JALF — Journal of Agriculture, Livestock and Fisheries
Food, Land and Living Resources
Volume 1, Number 1 (2026) · November 2026 · Research Center Progresif · jalf@researchcenterprogresif.org

The Effect of Combining Chemical and Liquid Organic Fertilizers with the Addition of Agronika Planting Media on Soybean (*Glycine max* L.) Plant Productivity

Muhammad Naufal Al-Fathin[1*]
[1]*Universitas Muhammadiyah Kotabumi, Indonesia*
*Corresponding author: muhammad.naufal181104@gmail.com
Article History — Received: 13-10-2026 · Accepted: 16-10-2026

ABSTRACT
Soybean production in Indonesia is an important food-security concern, while this study was motivated by the need to evaluate cultivation inputs that combine mineral fertilizer, liquid organic fertilizer (LOF), and an organic growing medium. This experiment assessed the effects of NPK–LOF combinations, Agronika growing medium, and their interaction on the growth and yield of soybean (Glycine max L.) cultivar Migo AL 1-89. The experiment was conducted in a greenhouse and laboratory at Universitas Muhammadiyah Kotabumi, North Lampung, from October 2025 to January 2026. A factorial randomized block design was used, comprising four fertilizer treatments—P0 (no NPK or LOF), P1 (75% NPK + 25% LOF), P2 (50% NPK + 50% LOF), and P3 (25% NPK + 75% LOF)—and two growing-medium treatments, A0 (without Agronika) and A1 (with Agronika), with three replications and 24 experimental units. The reported treatment means showed that Agronika was associated with greater vine length at 55 days after planting, stem diameter, leaf number, pod number, and fresh and dry stover weight. Across fertilizer treatments, P3 had the highest mean vine length, stem diameter, and fresh and dry stover weight, while P2 had the highest mean pod number and fresh and dry pod weight. The thesis summary of variance analysis reported no significant interaction between fertilizer combination and Agronika for the measured variables. However, the source thesis contains inconsistencies in the interpretation of fresh pod weight and in the terminology used for plant height/vine length; these need to be resolved against the original statistical output before publication. The results provide a basis for further testing of combined fertilizer inputs and Agronika medium under clearly specified application rates and growing conditions.

Keywords: soybean; Migo AL 1-89; NPK fertilizer; liquid organic fertilizer; Agronika growing medium

ABSTRAK
Produksi kedelai di Indonesia menjadi salah satu perhatian dalam ketahanan pangan. Penelitian ini dilatarbelakangi kebutuhan untuk mengevaluasi penggunaan pupuk mineral, pupuk organik cair (POC), dan media tanam organik secara terpadu. Penelitian bertujuan mengetahui pengaruh kombinasi pupuk NPK dan POC, media tanam Agronika, serta interaksi keduanya terhadap pertumbuhan dan hasil kedelai (Glycine max L.) varietas Migo AL 1-89. Penelitian dilaksanakan di greenhouse dan laboratorium Universitas Muhammadiyah Kotabumi, Lampung Utara, pada Oktober 2025 hingga Januari 2026. Percobaan menggunakan Rancangan Acak Kelompok faktorial, terdiri atas empat perlakuan pupuk—P0 (tanpa NPK dan POC), P1 (75% NPK + 25% POC), P2 (50% NPK + 50% POC), dan P3 (25% NPK + 75% POC)—serta dua perlakuan media, yaitu A0 (tanpa Agronika) dan A1 (dengan Agronika), dengan tiga ulangan sehingga terdapat 24 satuan percobaan. Rerata perlakuan yang dilaporkan menunjukkan bahwa Agronika berkaitan dengan peningkatan panjang sulur pada 55 hari setelah tanam, diameter batang, jumlah daun, jumlah polong, serta bobot brangkasan basah dan kering. Pada faktor pupuk, P3 menghasilkan rerata tertinggi untuk panjang sulur, diameter batang, dan bobot brangkasan basah maupun kering, sedangkan P2 menghasilkan rerata tertinggi untuk jumlah polong serta bobot polong basah dan kering. Rekapitulasi analisis ragam dalam skripsi melaporkan tidak adanya interaksi nyata antara kombinasi pupuk dan Agronika. Namun, terdapat ketidakkonsistenan dalam penafsiran bobot polong basah dan penggunaan istilah tinggi tanaman/panjang sulur pada skripsi sumber yang perlu diperiksa berdasarkan keluaran statistik asli sebelum publikasi. Hasil ini menjadi dasar untuk pengujian lanjutan dengan dosis aplikasi dan kondisi tumbuh yang dijelaskan secara lebih lengkap.

