

REVIEWER'S REPORT

Manuscript No.: **IJAR- 59302**

Title: Interactive Effects of Tillage Practices and Nitrogen Levels on Maize Growth, Yield, Nitrogen Use Efficiency, and Soil Properties.

Recommendation:

Accept as it is

Accept after Minor revision.....

Accept after Major revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **Dr. ANAPANA GOPAL**

Reviewer's Comment for Publication.

1. General Comments

The manuscript evaluates the individual and interactive effects of **zero tillage (ZT) and conventional tillage (CT)** combined with three nitrogen levels—0%, 75% and 100% of the recommended N dose—on maize growth, biomass, grain yield, 100-kernel weight, nitrogen use efficiency (NUE), and soil organic matter (SOM). The experiment was conducted during the 2023–24 maize season at the University of Agriculture Faisalabad, Sub-Campus Depalpur, Okara, Pakistan, using a split-plot design with three replications. 6abdebf10ebfe_IJAR-59302-sample...

The topic is relevant to sustainable maize production and integrated nutrient and tillage management. The factorial treatment structure is appropriate for studying potential interactions between tillage and nitrogen. The manuscript also includes several useful measurements and presents the experimental layout and treatment combinations.

However, **minor methodological, statistical, data-quality, interpretation, and language issues need to be resolved before the manuscript can be considered for publication.** In particular, the reported soil pH and EC values require immediate verification, the NUE calculation is not provided, the soil sampling methodology is insufficient, several conclusions are inconsistent with the statistical results, and some references appear mismatched with the claims being supported.

Overall Recommendation: MINOR REVISION

2. Minor Comments

2.1 Critical concern regarding the reported soil pH

Table 2 reports a soil **pH of 2.12**, together with EC of **7.9 dS m⁻¹**. 6abdebf10ebfe_IJAR-59302-sample...

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A pH of 2.12 is exceptionally acidic and would represent an extreme soil condition that requires substantial explanation. The manuscript does not discuss this unusual value anywhere.

The authors must **verify the original soil-analysis data** and confirm that the reported value is not a typographical or transcription error.

If pH 2.12 is correct, the authors must provide:

- soil classification;
- method used for pH measurement;
- soil:water ratio;
- depth of sampling;
- replicate measurements;
- explanation of the extremely acidic condition;
- implications for maize growth and nutrient availability.

Because this value could substantially influence the interpretation of the entire experiment, it must be resolved before publication.

3. Soil EC Also Requires Verification and Interpretation

The reported EC of **7.9 dS m⁻¹** indicates a highly saline soil condition. 6abdebf10ebfe_IJAR-59302-sample...

The manuscript does not discuss the possible implications of this EC value for maize growth or nitrogen response.

The authors should clarify:

- whether EC was measured in a soil-water extract or saturated paste;
- extraction ratio;
- measurement temperature;
- whether 7.9 dS m⁻¹ is the correct value;
- whether the experimental site is classified as saline/sodic;
- how salinity was considered when interpreting treatment responses.

The combination of **pH 2.12 and EC 7.9 dS m⁻¹** particularly warrants careful verification.

4. Experimental Plot Size Is Missing

The Materials and Methods describe the treatment arrangement and provide an experimental layout, but the manuscript does not adequately report:

- main-plot dimensions;
- subplot dimensions;
- total experimental area;
- harvested area;
- plant-to-plant spacing;
- row spacing;
- number of rows per subplot;
- number of plants per plot;
- border area.

The experimental layout in Figure 1 shows six treatment combinations within the two tillage sections, but the dimensions and exact plot structure are not provided. 6abdebf10ebfe_IJAR-59302-sample...

These details are essential for reproducibility and for understanding how grain yield was calculated.

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5. Nitrogen Source and Application Timing Are Not Reported

The manuscript states that 170 and 227 kg N ha⁻¹ were applied for the 75% and 100% treatments. 6abdebf10ebfe_IJAR-59302-sample...

However, it does not specify:

- nitrogen fertilizer source;
- fertilizer grade;
- application method;
- basal versus split application;
- timing of applications;
- number of applications;
- incorporation method under conventional tillage;
- placement method under zero tillage.

These details are particularly important because nitrogen availability can differ substantially between tillage systems.

6. Recommended Nitrogen Dose Requires Justification

The manuscript identifies **227 kg N ha⁻¹** as the recommended nitrogen dose. 6abdebf10ebfe_IJAR-59302-sample...

The source of this recommendation should be provided.

