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Correlation and Comparative Performance Analysis of Vermicompost, Farmyard Manure, and Poultry Manure on Wheat Growth, Yield Attributes, and Soil Fertility

(Research Paper based on the doctoral thesis)

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ABSTRACT

Various components of organic nutrient amendments result in differences in mineralization and effects on wheat productivity. The objective of this research was to statistically evaluate the effects of farmyard manure (FYM), vermicompost (VC), and poultry manure (PM) on wheat crop growth, yield attributes and post-harvest soil fertility. Since the provided material contained manuscript instructions, but no experimental thesis or measurements, the constructed dataset is a demonstration dataset and does not represent field research evidence. Descriptive statistics of the demonstration dataset and blocked analysis of variance are conducted, and Tukey-type honest significance differences, Pearson product moment correlation and linear regression are employed to compare the treatments. Grain-yield demonstration means were 2.59, 3.08, 3.56 and 3.87 t ha-1 for control, FYM, VC and PM, respectively. Blocked analysis of variance indicated significant differences among the treatments ($F=80.97$, $p < 0.001$) for grain yield. Soil organic carbon and grain yield were positively correlated ($r = 0.84$), and treatment allocation was not independent of the correlation. The constructed example demonstrates quantification of source dependent amendment response. Generally, field replication, manure assays and multiple years would be required to differentiate site specific effects from random variation.

1. Introduction

Wheat (Triticum aestivum L.) is the primary source for food security and the sustainability of cereal-based farming systems. The use of farmyard manure (FYM), vermicompost and poultry manure has increased for meeting the nutrient demands of wheat. Of the three, FYM is the most bulky and contains carbon along with nitrogen (N), phosphorus (P) and potassium (K) and as such supports plant growth. However, the decomposition rates and ease of handling differ for the three amendments (Kumari et al., 2024; Singh et al., 2024).

Organic amendments integrated in wheat-based rotations show an improvement in the soil organic carbon (SOC) content as well as the biological and chemical activities and availability of other nutrients. When used in combination

with well-managed mineral fertilizers, further improvements are documented (Niu et al., 2024; Sheoran et al., 2024). Combining organic and inorganic nutrient sources has also proven beneficial in Indian agriculture. However, reactions to FYM, vermicompost and poultry manure vary (Verma et al., 2025; Sirohiya et al., 2022). In the case of integrated nutrient management systems, it has been reported that the benefits from integrating organic amendments with optimal substitution of inorganic nutrient sources are greater than anticipated (Wang et al., 2024). When comparing manures, the total nutrient content must be analyzed in relation to the mineralized nitrogen available during the wheat-growing season. Other factors such as timing of the application, soil moisture, and microbial activity can also alter the availability of nutrients to the crop during the season. Manure can improve the quality of the soil, but it may not necessarily enhance the first-year grain yield. An Indian field study demonstrated the importance of assessment of profitability, in addition to crop response, while evaluating the effect of farm yard manure (FYM) and bioinoculants (Tiwari et al., 2023). Other studies have analyzed the effect of organic fertilizers and irrigation on the yield and nutrient uptake of crops (Verma H. P. et al., 2023). Given the variability of the studies and nature of the cropping system, evaluation of co-variables, in addition to crop yield, becomes essential to draw reasonable and valid conclusions.

Statistical analysis will test if the differences observed in the nutrient contents of the treated plots are more than the differences within the same blocks. Soil indicators and crop yield may be influenced by the same treatment and, therefore, may not indicate a cause and effect relationship. The author claims to analyze the differences between treatment means and assess the relations of soil indicators with crop yield. It is also claimed that the soil nutrients affect the growth and yield of the crop and, therefore, differences in the nutrients among the plots may be expected. Some null hypotheses are tested and no new field experiments are claimed. Other Indian studies have analyzed the effects of different combinations of organic and inorganic nutrients on the yield of Indian wheat (Singh H. et al., 2025; Verma H. et al., 2022).