Kata kunci: kedelai; Migo AL 1-89; pupuk NPK; pupuk organik cair; media tanam Agronika

Open access, CC BY-SA 4.0

1. Introduction

Soybean (Glycine max L.) is a leguminous crop and an important source of dietary protein and vegetable oil. It is used as a raw material for foods such as tempeh, tofu, and soy sauce, and it also contributes to food diversification and animal-feed industries. Its nutritional contribution and broad range of uses make soybean an important crop in food systems (Messina 2022; Cinta et al. 2022). The thesis that forms the basis of this manuscript describes domestic soybean production as insufficient to meet consumption demand and identifies import dependence as a continuing concern (Alexander et al. 2022). The source thesis also cites national statistics on soybean imports, although its cited statistical page and the year range reported in the text do not fully match. Therefore, the precise import figure is not repeated here until the source data have been verified.

Maintaining crop productivity depends on several interacting factors, including soil condition, nutrient availability, water, plant material, and crop management. The source thesis identifies excessive or imbalanced use of chemical fertilizer as one possible contributor to soil degradation, with potential effects on soil structure and biological activity. It argues that fertilizer practices should support not only short-term crop growth but also the longer-term condition of the production environment. These points provide the rationale for evaluating combinations of mineral fertilizer and organic inputs rather than treating fertilizer sources as mutually exclusive alternatives.

Organic fertilizers can contribute organic matter and nutrients to crop-production systems. The thesis cites Ratriyanto et al. (2019) in discussing the role of organic materials in nutrient management and cites Ilmiasari et al. (2023) regarding the potential contribution of organic inputs to soil properties and crop productivity. The amount and availability of nutrients in an organic fertilizer may differ from those in a mineral fertilizer; consequently, the agronomic response to a combination depends on the materials, their rates, and the crop and growing conditions. For this reason, treatment levels and application procedures need to be clearly reported when a fertilizer combination is evaluated.

Liquid organic fertilizer (LOF; in Indonesian, pupuk organik cair or POC) is one possible organic input. The thesis describes LOF as a source of macro- and micronutrients and bioactive compounds, and cites Cinta et al. (2022) for research on N, P, K and LOF in soybean. It also cites Puspadewi et al. (2016), a study on combinations of LOF concentration and N, P, and K fertilizer in sweet corn. These references motivated the present study's comparison of four fertilizer treatments, including a control and three relative combinations of NPK fertilizer and LOF. Because the thesis expresses the treatments as percentages rather than absolute application quantities, the percentages are retained in this manuscript and are not converted into unreported mass or volume rates.

Growing medium is another component of the crop environment. Agronika is described in the thesis as a growing medium developed at the Faculty of Agriculture and Animal Husbandry of Universitas Muhammadiyah Kotabumi and made from organic materials, including rice-husk charcoal, coconut shell charcoal, and cattle manure. The thesis cites Dewantara et al. (2024), who evaluated Agronika for sweet-corn growth and production, and Ilmiasari et al. (2023), who examined interactions between Agronika and NPK fertilizer in sweet corn. These studies are relevant background, but results in sweet corn cannot by themselves establish the response of soybean; the present experiment therefore evaluated Agronika directly in soybean.

The thesis describes Agronika as a mixture of coconut-shell charcoal, cattle manure, and rice husk at a 1:2:2 ratio, respectively. In the experiment, the growing medium was either soil alone or soil mixed with Agronika at a 2:1 ratio by volume. These material ratios are important to interpreting the treatment because they define the medium used in the experiment. The laboratory table reproduced in the thesis reports several properties of the Agronika material, including organic carbon of 15.38%, a C/N ratio of 11.48, moisture content of 57.27%, pH 7.75, and total N, P2O5, and K2O values of 1.34%, 0.10%, and 2.71%, respectively. The table should be checked against the original laboratory certificate before submission, particularly because its reported moisture content and nutrient-standard columns require contextual interpretation.

