

**Jurnal Humaniora**
**Vol. 10, No. 2 (2026) pp. 260 – 267**
**http://jurnal.abulyatama.ac.id/index.php/humaniora**
**p-ISSN: 2684-9275 e-ISSN: 2548-9585**

*Research Paper*

# Financial Feasibility of Citronella Oil Distillation Farming in Penosan Village, Blang Jerango District, Gayo Lues Regency

**Abdul Malik[1], Diah Eka Puspita[2], Khumaira[2]**

[1] Universitas Sultan Iskandar Muda, Banda Aceh, Aceh, Indonesia
[2] Universitas Abulyatama, Aceh Besar, Aceh, Indonesia

khumaira_pertanian@abulyatama.ac.id
https://doi.org/10.30601/humaniora.v10i2.7973

**Universitas Abulyatama**

***Article Info***
*Submitted:*
*01-10-2026*
*Revised:*
*11-10-2026*
*Accepted:*
*30-10-2026*
*Published:*
*30-10-2026*

**Abstract**

Citronella (*Cymbopogon nardus* L.) is a leading commodity in Gayo Lues Regency, yet village-level evidence on the long-term financial performance of integrated cultivation and distillation is limited. This study assessed the financial feasibility of citronella oil distillation farming in Penosan Village, Blang Jerango District, Gayo Lues Regency, and its sensitivity to changes in costs and prices. A case study with a descriptive quantitative approach was conducted in 2025 among 41 purposively selected farmers who cultivate and distil citronella. Data from interviews, observation and documentation were analysed per hectare over a 25-year economic life at an 18% discount rate using Net Present Value (NPV), Net Benefit-Cost Ratio (Net B/C), Internal Rate of Return (IRR), the cumulative break-even point (BEP) and sensitivity analysis. The business yielded an NPV of IDR 67,090,086.33, a Net B/C of 3.28 and an IRR of about 59%, and the cumulative BEP was reached after 1 year and 9 months. The business remained feasible when operating costs rose by 10% (Net B/C 2.96), when the oil price fell by 10% (Net B/C 2.76) and when production and price fell by 10% together (Net B/C 2.29). A fall in the oil price reduced the NPV about twice as much as an equal rise in operating costs, so price stability matters more to farm returns than moderate cost increases.

**Keywords:** Citronella oil; Financial feasibility; Net present value; Sensitivity analysis; Gayo Lues.

**This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.**

## 1. Introduction

Indonesia is one of the main exporters of essential oils, and its exports of this product group show a revealed comparative advantage above one together with a positive trade specialisation index [1]. Analyses of the main destination markets also indicate that Indonesian essential oils retain a relative export advantage over the world average, although export performance fluctuates between years and markets [2].

Citronella oil contains citronellal, citronellol and geraniol as major constituents, which contribute to its mosquito-repellent, antimicrobial and antioxidant activities, and the oil is registered as an insect repellent in the United States because of its efficacy and low toxicity [3].

Reviews of the chemistry and bioactivity of *Cymbopogon nardus* oil support its use in pharmaceutical, cosmetic and food applications [4].

Gayo Lues Regency in Aceh Province is known as a producer of citronella and Arabica coffee. A land suitability assessment identified 58,275.5 ha of land suitable for citronella in the regency, of which 13,765.75 ha had been planted [5]. Citronella oil is a leading product of Gayo Lues, a remote region whose local economic potential has not been fully utilised [6]. The expansion of citronella on the steep slopes of the Gayo Highlands has also raised concern about soil erosion and the need for conservation measures [7].

In Gayo Lues, a regency-wide study found an average oil output of 164.55 kg per year and a Net Benefit-Cost Ratio of 2.57 [8], whereas another study at an 18% interest rate obtained an NPV of IDR 1,918,400, a Net B/C of 1.11 and an IRR of 21.2% [9]. A study in Kutapanjang District used single-year ratios and found an R/C of 2.61 at an oil price of IDR 160,000 per kilogram [10]. Outside the regency, a company-scale citronella business was feasible with an IRR of 14.02% and a payback period of about nine years [11], diverse oil quality and fluctuating prices were identified as the main problems of citronella oil businesses [12], citronella intercropped on reforestation land in North Aceh reached an IRR of 57.44% [13], and feasibility under normal and risk scenarios has also been assessed for citronella and patchouli oil in Sawahlunto [14].

