EPA Paper Template and Author Guideline

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Abstract

The abstract is a single, unstructured paragraph (150–250 words) that can be read on its own. It should briefly state the problem and why it matters (context and motivation), summarize what you did (approach, method, system, or study design), and indicate the evaluation setting (e.g., data source, crop/region/season, sensors, experimental setup, or benchmark). Include the most important outcomes—preferably with concrete quantitative results (e.g., accuracy, yield gain, cost reduction, runtime, or other relevant metrics)—so readers can understand the value of the work without reading the full paper. End by clearly stating the main contribution and the implications for research and/or practice. Avoid citations, equations, lengthy background, detailed implementation steps, and unexplained acronyms.

Keywords: Keyword 1, Keyword 2, Keyword 3, Keyword 4, Keyword 5

1 Introduction

The introduction should convince readers that the problem is important, that a clear gap exists in current knowledge or practice, and that your paper offers a credible, valuable contribution. Write for an informed but broad audience across the full spectrum of agriculture and food systems. A strong introduction is typically 3–6 paragraphs and moves from broad motivation to a specific research objective, then to contributions and a roadmap.

Begin with the context and stakes. In a few sentences, describe the real-world setting and why it matters. Good openings anchor the work in a concrete challenge and its consequences: improving yield stability in rainfed crops, detecting disease in orchards before it spreads, accelerating phenotyping for breeding programs, reducing fertilizer losses to protect water quality, optimizing irrigation under scarcity, improving feed conversion in aquaculture, lowering greenhouse gas emissions, preventing post-harvest spoilage, or enabling credible traceability from farm to fork. State who is affected (growers, breeders, agronomists, aquaculture managers, processors, regulators, consumers) and what decisions or outcomes are at risk. Avoid overly generic statements (e.g., “agriculture is important”); instead, tie the motivation to a specific decision point and measurable impact.

Next, define the problem precisely. State the task you address and the conditions under which it must work. For example, your task might be yield prediction for a specific crop and region, genotype-to-phenotype prediction under multi-environment trials, segmentation of plant organs for phenotyping, early warning of disease from leaf imagery, weed detection for site-specific spraying, biomass estimation from UAV imagery, drought stress mapping from satellite time series, water quality monitoring for aquaculture ponds, or batch-level traceability inference in a supply chain. Clarify the inputs and outputs, temporal requirements (real-time vs. seasonal), operational constraints (cost, connectivity, compute), and what success looks like (accuracy, timeliness, robustness, interpretability, or decision utility). Briefly explain what makes the problem hard: spatial and seasonal variability, confounding weather and management effects, noisy sensors, limited labels, domain shift between farms or species, class imbalance in rare events (e.g., disease outbreaks), or the need for trusted decisions in high-stakes contexts.

Then establish the gap in prior work. Cite relevant studies to show what exists and what is missing—the goal is not a full survey, but a clear justification for why your work is needed[1]. State limitations precisely and connect each one to the real agricultural decision or operational setting it affects. To make the gap easy to see, present concrete context for example: (i) crop models trained on a single season or region that fail under new weather regimes; (ii) breeding/genetics methods that assume dense phenotypes or high-quality labels that are unrealistic in multi-environment trials or smallholder contexts, and that do not generalize across populations; (iii) remote-sensing pipelines that report accuracy but omit uncertainty, making recommendations risky under different environmental conditions; (iv) phenotyping systems validated in controlled environments that break in the field due to occlusion, lighting changes, canopy complexity, or sensor noise; (v) aquaculture monitoring models that degrade with turbidity, biofouling, changing illumination, or sensor drift; (vi) sustainability assessments that are difficult to audit or reproduce because data and assumptions are opaque; and (vii) traceability methods that struggle with missing, inconsistent, or noisy records across supply-chain actors. When possible, translate the gap into its practical consequence—for example why stakeholders still rely on manual scouting, expensive assays, conservative management, or delayed interventions despite recent progress.

After the gap, state your approach and objective. In one short paragraph, summarize your central idea at a high level—what you do and how it addresses the gap—without implementation details. Include a clear research question, hypothesis, or objective statement so reviewers can evaluate whether the rest of the paper delivers on it. If you introduce a system, explain its intended users and decisions it supports (e.g., variable-rate nitrogen recommendations, genotype selection, pond aeration scheduling, quality grading, sustainability reporting, or supply-chain verification). If you propose a method, state what it improves (e.g., generalization across regions, interpretability for agronomic decision-making, uncertainty-aware predictions, robustness to sensor noise, or scalable deployment).