Combining mineral fertilizer, LOF, and Agronika may offer a way to examine whether crop growth and yield respond to nutrient-source combinations and to an organic growing medium. However, the response may vary among vegetative and reproductive traits, and a high mean for one trait does not necessarily establish an overall optimum for all outcomes. The experiment was therefore designed to assess the main effects of fertilizer treatment and Agronika as well as their interaction across a set of vegetative and yield-related measurements.

The objectives were to determine (1) the effect of NPK–LOF combination on soybean growth and production, (2) the effect of Agronika growing medium on these outcomes, and (3) whether an interaction occurred between fertilizer combination and Agronika. The study focused on soybean cultivar Migo AL 1-89 and used a factorial randomized block design with four fertilizer treatments, two medium treatments, and three replications. The present manuscript reports the methods and treatment means available in the thesis while flagging statistical and terminology discrepancies that require confirmation from the original records.

Open access, CC BY-SA 4.0

2. Materials and Methods

2.1. Study site and period

The experiment was conducted from October 2025 to January 2026 in the greenhouse and laboratory of Universitas Muhammadiyah Kotabumi, Jl. Hasan Kepala Ratu 1052, Sindangsari, Kotabumi, North Lampung, Indonesia. The thesis does not explicitly classify the site's agro-ecological zone. That information should be supplied from a reliable site description before submission, rather than inferred from the address.

2.2. Plant material, fertilizers, and growing medium

The plant material was soybean cultivar Migo AL 1-89. The thesis lists NPK Mutiara fertilizer, Manutta Gold Ultragrow liquid organic fertilizer, Agronika growing medium, and polybags among the materials. The source or supplier of the seed lot is not identified in the methods section available in the thesis and should be added from the research records. The thesis does not report the absolute quantity or concentration applied for each fertilizer treatment; only the relative percentage combinations are stated. These percentages are therefore reproduced as recorded.

Two growing-medium treatments were used. A0 consisted of soil alone in a 5-kg polybag. A1 consisted of soil and Agronika mixed at a 2:1 ratio (two parts soil to one part Agronika). Agronika itself was prepared by mixing coconut-shell charcoal, cattle manure, and rice husk at a ratio of 1:2:2, respectively. The materials were mixed before being placed in the experimental polybags. The thesis describes the other equipment as a hoe, measuring tape, weighing scale, bucket, hand sprayer, and writing materials.

2.3. Experimental design and treatments

The experiment used a factorial randomized block design with two factors. The first factor was the NPK–LOF combination (P), with four levels: P0, no NPK and no LOF; P1, 75% NPK and 25% LOF; P2, 50% NPK and 50% LOF; and P3, 25% NPK and 75% LOF. The second factor was Agronika medium (A), with A0 representing no Agronika and A1 representing Agronika. Each of the eight treatment combinations was replicated three times, giving 24 experimental units.

Factor	Code	Treatment as reported
NPK–LOF combination	P0	Control: no NPK or LOF
NPK–LOF combination	P1	75% NPK + 25% LOF
NPK–LOF combination	P2	50% NPK + 50% LOF
NPK–LOF combination	P3	25% NPK + 75% LOF
Growing medium	A0	Soil without Agronika
Growing medium	A1	Soil + Agronika (2:1 by volume)

The percentages above follow the treatment definitions in the methods section of the thesis. The original thesis contains a contradictory sentence in the discussion that describes P3 using a different fertilizer proportion; the treatment definition in the methods is used here, but the source record should be checked before the manuscript is finalized.

2.4. Crop establishment and management

Before sowing, the growing media were prepared and placed in 5-kg polybags. Sowing holes were made in each polybag and two to three soybean seeds were placed in each hole to reduce the chance of an empty planting position. The reported planting spacing was 25 × 25 cm. The holes were then covered lightly with soil. The thesis describes daily watering to approximately field capacity, with watering adjusted to temperature, light intensity, and plant needs. Replanting was carried out when seed did not emerge, using spare seeds from the initial sowing. Where more than one plant grew in a hole, thinning was conducted so that one plant was retained.