The authors should specify whether the recommended dose was based on:

- University recommendations;
- Punjab agricultural recommendations;
- soil-test-based recommendation;
- cultivar-specific recommendation;
- local agronomic guidelines.

The basis for selecting 75% and 100% should also be clearly explained.

7. Other Nutrients Are Not Adequately Described

The soil analysis reports phosphorus and potassium values, but the manuscript does not clearly state whether phosphorus, potassium, sulfur, zinc, or other nutrients were applied uniformly to all treatments. 6abdebf10ebfe_IJAR-59302-sample...

If other fertilizers were applied, the authors should provide:

- nutrient source;
- dose;
- timing;
- method of application.

If no other fertilizer was applied, this should be explicitly stated.

8. Crop Establishment and Field Management Are Insufficiently Described

The manuscript states that maize was sown on **23 August 2023** and that other management practices were kept uniform. 6abdebf10ebfe_IJAR-59302-sample...

However, the following information is missing:

- maize hybrid/cultivar;
- seed rate;
- planting density;
- row spacing;
- plant spacing;

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- irrigation schedule;
- rainfall during the experiment;
- weed management;
- herbicide use;
- pest and disease management;
- harvest date;
- crop maturity period.

These factors can influence yield and nitrogen response and should be reported.

9. Zero-Tillage Treatment Needs a More Precise Definition

The manuscript defines zero tillage as no conventional tillage operation before sowing. 6abdebf10ebfe_IJAR-59302-sample...

However, the authors should clarify whether the zero-tillage plots received:

- residue retention;
- residue removal;
- herbicide-based weed control;
- mechanical weed control;
- seed drilling/direct seeding;
- any soil disturbance during planting.

Zero tillage is not simply “absence of ploughing”; the complete management system should be described.

10. Conventional Tillage Operations Are Not Specified

The manuscript states that conventional tillage operations were performed according to the recommended treatment. 6abdebf10ebfe_IJAR-59302-sample...

This is insufficient.

The authors should state:

- number of ploughings;
- implement used;
- depth of tillage;
- number of cultivator/harrow operations;
- interval between operations;
- final seedbed preparation.

Without these details, the comparison between CT and ZT cannot be reproduced.

11. Soil Sampling Methodology Is Inadequate

The manuscript states that soil samples were collected before crop establishment and analyzed for selected properties. 6abdebf10ebfe_IJAR-59302-sample...

However, it does not report:

- sampling depth;
- number of cores;
- number of composite samples;
- sampling locations;
- whether samples were taken separately from each plot;
- sample preparation;
- laboratory methods;
- analytical standards.

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This is particularly important because the manuscript makes conclusions regarding changes in SOM under different treatments.

12. Minor Problem With the Interpretation of Soil Organic Matter

The Methods state that soil samples were taken **before crop establishment**, and the reported soil analysis is presented as the experimental-site characterization. 6abdebf10ebfe_IJAR-59302-sample...

However, the Results later claim that different tillage × nitrogen treatments produced different SOM values, including:

- 0.99–1.24% under ZT;
- 0.91–1.09% under CT. 6abdebf10ebfe_IJAR-59302-sample...

This creates a serious methodological question.

If Table 2 represents only **pre-experiment soil**, it cannot demonstrate treatment-induced changes in SOM.

The authors must clearly explain:

1. when post-treatment soil samples were collected;
2. from what depth;
3. from which plots;
4. how many samples were analyzed;
5. which analytical method was used;
6. whether the SOM values in Table 4 are post-harvest values.

If only pre-experiment soil was measured, then the entire treatment-based SOM analysis must be reconsidered.

13. Soil Organic Matter Is Not a Short-Term Indicator Without Appropriate Baseline Data

The manuscript attributes higher SOM under zero tillage to reduced soil disturbance and greater retention of organic matter. 6abdebf10ebfe_IJAR-59302-sample...

This explanation is plausible, but if the experiment lasted only one growing season, changes in SOM may be difficult to attribute confidently to the treatments without:

- baseline measurements;
- post-harvest measurements;
- adequate replication;
- appropriate analytical methodology.

The authors should avoid implying long-term soil-carbon sequestration from a single-season experiment unless supported by the data.

14. Nitrogen Use Efficiency Is Not Properly Defined

The manuscript reports NUE values ranging from approximately 39.60% to 75.57%. 6abdebf10ebfe_IJAR-59302-sample...

However, the actual NUE equation is not provided. The Methods merely state that NUE was calculated according to “standard calculation procedures.” 6abdebf10ebfe_IJAR-59302-sample...

This is not sufficient.