Conclude the introduction with contributions and a brief preview of evidence. Provide a concise list of main contributions. Each contribution should be specific and verifiable, such as: a new dataset or benchmark spanning multiple crops, varieties, or environments; a method for fusing genomics with phenomics and weather; a remote-sensing model validated across satellites/seasons; a field-ready phenotyping pipeline; an aquaculture monitoring study with operational outcomes; an interpretable sustainability model linking management to emissions or nutrient losses; or a traceability approach that detects anomalies and quantifies confidence. Where appropriate, summarize a headline result (with a number) to communicate significance (e.g., fewer false alarms, lower input use, faster phenotyping throughput), but avoid over-claiming and keep the wording aligned with the evidence presented later.

Optionally, include a paper roadmap (1–2 sentences) describing how the remainder is organized. Throughout the introduction, keep the narrative focused, avoid long lists of citations, and ensure that every claim is either supported by a citation, justified by logic, or clearly marked as your contribution. Prefer plain language over jargon, expand acronyms at first use, and maintain consistency between the stated problem, the method, and the evaluation that follows.

2 Materials and Methods

The Materials and Methods section should explain, in sufficient detail, how the study was conducted so that an informed reader can reproduce the work or implement a comparable approach. This section must describe not only the analytical or computational method, but also the biological system, production context, and measurement protocols that generate the evidence. Write in past tense for what you did, define key terms and variables, and report the specific settings that affect outcomes (e.g., species/variety or breed/strain, production environment, time period, and management conditions). Avoid reporting results or interpretation here; reserve those for the Results and Discussion sections.

Start by stating the study context and objective. Specify the agricultural domain and unit of analysis (for example, individual plants, plots, herds, ponds, genotypes, harvested lots, or supply-chain batches) and define the primary outcome(s) you model or measure (such as yield, quality, disease incidence, growth and survival, a genetic trait, environmental impact, or traceability accuracy). Clearly describe the system boundary relevant to your claim (e.g., on-farm management decisions, breeding program selection, post-harvest handling, sustainability assessment, or end-to-end provenance).

Next, describe the data and materials. Identify all data sources, how they were obtained, and the sampling or collection protocol. Report where and when the study took place (location, season/year, facility type, or production system), what biological materials were involved, and how measurements were taken (field observations, lab assays, operational records, or expert annotations). Provide sample sizes and any inclusion or exclusion criteria. If you use external datasets, name the dataset and version/date accessed; if data are restricted, explain constraints and provide enough metadata for others to replicate with comparable data.

Then explain preparation steps that transform raw observations into analysis-ready inputs. Describe cleaning and quality-control rules, how missing values and outliers were handled, and how variables were standardized or normalized. Define how labels or ground truth were created, including any aggregation across time or space. If relevant, explain how you accounted for major sources of variability or confounding that are common (for example, differences across environments, management practices, genetics, or production cycles) and how those factors were measured or controlled.

After that, present the method in reproducible terms. Describe the model, algorithm, protocol, or system you used, including inputs, outputs, assumptions, and key parameters. Include baselines or reference methods used for comparison and justify why they are appropriate for your agricultural context. Provide implementation details that affect reproducibility (software, versions, and any critical settings). If the approach is complex, a brief workflow description can help readers understand the pipeline from data collection to final outputs, but keep it focused on what is necessary to replicate.

Finally, describe the evaluation protocol. For example, any grouping used to prevent information leakage for an AI model (e.g., separation by farm, year, genotype, facility, or batch) and the performance metrics, including their definitions.

As a practical check, a reader should be able to answer the following from this section alone: what system was studied, what was measured and how, what method was applied, how the evaluation was performed, and what steps would be required to reproduce the work under comparable conditions.

2.1 Figures

Use figures to clarify the study design, workflow, and key methodological components (e.g., experimental layout, pipeline overview, system architecture, or measurement setup). Each figure should be referenced in the text and include a caption that is understandable on its own, stating what is shown, what the reader should learn from it, and any essential context (units, scales, abbreviations). Ensure axes, legends, and labels are readable at the final publication size. Avoid decorative graphics; include figures only when they improve understanding or reproducibility.