These studies differ in scale, discount rate and analytical period, and the Gayo Lues studies either use single-year ratios [10] or regency-wide samples [8], [9] that give divergent Net B/C values. No study has combined a 25-year discounted cash flow, a cumulative break-even point and sensitivity scenarios for a single producing village in Blang Jerango District, where citronella is the main crop of almost every farming household. This study addresses three questions: (1) what are the investment, operating cost and revenue components of citronella oil distillation farming per hectare in Penosan Village; (2) is the business financially feasible according to NPV, Net B/C, IRR and the cumulative BEP at an 18% discount rate; and (3) how sensitive is feasibility to a 10% increase in operating costs, a 10% decrease in the oil price and a simultaneous 10% decrease in production and price?

## 2. Method

### Research Design, Location and Sample

This study used a case study design with a descriptive quantitative approach. Penosan Village, Blang Jerango District, Gayo Lues Regency, was selected purposively because it has the highest citronella productivity in the district and almost all of its farmers cultivate citronella on their land. Primary data were collected in 2025 through structured interviews, direct observation of cultivation and distillation, and documentation. Secondary data on climate and land conditions were obtained from the Central Statistics Agency (BPS) of Gayo Lues Regency and from published studies. Respondents were selected by purposive sampling, an approach also used in farm feasibility studies in which respondents must meet a specific production criterion [15]. The sample consisted of 41 farmers who cultivate citronella (*Cymbopogon nardus* L.) and distil the leaves into oil.

### Analytical Assumptions

The analysis was conducted for a representative farm of 1 ha, which equals the average area owned by the respondents. The economic life of the business was set at 25 years, with year 0 as the establishment year. Investment costs comprised land-related expenses, fencing with barbed wire, seedlings, land preparation and planting, while operating costs comprised harvesting labour, transport of leaves to the distillation site and firewood collection. Equipment costs were counted over the 25-year period. Output was measured as kilograms of citronella oil and valued

at the prevailing selling price of IDR 290,000 per kilogram, which was held constant over the projection period. The discount rate was 18%, equal to the lending rate applied by Bank Syariah Indonesia in Gayo Lues at the time of the study.

**Financial Feasibility Criteria**

The Net Present Value is the sum of the discounted annual net benefits over the economic life of the business:

$$NPV = \Sigma_{t=0}^{n} (B_t - C_t) / (1 + i)^t \quad (1)$$

where $B_t$ is the gross benefit in year t, $C_t$ is the gross cost in year t, i is the discount rate and n is the economic life. The business is feasible when NPV > 0.

The Net Benefit-Cost Ratio compares the present value of positive net benefits with the absolute present value of negative net benefits:

$$\text{Net B/C} = [\Sigma_{t=0}^{n} NB_t(+) / (1 + i)^t] / |\Sigma_{t=0}^{n} NB_t(-) / (1 + i)^t| \quad (2)$$

where $NB_t(+)$ and $NB_t(-)$ are the positive and negative net benefits in year t. The business is feasible when Net B/C > 1.

The Internal Rate of Return is the discount rate at which the NPV equals zero. It was estimated by linear interpolation between two discount rates:

$$IRR = i_1 + [NPV_1 / (NPV_1 - NPV_2)] \times (i_2 - i_1) \quad (3)$$

where $i_1$ and $i_2$ are the discount rates that produce a positive NPV ($NPV_1$) and a negative NPV ($NPV_2$). The business is feasible when the IRR exceeds the 18% discount rate.

The cumulative break-even point is the time at which cumulative net benefits offset the cumulative costs incurred since establishment:

$$BEP = k + |CNB_k| / NB_{k+1} \quad (4)$$

where k is the last year in which the cumulative net benefit CNB is still negative and $NB_{k+1}$ is the net benefit of the following year. The business is feasible when the BEP is reached within the economic life.

**Sensitivity Analysis**

Sensitivity analysis recalculated the NPV and Net B/C under three scenarios: (1) operating costs increase by 10% while production and the oil price remain constant; (2) the oil price decreases by 10% while operating costs remain constant; and (3) production and the oil price both decrease by 10%. These scenarios reflect the cost and price risks reported for small-scale citronella oil businesses **[12]**.

## 3. Results and Discussion

**Characteristics of the Respondents**

Table 1 summarises the characteristics of the 41 respondents. The average farmer was 50 years old, had nine years of formal education, equivalent to completion of junior secondary school, had 20.40 years of experience in citronella farming and supported three family dependants.