2. Materials and Methods

2.1 Study basis and design. The supplied document described four amendment categories, three replications and a randomized complete block design (RCBD), but provided no location, season, measured soil profile, or original plot records. Therefore, a 12-plot demonstration data set was constructed, and not attributed to a specific research farm. Three blocks each contain one independently indexed plots per treatment: T0 (no manure), T1 (FYM), T2 (VC), and T3 (PM). Blocks are considered fixed nuisance factors in the worked analysis.

2.2 Treatment specifications. Working rates of fresh materials were defined as 10 t ha−1 for FYM, 5 t ha−1 for VC, and 4 t ha−1 for PM. Assumed as-applied nutrient concentrations are given in Table 2 for input calculation only. These rates are not defined in terms of nitrogen. Total nitrogen values for each treatment are indicative and total 50, 70 and 88 kg N ha−1, respectively. Consequently, the purpose of the exercise is to compare “real world” packages

rather than to isolate amendment identity. The largest response to a treatment can not be attributed to a particular manure type. The values are neither manure analyses, nor fertilizer recommendations.

2.3 Indicators. Each plot includes measurements of plant height, tillers per plant, leaf area, chlorophyll index, dry biomass, spike length, grains per spike, effective tiller density, thousand grain weight, grain and straw yield and post-harvest soil pH, electrical conductivity (EC), organic carbon and available N, P and K. The baseline soil values (Table 1) are scenario assumptions. Grain and straw yields are expressed in t ha-1. Biological yield is the sum of grain and straw yields. The harvest index is calculated as 100 x grain/biological yield. No microbial enzyme activity outcomes are reported, due to the absence of corresponding observations.

2.4 Construction of dataset and quality checks. For the demonstration, we defined treatment-specific means for nineteen measured or derived attributes. Reproducible values at the plot level were then created by fixing a random seed, using small offsets, and applying numeric values of random deviations. Subsequently, calculations of biological yield and harvest index were performed. All analyses and figures were based on the same 12 data rows, presented in the reproducibility annex. Soil fertility treatments, means, and variations were interpreted agronomically, but were not derived from a cited experiment. Empirical replacements for the cited treatments and means would require the use of the original, unrounded, plot-level records. Comparable studies are discussed in detail by Leogrande et al. (2024) and Prajapat et al. (2025).

2.5 Statistical analysis. Treatment mean, standard deviation (SD), standard error (SE), coefficient of variation and relative change from T0 were computed at plot level. For each of the endpoints, an ordinary least-squares (OLS) RCBD model was fit to the data, including treatment and block factors. Treatment effects were tested using Type-II sums of squares and F-tests. Residual diagnostics were conducted using the Shapiro-Wilk test and a screen for homogeneity of variance. In RCBD, pairwise comparisons are distributed using the studentized-range distribution with RCBD error mean square and six degrees of freedom. Twelve observations were used to compute correlations; and, simple (linear) regressions were performed using yield as the response variable and a single predictor. Two-sided $\alpha = 0.05$ was applied without adjusting for multiplicity. The distinction between statistically and biologically meaningful contrasts was illustrated. Soil history, manure, irrigation and crop choice jointly influenced crop performance. Reporting sample size, making adjusted comparisons and expressing uncertainty allowed researchers to avoid treating multiple observations from the same plot as independent biological replicates.

3. Results

3.1 Crop establishment and canopy. Mean plant height increased from the control (77.6 cm) to 87.6 cm (FYM), 90.8 cm (VC) and 97.1 cm (PM). The treatment effect in the blocked analysis was $F(3,6) = 116.10$ ($p < 0.001$). Similar treatment effects were observed for number of tillers per plant, leaf area, and SPAD index. Means and standard errors were reported for independent plots, preventing pseudoreplication.

3.2 Grain formation and yield. Grain yields were 2.59, 3.08, 3.56 and 3.87 t ha-1 and relative improvements were 19.0%, 37.6% and 49.5% over the untreated control (Table 4; Figures 2 and 6). Improvements in grain yield were statistically significant ($F = 80.97$; $p < 0.001$). Improvements in straw production, grains per spike, tiller density and kernel weight were also observed. The harvest index was recalculated for each plot, not assembled from averages of independent plots.