Figures 1, 2, and 3 illustrate a single-column figure, a full-width two-column figure, and a 2×2 multi-panel layout, respectively.

2.2 Tables

Use tables for precise, compact reporting of materials and methods details that readers may need to reproduce the work, such as dataset summaries, treatment descriptions, variable definitions, model settings, or evaluation configurations. Give each table a clear title/caption and define all abbreviations, units, and symbols.

Figure 1: Single-column example. Use a clear, self-contained caption that explains what the figure shows and why it matters.

Use consistent formatting and align numbers by decimal where appropriate. Each table should be cited in the text and should not duplicate information already conveyed clearly elsewhere. If you are not comfortable writing LaTeX tables by hand, consider using an online LaTeX table generator: these tools let you design the table visually and then export the corresponding LaTeX code.

Table 1: Sample 3×4 table. Replace placeholders with your data and include units where applicable.

Item	**Col 1**	**Col 2**	**Col 3**
Row 1	Value 1	Value 2	Value 3
Row 2	Value 4	Value 5	Value 6
Row 3	Value 7	Value 8	Value 9

Table 1 shows a simple example of how to present compact, structured information with clear headers; ensure that all quantities are reported with appropriate units and consistent formatting.

2.3 Equations

Use equations when they provide an unambiguous definition of a model, objective function, statistical estimator, or mechanistic relationship. Define every symbol at first use in the surrounding text, specify domains/units where relevant, and keep notation consistent throughout the paper. Number only the equations that are referenced later. If equations depend on assumptions (e.g., independence, steady state, linearity), state those assumptions explicitly in the text. Avoid introducing complex notation if a short verbal definition would be clearer for the target audience.

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A simple relationship can be written inline when it does not need to be referenced later (e.g., $y = \beta_0 + \beta_1 x$). If you want the same content displayed on its own line for readability but still do not need to reference it, use an unnumbered display equation as below:

$$y = \beta_0 + \beta_1 x$$

In contrast, numbered display equations should be used when you will refer back to them. Equations (1), (2) and (3) are examples of numbered equations.

$$\hat{y}_i = f(\mathbf{x}_i;\, \theta) \tag{1}$$

$$\mathcal{L}(\theta) = \frac{1}{N} \sum_{i=1}^{N} \Big(\hat{y}_i - y_i\Big)^2 \tag{2}$$

$$\theta^* = \arg\min_{\theta} \mathcal{L}(\theta) \tag{3}$$

$$z = \begin{cases} 1, & \text{if } \hat{y} \geq \tau, \\ 0, & \text{otherwise,} \end{cases} \tag{4}$$

2.4 References and citations

This journal uses a numeric citation style in which references are numbered in the order they first appear in the text and cited using Arabic numerals in square brackets (e.g., [1], [2], [3]). The reference list should be ordered by citation sequence rather than alphabetically. All references cited in the text must appear in the reference list, and all listed references must be cited. DOIs should be included where available.

Figure 2: Two-column example. A full-width figure for complex workflows, system diagrams, or multi-panel summaries that require additional horizontal space.

(a) Panel A

(b) Panel B

(c) Panel C

(d) Panel D

Figure 3: 2×2 grid example. The caption should explain what varies across panels and define any shared notation or conditions.

3 Results

The Results section reports what you found, not what it means. Present outcomes in a clear, structured order that matches your research questions and Methods, using text to highlight the key patterns and figures/tables to provide the evidence. Start with a short paragraph that reminds the reader what was evaluated (without repeating the Methods) and then report results from primary to secondary analyses.

Focus first on the primary outcomes and comparisons. Report the main endpoint(s) with appropriate units. Use consistent baselines and avoid selective reporting: include the comparisons needed for fair assessment and clearly state sample sizes for each result.