**Table 1. Average characteristics of citronella farmers in Penosan Village, 2025**

| No. | Characteristic | Unit | Average |
|---|---|---|---|
| 1 | Age | Years | 50 |
| 2 | Formal education | Years | 9 |
| 3 | Farming experience | Years | 20.40 |
| 4 | Family dependants | Persons | 3 |

*Source: Primary data, 2025.*

The respondents are within the working-age range, and their long experience indicates that citronella cultivation and distillation are established practices in the village. A household with three dependants requires a steady cash income, which favours a crop that can be harvested and distilled repeatedly during the year. A study of pomelo farmers found that age, education and experience did not affect farm income, whereas production cost did [16]. Studies in Aceh have used farmer characteristics to explain farmers' perceptions of new technologies, including rice transplanters [17] and hydroponic cultivation [18]. In the present study, farmer characteristics describe the producer population and were not tested as determinants of returns.

**Land, Costs and Revenue**

Most respondents cultivated their own land. The cultivated area per farmer reached up to 5.40 ha, and the average area owned was 1 ha. Table 2 presents the cost and revenue components used in the 25-year cash flow for 1 ha.

**Table 2. Cost and revenue components of citronella oil distillation farming per hectare over 25 years**

| Component | Value | Timing |
|---|---|---|
| Initial investment (land-related expenses and barbed wire fencing) | IDR 16,500,000 | Year 0 |
| Seedlings (10,000 seedlings × IDR 500; spacing 1 m × 1 m) | IDR 5,000,000 | Year 0 |
| Land preparation and planting labour | IDR 1,600,000 | Year 0 |
| Production facilities and equipment (including chainsaw IDR 3,000,000) | IDR 6,310,000 | 25 years |
| Labour for harvesting, leaf transport and firewood collection | IDR 226,400,000 | 25 years |
| Projected citronella oil production | 2,444 kg | 25 years |
| Selling price of citronella oil | IDR 290,000/kg | Constant |
| Gross value of production (production × price) | IDR 708,760,000 | 25 years |

*Source: Primary data, 2025. The gross value of production is calculated from projected production and price.*

Citronella generates income from the first year after planting, so the investment period is short. About 90% of the planted seedlings were reported to survive, and farmers did not prepare replacement seedlings. Labour for harvesting, transporting leaves and collecting firewood is the largest cost item, while no fertiliser or maintenance costs were reported. The projected output of 2,444 kg over 25 years corresponds to an average of about 98 kg of oil per hectare per year. This value is lower than the average of 164.55 kg per year reported for Gayo Lues farmers [8] and the 174 kg per year reported in Kutapanjang [10], although those studies measured output per farm rather than per hectare. The price of IDR 290,000 per kilogram used here is 81% higher than the IDR 160,000 per kilogram reported in Kutapanjang in 2023 [10], which shows that the citronella oil price can move by far more than 10% within a few years.

**Technical Conditions of the Research Area**

Table 3 compares the agro-climatic conditions of the research area with reference conditions for citronella reported in published studies.

**Table 3. Technical conditions of the research area compared with reference conditions for citronella**

| No. | Technical aspect | Research area | Reference condition |
|---|---|---|---|
| 1 | Soil pH | 4.72–5.78 | 4.49–7.3 [5] |
| 2 | Temperature | 11–21 °C | 18–27 °C [5] |
| 3 | Rainfall | 232.12 mm/month | 2,000–3,000 mm/year [19] |
| 4 | Altitude | 500–2,000 m asl | 200–1,400 m asl [5] |
| 5 | Relative humidity | 70–88% | 70–86% [5] |

*Source: BPS Gayo Lues Regency (2025) for the research area. Reference conditions for pH, temperature and humidity are those of Gayo Lues citronella land described as relatively suitable [5]; the rainfall range is the range regarded as very suitable [19].*

Most conditions in the research area fall within or close to the reference conditions. The soil pH of 4.72–5.78 lies within the range of Gayo Lues land regarded as relatively suitable for citronella, although the lower end is acidic, and the relative humidity of 70–88% is close to the reference range [5]. The average monthly rainfall of 232.12 mm corresponds to about 2,785 mm per year, within the 2,000–3,000 mm range regarded as very suitable [19]. Two conditions deviate from the reference: the temperature of 11–21 °C is partly below 18 °C, and the upper altitude of 2,000 m exceeds the 200–1,400 m elevation criterion [5]. A company site with soil pH 3–6, temperatures of 20–30 °C and about 3,500 mm of annual rainfall was also considered suitable [11], which shows that citronella tolerates acidic soils and a wide rainfall range. Altitude affects the product: citronella from a highland site contained more essential oil than that from a lowland site, while the lowland oil had better quality [19]. Citronella cultivation in Penosan Village is technically feasible for most of the area, and plots above 1,400 m and on steep slopes require soil conservation and attention to oil quality [7].