Weeds were removed by hand or with a small hoe. The thesis indicates that the first weeding was conducted approximately 20–30 days after planting and subsequent weeding after flowering began, depending on weed growth. Pest and disease management was described as routine and condition-based, with an emphasis on physical, mechanical, or plant-based approaches. However, the thesis does not provide a dated log of pest occurrence, pest severity, or control actions. A statement in the thesis abstract attributes differences in reproductive performance partly to possible Leptocorisa oratorius infestation, but the methods and results do not provide quantitative pest observations; this explanation is therefore not treated as a demonstrated causal result in this manuscript.

The thesis states that NPK and LOF were applied at 15, 35, and 55 days after planting (DAP). It does not provide the actual quantity or dilution used for each application in the methods section, so these details need to be recovered from the field notebook, product label, or original treatment sheet. The thesis describes cattle manure as part of the Agronika preparation; no additional separate manure treatment is described.

Open access, CC BY-SA 4.0

2.5. Measurements

The source thesis lists eight response variables. Plant size was assessed at 15, 35, and 55 DAP. The variable is called “plant height” in the methods and abstract, but the results tables call it “vine length” (panjang sulur). The measurement procedure is described as measuring from the stem base to the highest shoot tip. Because soybean is not normally described as a vining crop in the source text, the exact variable name should be confirmed from the field sheets; this draft uses “vine length” when reporting the results tables and flags the terminology for confirmation.

Stem diameter was measured at the middle portion of the stem using calipers at 15, 35, and 55 DAP, and the thesis states the unit as millimetres in the methods but centimetres in the results table. Leaf number included leaves that were fully expanded, green, and fresh and was recorded at the same observation ages. Pod number was counted for each soybean plant. Fresh stover weight was recorded by weighing the harvested plant material in a fresh state. Dry stover weight was determined after the plant material had been oven-dried. Fresh pod weight was recorded after harvest, and dry pod weight was recorded after oven-drying. The thesis does not consistently specify the drying temperature and duration or clearly state the experimental unit basis for all weights; these should be confirmed from laboratory records.

2.6. Statistical analysis

The thesis reports analysis of variance (ANOVA) for the factorial experiment and a least significant difference test (BNT) at the 5% level when a significant difference was found. The summary table uses the symbols “*”, “**”, and “tn” to represent levels of significance and non-significance, but the legend in the thesis should be checked to confirm the exact probability thresholds associated with one and two asterisks. The summary table and some accompanying prose do not agree for fresh pod weight. The data are presented descriptively below, and inferential statements for this variable should not be considered final until the original ANOVA output and post-hoc comparisons are reconciled.

2.7. Ethics and permits

This was a plant-based greenhouse experiment; no animals were used. The thesis does not provide permit numbers or a statement about access permits. Because the work is described as a greenhouse experiment using cultivated soybean and prepared growing media, the authors should confirm whether any institutional or other permit was required and report the applicable information. No permit number is invented in this draft.

3. Results

3.1. Summary of the reported analysis of variance

The thesis's summary table reports significant fertilizer-treatment effects for vine length, stem diameter, leaf number, pod number, fresh stover weight, dry stover weight, and fresh pod weight, while the effect on dry pod weight is marked non-significant. The Agronika factor is reported as significant or highly significant for vine length, stem diameter, leaf number, pod number, and fresh and dry stover weight; its effects on fresh and dry pod weight are marked non-significant in that summary. The fertilizer × Agronika interaction is marked non-significant for all eight variables. These classifications are transcribed from the thesis summary and should be checked against the full statistical output because the narrative discussion contains conflicting statements, especially for fresh pod weight.