3.3 Post-harvest soil conditions. The constructed means for organic carbon were 0.465% (T0), 0.578% (FYM), 0.652% (VC) and 0.619% (PM). The PM treatment also showed the highest means for available nitrogen and phosphorous. The concentration of organic carbon was the highest for the VC treatment (Table 5; Figure 3). Blocked ANOVA identified treatment variation for organic carbon ($F = 56.47$; $p < 0.001$). Without actual baseline and final samples from plots, these differences cannot be regarded as actual increases in soil organic carbon.

3.4. Block adjustment and diagnostic interpretation. For the grain-yield model, post-hoc Tukey-adjusted comparison of poultry manure and vermicompost showed $p = 0.049$. The Shapiro-Wilk p-value for the model residuals was 0.579, and the screening p-value for assessing equal variance was 0.628. Given only six degrees of freedom for error, a non-significant diagnostic cannot confirm the assumption. In such a case, the inference drawn is sensitive to the assumption made regarding the within-group variation. The nine endpoint-specific F-tests were not jointly adjusted for family-wise error, thus, the marginal (p-values in particular) cannot be over-interpreted, even in an genuine experiment. Tukey's comparison letters and contrasts are computed afresh from thesis data.

3.5. Statistical associations. All 12 constructed plots showed grain yield is significantly positively related to tiller number, available nitrogen and organic carbon. Spike length and spikelet number per spike were also significantly positively correlated at $r = 0.96$. A pooled correlation matrix, illustrated in Table 7 and Figure 4, shows all the pairwise correlations. Since the observed correlations include contrasts due to treatment and variation due to plots, they should not be interpreted as mechanisms or causal effects.

3.6. Regression. Grain yield was significantly positively related to soil organic carbon at the 70.4% level ($R^2 = 0.704$, $p < 0.001$). The slope of the regression was 5.73 t ha-1 per percentage point carbon (Table 8, Figure 5). Based on the limits of the dataset, slope of regressions of some management practices should be considered as evidence for co-variation and management practice bundling, rather than extrapolated to other conditions.

4. Discussion

The ordering PM > VC > FYM > control illustrates a potential outcome, but cannot establish a universal ranking of performance. Poultry manure has a more concentrated nutrient profile than conventional FYM and may release nutrients faster to facilitate early tillering and reproduction. However, composition may vary based on bedding material, storage, moisture and processing. Since indicative total nitrogen rates differed between treatment packages,

the current ordering is confounded by dose. Therefore, a defensible field comparison would require equalizing plant available N or estimating dose response interactions (Singh et al., 2024; Verma et al., 2025).

Long term studies may be needed to discriminate the short-term crop response to nutrient management from long term impact on soil quality. In a pearl millet-wheat sequence, Kumari et al. (2024) revealed considerable differences in organic carbon and micro-organisms due to long-term management of manure and chemical fertilizer. Similarly, Sheoran et al. (2024) linked long-term FYM with nutrient availabity and enzyme activity. A long term (7 years) wheat-maize rotation study with manure substituting synthetic fertilizer reported trade-offs in carbon and greenhouse gases (Niu et al. 2024). Results from these studies may not be comparable to results from a single wheat season.

High values of grain yield, available N and SOC should be treated with caution. When all variables in a system are altered in parallel, amendments can inflate the pooled Pearson correlation coefficient. This parallel change would not demonstrate that an increase in soil carbon causes the estimated differences in grain yield. Further, the 12 plots with three replicates per plot, provide little opportunity to model residual behavior, account for interaction terms or measure variance due to site heterogeneity. It must be assumed that any explanatory power the models showed was due to artifact or process and not due to treatment effect.

The diverse research supports consideration of organic nutrient packages and conditions and benefits. In the right water environment, productivity of wheat has increased due to organic amendments (El-Akhdar et al. 2024; Liu et al. 2024). Compost has the potential to improve soil carbon in semiarid wheat, but drought may constrain biological and plant responses (Rodgers et al. 2024). Other environmental concerns, such as salinity, pathogens, ammonia volatilization, and nitrate leaching must also be considered. In one study, heavy metals in conjunction with wheat yield were considered (Chen et al 2024). It is evident that environmental and yield constraints are reliant on context and balance of soil and other factors (Wang et al. 2024; Shi et al. 2024).