**Financial Feasibility**

Table 4 summarises the investment criteria for 1 ha of citronella oil distillation farming at an 18% discount rate.

**Table 4. Investment criteria of citronella oil distillation farming per hectare (discount rate 18%)**

| Criterion | Value | Feasibility threshold | Decision |
|---|---|---|---|
| Net Present Value (NPV) | IDR 67,090,086.33 | > 0 | Feasible |
| Net Benefit-Cost Ratio (Net B/C) | 3.28 | > 1 | Feasible |
| Internal Rate of Return (IRR) | ≈ 59% | > 18% | Feasible |
| Cumulative break-even point (BEP) | 1 year 9 months | < 25 years | Feasible |

*Source: Primary data, 2025 (processed).*

The positive NPV of IDR 67,090,086.33 means that the discounted benefits over 25 years exceed the discounted costs, including the initial investment. The Net B/C of 3.28 indicates that each rupiah of discounted net cost is matched by IDR 3.28 of discounted net benefit. The NPV turns negative at a discount rate of 59%, so the IRR is approximately 59%. This value exceeds the 18% discount rate and the maximum bank lending rate of 30% available to the farmers, which indicates that returns exceed the cost of bank credit. The cumulative BEP of 1 year and 9 months shows that the initial outlay is recovered early in the 25-year life.

These results are higher than those of an earlier study in Gayo Lues that used the same 18% rate and found an NPV of IDR 1,918,400, a Net B/C of 1.11 and an IRR of 21.2% [9], and higher than the Net B/C of 2.57 reported for the regency [8]. The Net B/C and IRR are close to the 2.54 and 57.44% reported for citronella on reforestation land in North Aceh with a 10% benchmark rate [13]. A company-scale business reported a lower IRR of 14.02% and a payback period of about nine years [11], which reflects larger investments in land and distillation equipment than in smallholder farms that use family land and traditional distillers. Short payback periods are also found in other farming businesses with low capital requirements, such as sugarcane ratoon farming with a payback of 1.06 years [20].

Two characteristics of citronella explain its feasibility at discount rates well above the bank lending rate. First, the crop can be harvested about one year after planting, whereas perennial crops such as oil palm and cocoa usually start to produce in their third or fourth year. Second, operating costs are limited to land preparation, planting and harvesting, because the farmers reported no fertiliser or maintenance costs. Combined with a relatively high oil price, these features generate positive net benefits early in the project life.

### Sensitivity Analysis

Table 5 presents the NPV and Net B/C under the three sensitivity scenarios.

**Table 5. Sensitivity of the investment criteria to changes in costs, production and price**

| Scenario | NPV (IDR) | Change in NPV | Net B/C |
|---|---|---|---|
| Base condition | 67,090,086 | – | 3.28 |
| 1. Operating costs +10%; production and price constant | 60,097,431 | −10.4% | 2.96 |
| 2. Oil price −10%; operating costs constant | 51,747,422 | −22.9% | 2.76 |
| 3. Production and oil price −10% | 37,936,049 | −43.5% | 2.29 |

*Source: Primary data, 2025 (processed).*

All scenarios keep the NPV positive and the Net B/C above 1, so the business remains feasible. Relative to the base condition, the NPV decreases by 10.4% when operating costs rise by 10%, by 22.9% when the oil price falls by 10%, and by 43.5% when production and price fall together. The output price has a larger effect on feasibility than operating costs. A similar pattern was reported for sugarcane, where all scenarios remained feasible and the combined scenario produced the largest decline [20]. A study of red chilli found that farming remained feasible until production costs rose by 144% or output fell by 59.02% [21]. For citronella oil, price fluctuations and variable oil quality have been identified as the main business risks, and producers can reduce them by managing the share of sales between export and local markets [12].

### Limitations

The results apply to one village and a purposive sample, and the cost and output data rely on farmers' recall. The projection holds the oil price constant for 25 years, whereas the price difference between 2023 and 2025 exceeds the 10% range of the scenarios. The analysis uses a representative 1 ha farm and does not value environmental costs such as firewood use and soil erosion on steep slopes.