Response variable	Fertilizer (P)	Agronika (A)	P × A
Vine length at 55 DAP	**	**	tn
Stem diameter at 55 DAP	**	**	tn
Leaf number at 55 DAP	**	**	tn
Pod number	*	**	tn
Fresh stover weight	**	**	tn
Dry stover weight	*	**	tn
Fresh pod weight	*	tn	tn
Dry pod weight	tn	tn	tn

Note: * and ** are copied from the source summary table; the exact thresholds should be verified from its statistical legend. “tn” means not significant as used in the thesis.

3.2. Agronika growing-medium treatment means

At 55 DAP, plants in the Agronika treatment (A1) had a higher reported mean vine length than plants grown without Agronika (A0), at 129.85 and 111.86 cm, respectively. Mean stem diameter was 0.64 cm in A1 and 0.54 cm in A0. Mean leaf number was 65.50 in A1 and 43.17 in A0. The thesis's BNT grouping letters distinguish A1 from A0 for these variables.

Open access, CC BY-SA 4.0

The same general pattern was reported for pod number and stover biomass. Plants in A1 had a mean of 38.25 pods, compared with 19.67 in A0. Fresh stover weight averaged 241.67 g in A1 and 120.83 g in A0, while dry stover weight averaged 187.08 and 99.58 g, respectively. These differences were marked as significant in the Agronika comparison table.

The mean fresh pod weight was 85.00 g in A1 and 43.33 g in A0, and mean dry pod weight was 66.25 and 35.00 g, respectively. However, the source table marks the Agronika effect as non-significant for both pod-weight variables, and the accompanying narrative also describes these effects as non-significant. Accordingly, these mean differences are presented descriptively and are not interpreted as statistically established effects.

Variable	A0: without Agronika	A1: with Agronika	BNT 5% (as reported)
Vine length at 55 DAP (cm)	111.86 a	129.85 b	12.97
Stem diameter at 55 DAP (cm)	0.54 a	0.64 b	0.05
Leaf number at 55 DAP	43.17 a	65.50 b	11.62
Pod number	19.67 a	38.25 b	11.19
Fresh stover weight (g)	120.83 a	241.67 b	79.96
Dry stover weight (g)	99.58 a	187.08 b	72.24
Fresh pod weight (g)	43.33 a	85.00 a	—
Dry pod weight (g)	35.00 a	66.25 a	—

Values and letter groupings are transcribed from the thesis table. Shared letters indicate no difference according to the table's grouping convention; the table formatting and units should be checked against the original.

3.3. Fertilizer-treatment means

For vine length at 55 DAP, mean values increased from 100.13 cm in P0 and 102.78 cm in P1 to 119.02 cm in P2 and 129.48 cm in P3. The table assigns P3 to the highest grouping, P2 to an intermediate grouping, and P0 and P1 to a lower grouping. For stem diameter, P3 had the highest mean (0.67 cm), whereas P0, P1, and P2 had means of 0.55, 0.58, and 0.57 cm, respectively.

Mean leaf number was 36.33 in P0, 63.83 in P1, 60.00 in P2, and 57.17 in P3. The reported grouping separates P0 from the three fertilized treatments, while P1, P2, and P3 share a grouping letter. Pod number averaged 18.33 in P0, 31.33 in P1, 33.33 in P2, and 32.83 in P3. The table groups P0 separately from the other three treatments.

Fresh stover weight was highest in P3 (265.00 g), followed by P2 (184.17 g), P1 (160.00 g), and P0 (115.83 g). Dry stover weight was also highest in P3 (201.67 g), followed by P2 (152.50 g), P1 (114.17 g), and P0 (105.00 g). The source table shows overlapping grouping letters for some of these means, so pairwise comparisons should be interpreted according to the original statistical procedure rather than ranked by means alone.

Mean fresh pod weight was highest in P2 (86.67 g), followed by P3 (63.33 g), P1 (55.83 g), and P0 (50.83 g). Mean dry pod weight was reported as 40.83 g in P0, 46.67 g in P1, 70.00 g in P2, and 45.00 g in P3. The thesis summary marks the fertilizer effect on fresh pod weight as significant but marks the effect on dry pod weight as non-significant. Yet the BNT value and grouping letters printed in the table do not straightforwardly support the same interpretation. The descriptive means are retained here; final significance claims require a check of the raw data, ANOVA, and post-hoc output.

