello Village, through the East Manggarai Regency Agriculture Service, is a polishing machine.

Marketing is relatively limited because people still need time to start consuming it again. Promotion and reintroduction of sorghum as a healthy alternative food is needed. If efforts are made sustainably, they will gradually make sorghum an alternative daily food. In addition, sorghum contains lower sugar content than rice, making it suitable as a functional food for diabetes sufferers. The taste of sorghum rice is relatively the same as rice, but the difference is that sorghum rice is round, while rice is flatter and oval. Because sorghum has high fiber content, if someone eats a little sorghum, they will feel full.

The price of sorghum depends on consumer demand, based on information, the price of sorghum varies quite widely from 6,500 IDR/kg-12,000 IDR/kg. The price of sorghum is not yet uniform due to limited farmers' planting and the consequences for the supply of sorghum to the market. On this basis, sorghum prices still vary greatly. Based on the information above, there needs to be a movement facilitated by government agencies, NGOs, and PTs working together to help market sorghum, so that farmers are enthusiastic about cultivating sorghum.

Nationally, there is a government plan to add 115,000 hectares of new land for sorghum cultivation. This is emphasized in Gayati's writings, (2022) is said that there is a desire from the President to make the NTT province a central area for sorghum production



The development of sorghum in East Manggarai is motivated by the recent ecological disaster as acknowledged by the East Manggarai Regional Government. This results in the disaster of livestock deaths, crop damage resulting in malnourished babies, declining agricultural products, and resulting in a food crisis. Therefore, the East Manggarai Government encourages optimal use of land for planting sorghum to increase food security and nutrition. The development of sorghum is also a strategic step in dealing with climate change, activating the economy after the COVID-19 pandemic, and increasing conflict between countries which could result in a global food availability crisis. Thus, sorghum cultivation is a regional leverage to contribute to national food availability.

With support from the government in 2022, land extensification of 400 ha will be developed. This expansion is accompanied by the regional government, Ruteng Diocese, and the Kehati Foundation. This expansion is spread across the districts of North Lamdaleda, Sambu Rampas, Borong, and Komba City which are lowland areas and coastal areas. Regarding seed supplies, currently, there are officially certified organic seeds in the cultivation area in Melo Village.

In Nuka's article (2022), it is stated that the regional government continues to encourage sorghum development in East Manggarai. This encouragement has been translated into the East Manggarai Regent's regulations as a sorghum district as well as a region that has food independence. Seriousness is indicated by the Regent's Regulation Number 34 of 2021, which regulates the community and household, government, culture, and religion in every situation making sorghum the main treat. Through sorghum, efforts are made to improve the economy and nutrition of families, as well as making sorghum farming an environmentally friendly farming business, apart from protecting local sorghum seed varieties from extinction.

Sorghum productivity in Manggarai Regency is still relatively low. Sorghum is generally planted in the third rotation after rice and corn and does not require as intensive care as rice or corn, so sorghum tends to be left alone. The results of the interview revealed that sorghum is planted in April after the corn or rice is harvested. Because of its resistance to drought, sorghum makes use of the remaining water after the corn or rice is harvested.

The average area of land planted with sorghum is 0.69 ± 0.36 of the planted land, resulting in a production of $1,042.84 \pm 807.33$ kg or $1,511.37$ kg/ha. This yield is relatively lower than that produced by farmers in East Flores, which reaches 3000 to 4000 kg (De Rosary, 2020), and in East Sumba Regency it reaches 3,630 kg/ton (Victory News, 2022). The trend of increasing sorghum productivity over 2-3 years is between 10% -15%.

CONCLUSION

The public's perception of sorghum as an alternative food is in the moderate category, meaning that the public is quite interested in sorghum cultivation.

The driving factors for the development of sorghum in East Manggarai are land ownership, availability of labor, government support from regulations, and equipment assistance. These factors encourage an increase in sorghum productivity which is still relatively low and there are limitations in marketing.

Public interest in sorghum needs to be increased through reintroducing sorghum at various events. Considering that sorghum is not a new crop, many groups of young children are not used to consuming sorghum.

Sorghum productivity is still low; therefore there is a need for synergistic cooperation between various parties to encourage the increase of sorghum through the provision of various physical facilities, also improving the quality of resources.

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