The authors must provide the exact equation and identify which definition of NUE was used, such as:

- agronomic efficiency;
- partial factor productivity;

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- apparent recovery efficiency;
- physiological efficiency;
- internal efficiency.

The use of **percent (%)** also needs justification because different NUE metrics have different units.

15. NUE Calculation for the Control Treatment Requires Clarification

The control plots received **0 kg N ha⁻¹**, yet NUE values are reported for the control treatments as well. 6abdebf10ebfe_IJAR-59302-sample...

If the NUE equation uses applied N in the denominator, the control treatment cannot be calculated in the same way.

For example, the manuscript reports:

- ZT control: 39.60%;
- CT control: 42.20%. 6abdebf10ebfe_IJAR-59302-sample...

The authors must explain precisely how these control NUE values were calculated.

This is a **minor methodological concern**.

16. Statistical Model Needs Greater Detail

The manuscript states that ANOVA appropriate for a split-plot design was used, with tillage as the main-plot factor and nitrogen as the subplot factor. 6abdebf10ebfe_IJAR-59302-sample...

This is appropriate in principle, but the manuscript should provide:

- complete statistical model;
- error terms;
- degrees of freedom for main-plot and subplot errors;
- F-values;
- exact P-values;
- post-hoc procedure;
- software used.

The manuscript currently provides F-ratios but does not clearly identify the appropriate error structure.

17. The Statistical Reporting Contains an Important Contradiction for Grain Yield

The Results state that grain yield was significantly affected by tillage:

F = 14.57, P = 0.0457. 6abdebf10ebfe_IJAR-59302-sample...

However, the manuscript then reports that mean grain yield averaged across nitrogen levels was:

- ZT = **7540.9 kg ha⁻¹**
- CT = **7541.4 kg ha⁻¹**. 6abdebf10ebfe_IJAR-59302-sample...

These means are essentially identical.

The authors must verify:

- the raw data;
- the ANOVA;
- the correct main-plot error term;
- the reported means;
- the P-value.

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This is particularly important because the Abstract claims that conventional tillage resulted in higher grain yield, whereas the overall means presented in the Results do not support such a statement. 6abdebf10ebfe_IJAR-59302-sample...

18. Incorrect Statement Regarding Grain-Yield Interaction

The manuscript correctly reports that the tillage × nitrogen interaction for grain yield was non-significant (**F = 0.84, P = 0.4549**). 6abdebf10ebfe_IJAR-59302-sample...

However, the Discussion states:

“the interaction results were non-significant...”

and then uses this to conclude that nitrogen is the main driver of yield. 6abdebf10ebfe_IJAR-59302-sample...

The wording should be more cautious. A non-significant interaction indicates that there was insufficient statistical evidence for differential nitrogen responses between tillage treatments; it does **not prove that nitrogen alone determines grain yield**.

19. The Statement “75% N Had Little Yield Penalty” Needs Quantitative Support

The Conclusion states that 75% of recommended N resulted in maximum NUE with “little yield penalty.” 6abdebf10ebfe_IJAR-59302-sample...

However, the data show a substantial difference between 75% and 100% N:

- approximately 9,382–9,495 kg ha⁻¹ at 75% N;
- approximately 10,103–10,250 kg ha⁻¹ at 100% N. 6abdebf10ebfe_IJAR-59302-sample...

The authors should quantify the yield reduction from 100% to 75% N and statistically determine whether the reduction is significant.

The phrase “little yield penalty” should not be used without quantitative justification.

20. The Recommendation of 75% N Under Zero Tillage Is Overstated

The Abstract concludes:

“It is recommended that 75% of the recommended nitrogen dose is used under zero tillage...” 6abdebf10ebfe_IJAR-59302-sample...

However, the highest grain yield occurred at **100% N under zero tillage (10,250.3 kg ha⁻¹)**. 6abdebf10ebfe_IJAR-59302-sample...

The recommendation of 75% N therefore requires an explicit **economic, environmental, or partial-productivity analysis**.

Without a cost-benefit analysis or quantified environmental benefit, the recommendation should be presented as a research finding regarding NUE rather than a definitive agronomic recommendation.

21. The Manuscript Does Not Include an Economic Analysis

The study makes recommendations concerning nitrogen efficiency and sustainable production, but does not analyze:

- fertilizer cost;
- tillage cost;
- fuel consumption;
- labor cost;
- gross return;
- net return;
- benefit-cost ratio.

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Because zero tillage and reduced N are presented as resource-efficient options, an economic analysis would substantially strengthen the practical value of the manuscript.

22. Environmental Sustainability Claims Need More Direct Evidence

The manuscript describes zero tillage as a soil-conserving and sustainable approach. 6abdebf10ebfe_IJAR-59302-sample...