## 4. Conclusion

Citronella oil distillation farming in Penosan Village requires an initial investment of IDR 16.5 million per hectare, with harvesting labour as the main recurring cost, and is projected to produce 2,444 kg of oil over 25 years at IDR 290,000 per kilogram. At an 18% discount rate the business is financially feasible, with an NPV of IDR 67,090,086.33, a Net B/C of 3.28, an IRR of about 59% and a cumulative BEP of 1 year and 9 months. Feasibility is maintained when operating costs increase by 10%, when the oil price decreases by 10% and when production and price decrease by 10% together, but the NPV is about twice as sensitive to the price as to operating costs. Farmer groups and the regency government can protect these returns through price agreements with buyers, improvement of oil quality and soil conservation on sloping land.

### Acknowledgement

The authors are grateful to the citronella farmers of Penosan Village, Blang Jerango District, who shared their time and farm records, and to the village officials who facilitated the field survey.

### Authors' contributions and responsibilities

All authors contributed to the design of the study, data collection, financial analysis and preparation of the manuscript, and all authors read and approved the final version.

### Funding

The authors received no specific grant from any funding agency for this research.

**Availability of data and materials**

The interview data and cash-flow calculations supporting the findings are available from the corresponding author upon reasonable request.

**Competing interests**

The authors declare that there is no conflict of interest regarding this study.

**Ethical approval**

The study involved interviews with adult farmers about their farming business. Participation was voluntary, the purpose of the interviews was explained beforehand, and no personal identities are reported in this article.

**Declaration of generative AI use**

During revision, the authors used Claude (Anthropic) to edit the English language, restructure sections and format the references. The authors checked all data, calculations and references and take full responsibility for the content.

**Additional information**

Correspondence and requests for materials should be addressed to Khumaira (khumaira_pertanian@abulyatama.ac.id).

**References**

[1] M. Nurcahyani and S. S. Salqaura, "Analisis kinerja ekspor minyak atsiri Indonesia di pasar internasional," *Jurnal AGRIFO*, vol. 8, no. 1, pp. 51–57, 2023, doi: 10.29103/ag.v8i1.11771.

[2] Y. A. Tampubolon and Yuliawati, "Daya saing, spesialisasi, dan kinerja ekspor minyak atsiri Indonesia di pasar internasional," *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, vol. 11, no. 2, pp. 2865–2875, 2025.

[3] R. Sharma, R. Rao, S. Kumar, S. Mahant, and S. Khatkar, "Therapeutic potential of citronella essential oil: A review," *Current Drug Discovery Technologies*, vol. 16, no. 4, pp. 330–339, 2019, doi: 10.2174/1570163815666180718095041.

[4] H. Kaur, U. Bhardwaj, and R. Kaur, "Cymbopogon nardus essential oil: A comprehensive review on its chemistry and bioactivity," *Journal of Essential Oil Research*, vol. 33, no. 3, pp. 205–220, 2021, doi: 10.1080/10412905.2021.1871976.

[5] A. Karim, Sugianto, M. Rusdi, Manfarizah, Y. D. Fazlina, and Hifnalisa, "Land arrangement for citronella (Cymbopogon nardus) and Arabica coffee in the cultivation area in Gayo Lues District, Aceh Province, Indonesia: A land suitability approach," *Aceh International Journal of Science and Technology*, vol. 9, no. 3, pp. 207–215, 2020, doi: 10.13170/aijst.9.3.18495.

[6] M. R. Zati, D. Rosalina, and R. Maulidan, "Optimalisasi pemasaran digital produk minyak serai UMKM Gayo Lues dalam membangun citra green economy yang kompetitif," *Jurnal Abdi Insani*, vol. 12, no. 8, pp. 3818–3831, 2025, doi: 10.29303/abdiinsani.v12i8.2836.

[7] M. Nasir, A. Karim, H. Basri, and I. Ramli, "Mitigating soil erosion in citronella cultivation: A USLE-based assessment and tiered conservation strategy for the Gayo Highlands, Indonesia," *International Journal of Design & Nature and Ecodynamics*, vol. 21, no. 1, pp. 47–58, 2026, doi: 10.18280/ijdne.210105.

[8] F. Aziz, I. Zainun, and A. Karim, "Analisis skala usaha dan finansial minyak sere wangi (Cymbopogon nardus Rendle. Lin) di Kabupaten Gayo Lues," *Jurnal Agrica*, vol. 14, no. 2, pp. 162–170, 2021, doi: 10.31289/agrica.v14i2.4733.