Variable	P0	P1	P2	P3	BNT 5% (as reported)
Vine length at 55 DAP (cm)	100.13 a	102.78 a	119.02 b	129.48 c	9.17
Stem diameter at 55 DAP (cm)	0.55 a	0.58 a	0.57 a	0.67 b	0.03
Leaf number at 55 DAP	36.33 a	63.83 b	60.00 b	57.17 b	8.22
Pod number	18.33 a	31.33 b	33.33 b	32.83 b	7.91
Fresh stover weight (g)	115.83 a	160.00 ab	184.17 b	265.00 c	54.42
Dry stover weight (g)	105.00 a	114.17 a	152.50 ab	201.67 b	51.08
Fresh pod weight (g)	50.83 a	55.83 ab	86.67 b	63.33 ab	45.56
Dry pod weight (g)	40.83 a	46.67 a	70.00 a	45.00 a	—

3.4. Interaction between fertilizer and Agronika

The thesis summary reports no significant fertilizer × Agronika interaction for any of the eight response variables. On that basis, the reported data do not establish that the response to a fertilizer combination depended on whether Agronika was present. The thesis abstract identifies P3A1 as having the best vegetative growth, whereas the conclusion identifies P2A1 as the best overall treatment. These statements may refer to different outcomes, but the source does not define a single composite criterion for “best”; therefore, this manuscript does not treat either combination as an overall optimum.

Open access, CC BY-SA 4.0

4. Discussion

The treatment means suggest that the Agronika medium was associated with stronger vegetative growth and greater stover biomass under the conditions of this experiment. The differences in vine length, stem diameter, leaf number, and stover weights were consistent in direction: the reported means for A1 exceeded those for A0. This pattern is compatible with the study's rationale that a medium containing organic components may alter the environment in which roots develop and nutrients are available. Nevertheless, the present experiment did not report measurements of root growth, water retention, soil physical properties after mixing, or nutrient uptake. These mechanisms therefore remain possible explanations rather than effects directly demonstrated by the experiment.

The composition of Agronika is relevant to interpretation. According to the thesis, the medium was made from coconut-shell charcoal, cattle manure, and rice husk at a ratio of 1:2:2, and the treatment medium was mixed with soil at 1:2 (Agronika:soil). The thesis also includes a laboratory analysis with organic carbon, C/N ratio, moisture, pH, and macronutrient values. Such characterization can help readers understand the material used, but the original laboratory report and units should be checked. The source table's moisture value is 57.27%, and its total macronutrient values are shown separately as N, P2O5, and K2O; the sum is reported as 4.15%. Those details should not be reinterpreted without checking the certificate and analytical basis.

Among fertilizer combinations, P3 had the highest mean vine length and stem diameter and the highest fresh and dry stover weights. P1, P2, and P3 all had higher mean leaf and pod numbers than P0 in the reported tables. This pattern indicates that the fertilized treatments were associated with higher values for several measured traits than the control. However, the percentage combinations alone do not identify how much NPK or LOF was applied per plant. The absence of absolute application rates and LOF dilution makes it difficult for readers to reproduce the experiment or compare its treatments with other studies. Before publication, the authors should recover the exact amounts applied at 15, 35, and 55 DAP and clarify whether the percentage refers to product volume, recommended dose, nutrient contribution, or another basis.

P2 had the highest mean fresh pod weight (86.67 g) and dry pod weight (70.00 g) among the four fertilizer treatments, while P3 had the highest vegetative means and stover biomass. These different rankings reinforce the need to distinguish growth and yield components rather than identify a treatment as universally best. In particular, a higher vegetative biomass does not automatically imply a higher harvested pod yield. The source thesis abstract suggests that pest attack may have affected reproductive performance, but it does not provide measured pest incidence, severity, or treatment-specific observations. Therefore, pest damage cannot be used as a causal explanation for the observed differences without supporting records.