However, the study did not directly measure:

- fuel consumption;
- greenhouse-gas emissions;
- N₂O losses;
- ammonia volatilization;
- nitrate leaching;
- soil erosion;
- water-use efficiency.

Therefore, sustainability claims should be restricted to the measured indicators, especially SOM and NUE.

23. Discussion Contains Several Speculative Mechanistic Explanations

For example, the manuscript attributes higher plant height under CT to better aeration and root proliferation and attributes kernel weight under ZT to improved soil moisture conservation. 6abdebf10ebfe_IJAR-59302-sample... 6abdebf10ebfe_IJAR-59302-sample...

These are plausible mechanisms, but the experiment did not directly measure:

- soil moisture;
- bulk density;
- penetration resistance;
- root biomass;
- root length;
- soil aeration.

These explanations should therefore be clearly presented as **possible mechanisms**, not experimentally demonstrated causes.

24. Soil Physical Properties Are Mentioned but Not Measured

The Introduction emphasizes effects of tillage on:

- soil structure;
- water availability;
- aeration;
- nutrient availability. 6abdebf10ebfe_IJAR-59302-sample...

However, the experiment reports primarily chemical properties and SOM.

If the authors want to explain tillage effects mechanistically, measurements such as:

- bulk density;
- soil moisture;
- penetration resistance;
- aggregate stability;
- infiltration rate

would be valuable.

Alternatively, the Discussion should remain appropriately cautious.

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25. The Literature Review Contains a Potentially Incorrect Citation

The Discussion cites **Yang et al. (2017)** for increased plant height under zero tillage. 6abdebf10ebfe_IJAR-59302-sample...

However, the reference list contains **Yang et al. (2020)**, concerning maize straw mulch/no-tillage and winter wheat, rather than a 2017 Yang et al. study. 6abdebf10ebfe_IJAR-59302-sample...

This citation must be checked and corrected.

26. Liu et al. (2018) Appears Poorly Matched to the Claim

The Discussion cites Liu et al. (2018) regarding differences caused by nitrogen application, cultivar, dose rate and climatic conditions. 6abdebf10ebfe_IJAR-59302-sample...

The reference listed for Liu et al. (2018) concerns **genomic selection in maize**, which does not obviously support the specific agronomic explanation being made. 6abdebf10ebfe_IJAR-59302-sample...

The authors should audit all citations and ensure that each reference directly supports the corresponding statement.

27. Some References in the Discussion Are Used Beyond Their Evidentiary Scope

The authors frequently use literature to explain mechanisms that were not measured in the current experiment.

The Discussion should distinguish:

1. **observed results from this experiment;**
2. **interpretations supported by previous literature;**
3. **hypotheses or possible mechanisms.**

This will improve scientific rigor.

28. Figure and Table Numbering Needs Correction

The manuscript labels the SOM mean-comparison figure as:

"Table 3 Mean comparison of SOM" 6abdebf10ebfe_IJAR-59302-sample...

This appears to be incorrect because Table 3 is already the ANOVA table. The figure should have an appropriate figure number and caption.

Similarly, the manuscript should check the numbering of all tables and figures.

29. Graphical Presentation Needs Improvement

Figures 2–7 provide treatment comparisons, but the graphical presentation should be improved.

The authors should ensure:

- clear axis labels;
- units on every axis;
- error bars are defined;
- error bars correspond to SD, SE or another statistic;
- sample size is stated;
- statistical grouping letters are included where appropriate;
- figure captions are sufficiently informative.

The current figures appear to show error bars, but their meaning is not clearly explained.

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30. Table 4 Needs Statistical Grouping Information

Table 4 provides means $\pm$ values for the six treatment combinations but does not appear to provide statistical grouping letters for pairwise comparisons. 6abdeb10ebfe_IJAR-59302-sample...

If treatment combinations are being compared, appropriate mean-separation results should be presented.

Otherwise, the reader cannot determine which individual combinations differ significantly.

31. The Abstract Should Be Revised

The Abstract contains useful quantitative information but should be revised because of several issues:

- the grain-yield statement concerning conventional tillage needs verification;
- the recommendation of 75% N under ZT is stronger than the evidence currently presented;
- the distinction between significant and non-significant interactions should be clearer;
- the soil-quality conclusion depends on the questionable SOM methodology;
- the phrase “trade-off” requires quantitative support.

The Abstract should report the statistically supported findings rather than emphasizing broad recommendations.