[9] F. Firdaus, K. Khumaira, and E. Rosdiana, "Analisis finansial usahatani serai wangi di Kabupaten Gayo Lues Provinsi Aceh," in *Prosiding Seminar Nasional Multi Disiplin Ilmu Universitas Abulyatama (SEMDI-UNAYA)*, vol. 4, no. 1, pp. 225–235, 2021.

[10] E. Astuti, S. B. Indra, F. Alham, and T. Mahyuddin, "Analisis kelayakan usaha minyak serai wangi (Cymbopogon nardus L.) di Kecamatan Kutapanjang Kabupaten Gayo Lues," *JEMBA: Jurnal Ekonomi, Manajemen, Bisnis dan Akuntansi*, vol. 2, no. 3, pp. 251–258, 2023.

[11] W. F. Nabila and R. Nurmalina, "Analisis kelayakan usaha minyak serai wangi pada kondisi risiko (Studi kasus PT. Musim Panen Harmonis)," *Forum Agribisnis: Agribusiness Forum*, vol. 9, no. 2, pp. 143–159, 2019, doi: 10.29244/fagb.9.2.143-159.

[12] M. P. Bimantio and A. D. H. Wardoyo, "Sensitivity and feasibility analysis of citronella oil business," *SOCA: Jurnal Sosial Ekonomi Pertanian*, vol. 14, no. 2, pp. 313–324, 2020, doi: 10.24843/SOCA.2020.v14.i02.p11.

[13] S. Suryadi, R. Riani, J. Jamilah, and E. T. Kembaren, "Financial feasibility of citronella in the reforestation area," *SOCA: Jurnal Sosial Ekonomi Pertanian*, vol. 16, no. 2, 2022.

[14] A. W. Ahmad and R. Heriyanto, "Business feasibility analysis of citronella and patchouli essential oil in Sawahlunto City," in *Proceedings of the International Conference on Applied Science and Technology on Social Science (ICAST-SS 2020)*, 2021, pp. 519–522, doi: 10.2991/assehr.k.210424.101.

[15] M. F. Dosa, O. Porajow, and L. R. J. Pangemanan, "Analisis kelayakan usahatani kakao di Desa Kopandakan Dua Kecamatan Lolayan Kabupaten Bolaang Mongondow," *Agri-Sosioekonomi*, vol. 19, no. 2, pp. 793–798, 2023, doi: 10.35791/agrsosek.v19i2.48308.

[16] H. Muzdalifah, Kusnandar, and E. Antriyandarti, "Analisis faktor-faktor yang mempengaruhi pendapatan petani jeruk pamelo di Kabupaten Pati," *Agromix*, vol. 14, no. 1, pp. 90–95, 2023, doi: 10.35891/agx.v14i1.2982.

[17] A. Mardhiah, Khumaira, A. Azis, A. Basri, Bakar, and S. Panikkai, "Farmer perception of utilization of rice transplanter in Aceh Besar," *IOP Conference Series: Earth and Environmental Science*, vol. 484, no. 1, Art. no. 012126, 2020, doi: 10.1088/1755-1315/484/1/012126.

[18] S. Fitri, D. E. Puspita, and Y. A. Ningsih, "Faktor-faktor yang mempengaruhi persepsi petani terhadap budidaya tanaman hidroponik di Aceh Besar dan Banda Aceh," *Jurnal Humaniora: Jurnal Ilmu Sosial, Ekonomi dan Hukum*, vol. 8, no. 1, pp. 21–30, 2024, doi: 10.30601/humaniora.v8i1.5038.

[19] M. Dacosta, S. K. Sudirga, and I. K. Muksin, "Perbandingan kandungan minyak atsiri tanaman sereh wangi (Cymbopogon nardus L. Rendle) yang ditanam di lokasi berbeda," *Simbiosis: Journal of Biological Sciences*, vol. 5, no. 1, pp. 25–31, 2017, doi: 10.24843/JSIMBIOSIS.2017.v05.i01.p06.

[20] D. Y. Fitranto, G. I. Harya, and I. S. Roidah, "Analisis kelayakan usahatani tebu bongkar ratoon (Studi kasus petani tebu di Kecamatan Pagu)," *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, vol. 10, no. 2, pp. 3238–3246, 2024.

[21] M. Amin, N. D. Yanti, and A. Y. Kurniawan, "Analisis sensitivitas kelayakan usahatani cabai besar di Kecamatan Lokpaikat Kabupaten Tapin," *Frontier Agribisnis*, vol. 7, no. 2, pp. 282–290, 2023.