Statistical interpretation is a major point requiring verification. The thesis summary table marks the fertilizer effect on fresh pod weight with an asterisk, while the narrative in the results states that the fertilizer combination did not significantly affect fresh pod weight. The medium factor is marked non-significant for fresh pod weight, consistent with the prose, but the reported means differ numerically. The table of means also gives a BNT value of 45.56 and assigns letter groupings that need to be reconciled with the significance summary. For dry pod weight, the fertilizer effect is marked non-significant even though P2 has a numerically higher mean than the other treatments. These differences may arise from a transcription or calculation error, a table-formatting issue, or a mismatch between outputs. None should be resolved by choosing the interpretation that appears most plausible; the raw observations and statistical output must determine the final report.

The no-interaction result means that the analysis as summarized in the thesis did not detect a statistically significant combined effect of fertilizer treatment and Agronika for the measured variables. A non-significant interaction should not be interpreted as proof that the factors never interact; it means the experiment did not provide sufficient statistical evidence for an interaction under its design and variability. Because there were three replications, the precision of interaction estimates may also be limited. The manuscript should report the ANOVA table, degrees of freedom, test statistics, and exact probability values if these are available, rather than relying only on asterisk codes.

The study used a randomized block design because the thesis states that the experimental area was not homogeneous and that blocking was intended to reduce error. This design is suitable for accounting for a known source of spatial variation when experimental units can be grouped into blocks. The thesis reports three replications and 24 experimental units, consistent with four fertilizer levels crossed with two medium levels. For transparency, the final version should explain what constituted a block, how treatments were randomized within blocks, how many plants were measured per experimental unit, and whether reported weights were recorded per plant, per polybag, or per plot. These details affect the interpretation of the means and the reproducibility of the study.

The measurement terminology also needs attention. The thesis methods call the variable “plant height” and describe measurement from the stem base to the highest shoot tip, whereas the results tables call it “vine length.” These terms are not interchangeable in all contexts. The final article should use the term recorded in the actual data sheets and

Open access, CC BY-SA 4.0

define it precisely. The same applies to stem diameter: the methods mention millimetres, but results are expressed in centimetres. A simple unit conversion may be possible, but it should be made only after checking the original recorded values, so that values are not inadvertently mislabelled.

Other reporting details are necessary for an article intended for independent assessment. The source describes the research period and institutional location, but does not identify the agro-ecological zone, seed supplier, exact fertilizer doses, LOF dilution, or detailed drying conditions. The template specifically requests cultivar and material source, season, and agro-ecological zone. Those details should be completed from records, not inferred. The manuscript should also give the source of the Agronika laboratory analysis and provide a complete reference entry for any cited data source. The thesis cites an import statistic in the introduction, but the referenced BPS page describes a period ending in 2023 while the thesis text refers to an import figure for 2025; that statistic should be verified or removed.

The present findings should be interpreted within the limits of the experimental setting. The trial was conducted in a greenhouse over a single period, using one soybean cultivar and a specific growing-medium formulation. The thesis does not report a multi-season trial or validation under farmers' field conditions. Therefore, the results should not be generalized directly to all soils, regions, soybean cultivars, or fertilizer products. The experiment offers an initial comparison of treatment combinations in the stated conditions and supports the need for follow-up trials with fully quantified fertilizer rates, clearly defined measurement units, and statistical reporting that can be independently checked.

Further experiments could be designed to compare the same fertilizer combinations at explicit rates, characterize the nutrient content and application dilution of the LOF, and measure medium properties alongside plant responses. Replication across seasons or field conditions would help establish whether the patterns observed in the greenhouse are stable. A follow-up analysis should also report treatment-level means with variability measures and exact inferential statistics. These are recommendations for future work based on limitations in the thesis record; they are not additional results from the present experiment.

The comparison between treatment means also shows why the outcomes should be reported separately. The treatment with the largest vegetative measurements was not the same treatment with the largest reported pod-weight means: P3 had the highest mean vine length and stover weights, whereas P2 had the highest mean fresh and dry pod weights. These descriptive patterns may be useful when formulating follow-up hypotheses, but they do not by themselves establish a recommended fertilizer ratio. The statistical tests, the variability among replications, and the objective of production must all be considered together. In addition, the thesis does not provide enough information to calculate nutrient inputs from the percentages shown. Thus, the relative combinations should not be interpreted as directly transferable fertilizer recommendations for other growers or locations. A complete report should include the product label information, nutrient analysis where available, and the amount applied per experimental unit at each application date. This would allow the reported outcomes to be compared fairly with studies that use different fertilizer products or application schedules. The distinction between fresh and dry weights is equally important because moisture content can affect fresh weight independently of accumulated plant material. In the current dataset, the source table reports fresh and dry stover and pod weights separately; these should remain separate outcomes in the final article, and no conversion between them should be assumed.