Organize results to reflect agricultural variability and real-world conditions. When relevant, report performance or responses across different contexts such as species or varieties, management regimes, environments (field, greenhouse, controlled facilities), seasons/years, production stages (growth, harvest, post-harvest), or supply-chain segments. For example, you may show how outcomes differ across Specie 1–3, across treatment levels, across genotypes, across farms or facilities, or across batches/lots. If your study spans different agricultural domains (e.g., crops, breeding, livestock, aquaculture, post-harvest quality, sustainability assessment, or traceability), keep a consistent reporting structure so readers can compare results across settings.

Include robustness and quality checks that support the credibility of the findings. Report sensitivity analyses, ablations, or stress tests as results (without interpretation), and disclose failure modes or conditions where performance degrades. If the work is decision-support oriented, present results in a way that reflects decision needs (e.g., ranked recommendations, threshold-based alerts, or cost-sensitive outcomes) while still reporting standard scientific metrics.

Write with precision and restraint: refer to each figure/table explicitly, avoid repeating every number already shown in tables, and do not introduce new methods in Results. Save explanations, implications, and broader claims for the Discussion; in Results, your goal is to provide a transparent, complete account of the empirical evidence.

4 Discussion

The Discussion explains what the results mean and why they matter in an agricultural context. Begin by answering the main research question in 2–3 sentences and restating the key findings at a high level (do not re-list all numbers). Then interpret the results—for example, in terms of mechanisms, agronomic relevance, and decision implications: explain what the findings suggest for management, breeding, production performance, product quality, sustainability outcomes, or traceability practices, and so on as appropriate to your study.

Connect your findings to prior work. Compare against the most relevant literature and clarify what is consistent, what differs, and why. When results vary across conditions (e.g., species/varieties, environments, seasons/years, facilities, production stages, or supply-chain segments), discuss plausible drivers such as management differences, environmental variability, biological constraints, data limitations, or operational factors.

Be explicit about limitations and scope. State where the evidence is strong and where it may not generalize (e.g., limited sites/years, narrow genetic diversity, specific production systems, measurement noise, potential confounding, or incomplete records). Distinguish practical constraints from methodological limitations, and avoid over-claiming beyond the evaluated settings. If relevant, note ethical, welfare, privacy, or governance considerations that affect adoption.

Conclude with implications and next steps. Summarize the actionable takeaway for the target stakeholders and propose concrete future work (e.g., broader validation, additional species or environments, stronger baselines, deployment trials, or improved data collection). The Discussion should leave the reader with a balanced view of impact, credibility, and what remains to be done.

Acknowledgments

Use the Acknowledgments section to recognize funding and support that contributed to this work. List grant numbers and funding agencies, and acknowledge institutional, field, laboratory, or operational support (e.g., farms, stations, hatcheries, facilities, or data providers) as appropriate. You may also thank individuals who assisted with data collection, technical help, or feedback but do not meet authorship criteria. Keep acknowledgments brief and avoid including confidential information.

5 Conclusion

The Conclusion section should briefly summarize the main findings of the study, highlight their significance, and state the primary contributions of the work. This section should not introduce new data, results, or citations. Authors may also include a short statement on limitations or future directions where appropriate.

Acknowledgments

Use the Acknowledgments section to recognize funding and support that contributed to this work. List funding agencies, programs, and grant/award numbers, and include any required wording specified by the funder. Acknowledge institutional, field, laboratory, or operational support that enabled the study (e.g., farms and producers, research stations, greenhouses, hatcheries, processing facilities, extension services, breeding programs, or data providers), and note any in-kind contributions such as seed, feed, chemicals, equipment, or access to facilities. You may also thank individuals who assisted with study coordination, sampling, animal/plant care, fieldwork, laboratory assays, data curation, software support, or manuscript feedback but do not meet authorship criteria. Keep acknowledgments concise, factual, and professional, and avoid including confidential details or statements that belong in the Results or Discussion.

Conflict of Interest

Include a Conflict of Interest statement for transparency. Declare any financial or nonfinancial relationships that could reasonably be perceived to influence the work (e.g., industry funding, employment, consulting/advisory roles, equity ownership, patents, or in-kind contributions). If no conflicts exist, explicitly state this.

6 Author Contributions

Use this section to briefly describe each author's role in the work (e.g., conceptualization, methodology, data collection, analysis, software, writing, supervision, funding acquisition). Keep statements concise and factual. For single-author papers, this section may be omitted.

References

[1] Joshua Schimel. *Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded.* OUP USA, 2012.