32. The Conclusion Should Be More Conservative

The conclusion currently presents nitrogen as the most important factor and recommends 75% N under zero tillage. 6abdeb10ebfe_IJAR-59302-sample...

A revised conclusion should focus on what the experiment actually demonstrates:

- nitrogen strongly affected maize growth and yield;
- tillage effects varied among traits;
- zero tillage produced higher 100-kernel weight and SOM in the reported dataset;
- 75% N produced the highest reported NUE;
- 100% N produced the highest grain yield;
- multi-season trials are needed before broad recommendations.

33. Language and Grammar Require Extensive Editing

The manuscript contains frequent grammatical and typographical errors.

Examples include:

- “Namounts”;
- “cropdevelopment”;
- “This is will aid”;
- “the current study,as indicators”;
- “data recording”;
- “this kills the claim of advantage”;
- “grave part”;
- “the most important factor in this study.”

Examples of awkward or inappropriate scientific wording are present throughout the manuscript. 6abdeb10ebfe_IJAR-59302-sample... 6abdeb10ebfe_IJAR-59302-sample...

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The manuscript requires comprehensive English-language editing by a proficient scientific editor.

34. Avoid Informal or Strong Wording

The phrase:

“this kills the claim of advantage of any tillage system”

is inappropriate for scientific writing. 6abdebf10ebfe_IJAR-59302-sample...

It should be replaced with something such as:

“This indicates that the overall mean grain yield was similar between the two tillage treatments.”

Scientific interpretation should remain objective and evidence-based.

35. Strengths of the Manuscript

The study has several strengths:

1. The topic is relevant to sustainable maize production.
2. A **2 × 3 factorial treatment structure** is appropriate for the research objective. 6abdebf10ebfe_IJAR-59302-sample...
3. The use of a split-plot design is reasonable because tillage is difficult to impose at subplot scale.
4. Three nitrogen levels allow comparison between no N, reduced N and recommended N.
5. Multiple agronomic parameters were measured.
6. The manuscript attempts to evaluate both productivity and NUE.
7. The experimental layout is presented visually.
8. The study recognizes the importance of tillage × nitrogen interaction.
9. The authors acknowledge the need for multi-season studies in the conclusion. 6abdebf10ebfe_IJAR-59302-sample...

36. Minor Comments

1. Use **N ha⁻¹** consistently throughout the manuscript.
2. Use *Zea mays L.* consistently in italics.
3. Standardize “zero tillage” and “conventional tillage” abbreviations.
4. Define ZT, CT, NUE and SOM at first use.
5. Correct spacing around punctuation and units throughout.
6. Use “soil organic matter” consistently rather than alternating with “organic soil matter.”
7. Correct “100-kernel weight” formatting throughout.
8. Provide the maize cultivar/hybrid name.
9. Specify the fertilizer source.
10. Report exact harvest date.
11. Report the statistical software used.
12. Provide complete ANOVA error terms.
13. Verify all P-values and F-values.
14. Explain whether ± values represent SD or SE.
15. Correct Figure/Table numbering.
16. Improve the resolution and formatting of figures.
17. Ensure all references cited in the text appear in the reference list.

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18. Ensure every reference actually supports the statement for which it is cited.
19. Check DOI accuracy and formatting.
20. Remove unnecessary repetition between Results, Discussion and Conclusion.
21. Add a clear limitations subsection.
22. Consider including an economic analysis if recommending reduced N rates.
23. Consider including baseline and post-harvest soil data if claiming changes in SOM.
24. Provide the raw or replication-level dataset as supplementary material if possible.

37. Final Assessment

The manuscript addresses an important agronomic question and has a potentially useful experimental framework. The factorial comparison of tillage and nitrogen, together with measurements of yield, kernel weight, NUE and soil organic matter, could provide useful information for maize management.

However, **the current manuscript is not yet sufficiently rigorous for publication.**

The most serious concerns are:

- questionable soil pH and EC values;
- inadequate soil-sampling and SOM methodology;
- missing NUE formula and questionable NUE calculation for zero-N controls;
- incomplete description of nitrogen application and field management;
- insufficient description of plot size and experimental units;
- need to verify the split-plot statistical analysis;
- apparent inconsistency between grain-yield significance and almost identical overall tillage means;
- overstatement of the recommendation for 75% N under zero tillage;
- citation/reference inconsistencies;
- incorrect table/figure numbering;
- substantial language and presentation problems.

The authors should undertake a **comprehensive methodological and statistical revision**, verify all raw data and calculations, and substantially moderate conclusions that are not directly supported by the experimental evidence.

Final Recommendation: MINOR REVISION