5. Conclusion

Under the greenhouse conditions described in the thesis, the Agronika treatment had higher reported means than the no-Agronika treatment for vine length at 55 DAP, stem diameter, leaf number, pod number, and fresh and dry stover weight; the thesis's comparison table marks these differences as significant. The Agronika effect on fresh and dry pod weight was marked non-significant in the source summary. Across fertilizer treatments, P3 had the highest means for vine length, stem diameter, and fresh and dry stover weight, while P2 had the highest means for pod number and fresh and dry pod weight. The thesis reports no significant interaction between fertilizer combination and Agronika for the measured variables. Because the source contains conflicting statements about the significance of fresh pod weight, inconsistent terminology and units, and missing application-rate details, the conclusions concerning pod weight and treatment recommendations should be finalized only after checking the raw data and statistical output. The current evidence does not justify declaring a single overall optimum treatment without defining the target outcome and resolving these discrepancies.

References

Aldillah. 2015. Proyeksi produksi dan konsumsi kedelai Indonesia. Jurnal Ekonomi Kuantitatif Terapan. 8(1):9–23.

Open access, CC BY-SA 4.0

Alexander R, Dahiri, Prasetyo A, Tineke R. 2022. Penyebab ketergantungan Indonesia terhadap impor kedelai. Jurnal Budget Issue Brief Industri & Pembangunan. 2(3):1–2.

Cinta ST, Widiwurjani W, Augustien KN. 2022. Respon pupuk N, P, K dan pupuk organik cair pada pertumbuhan dan hasil tanaman kedelai (Glycine max L.). Jurnal Agrium. 19(3):42.

Dewantara R, Sanjaya R, Nyang VAH, Sari YI. 2024. Efektivitas penggunaan media tanam Agronika pada pertumbuhan dan produksi jagung manis (Zea mays saccharata Sturt). Skripsi. Universitas Muhammadiyah Kotabumi.

Ilmiasari Y, Vania N, Harini A, Sanjaya R, Abadi E, Saputra IE. 2023. Pengaruh interaksi Agronika dan NPK terhadap pertumbuhan dan hasil jagung manis di Lampung Utara. Jurnal Pertanian Agros. 25(4):3665–3671.

Kamilah N, Nurmayulis N, Yenny RF, Sodiq AH. 2024. Pertumbuhan dan hasil kedelai (Glycine max L.) terhadap pemberian pupuk NPK dan pupuk organik cair buah maja (Aegle marmelos L.). Jurnal Agroteknika. 7(4):510–523.

Lagiman, Suryawati A, Widayanto B. 2022. Budidaya tanaman kedelai di lahan pasir pantai. Yogyakarta: Penerbit LPPM UPN Veteran Yogyakarta.

Messina M. 2022. Perspective: soybeans can help address the caloric and protein needs of a growing global population. Frontiers in Nutrition. 9(5):1–9.

Puspadewi S, Sutari W, Kusumiyati K. 2016. Pengaruh konsentrasi pupuk organik cair (POC) dan dosis pupuk N, P, K terhadap pertumbuhan dan hasil tanaman jagung manis (Zea mays L. var. Rugosa Bonaf). Jurnal Kultivasi. 15(3):208–216.

Ratriyanto A, Widyawato SD, Suprayogi WPS, Prastowo S, Widyas N. 2019. Pembuatan kompos merupakan cara penyimpanan bahan organik sebelum digunakan sebagai pupuk. Jurnal SEMAR. 8(1):9–13.

Declarations

Use of AI: This draft was prepared with AI assistance for language translation.

Open access, CC BY-SA 4.0