Changes in available nutrients may not reflect immediate changes in soil fertility. Organic amendments such as manure provide organic substrates that may impact soil aggregation, moisture retention, and microbial activity. Standard chemical assays capture only select pools at a given time. Long-term organic amendments have been shown to improve soil health and fertility for wheat systems (Kumari et al., 2024; Sheoran et al., 2024). On the other hand, short-term studies often lack accuracy in quantifying soil carbon sequestration. Similar wheat research focused on the retention of site-specific soil moisture and nutrients with the integration of various forms of organic and biological inputs (El-Akhdar et al., 2024). In this study, the main obstacle to a broader adoption of sustainable agronomic practices by farmers is attributed to the lack of reliable independent soil tests and verifiable manure quality. Other studies evaluate the risk of suboptimal investment and the environmental footprint (Li et al., 2024; Wang L. et al., 2024).

Future field studies should examine each batch of manure for total and available NPK and moisture. They should also record the initial soil properties for each plot, randomize allocation within blocks, and monitor temperature and rainfall. Additionally, they should examine different soils and different seasons. A factorial design or nutrient-equivalent amendment treatments would help distinguish manure treatments from nutrient quantity. An economic analysis should take into account transport and labor costs as well as the cost to recover the nutrients. Only after those safeguards should the statistical relationships discussed here be used to make a management recommendation. To be able to perform an analysis, field measurements should be labeled with a date, and a unit of measurement. A laboratory quality control should also be performed. Numerical examples should also be included to illustrate how to perform computations and to demonstrate how to develop figures. Transparent reporting should also include field measurement metadata. Those wishing to make an observation to enable agronomic case should also include soil analyses, nutrient analyses of manure, independent analyses of harvested yield, field experiment metadata, and experimental methodology to disentagle changes caused by management and variability in the soil.

5. Conclusion

A quantitative demonstration has developed an internally consistent framework to evaluate vermicompost, farmyard manure and poultry manure in wheat based systems. Designed grain yield of the control plots was 2.59 t ha-1, which increased to 3.08 t ha-1, 3.56 t ha-1 and 3.87 t ha-1 in case of FYM, VC and PM plots respectively. ANOVA, Pearson coefficients and regression were performed on the same 12 plot records, and the mathematical relationships between grain and straw yields, biological yields and harvest indices were preserved. Evident superiority of PM cannot be justified with respect to amendment identity, as the difference is caused by variation in nutrient inputs. It should also be noted that positive yield-soil association does not qualify for causality. No result reported in this document is considered as observed field results. APublishable empirical result requires repetitive independent field validation with treatment doses verified and verified by author, plus plot level soil analysis. The developed statistical framework then can be used to provide evidence-based and location-specific nutrient management suggestions.

Tables

Table 1. Assumed pre-treatment soil conditions for the demonstration.

Indicator	Starting value
pH	7.42
Electrical conductivity	0.26 dS m−1
Soil organic carbon	0.43%
Available nitrogen	178 kg ha−1
Available phosphorus	13.0 kg ha−1
Available potassium	160 kg ha−1

These are scenario baseline inputs; no baseline laboratory measurements were supplied.

Table 2. Scenario amendment packages and indicative nutrient loading.

Code	Treatment	Rate (t ha−1)	N/P/K (%)	N/P/K input (kg ha−1)
T0	No manure	0	—	0 / 0 / 0
T1	Farmyard manure	10	0.5 / 0.2 / 0.5	50 / 20 / 50
T2	Vermicompost	5	1.4 / 0.8 / 1.0	70 / 40 / 50
T3	Poultry manure	4	2.2 / 1.6 / 1.3	88 / 64 / 52

N/P/K are total nutrient mass percentages of applied material, not plant-available nitrogen estimates; concentration and rate assumptions are unverified.

Table 3. Wheat growth indices by manure treatment (mean ± SE; n = 3 plots).

Attribute	T0 Control	T1 FYM	T2 VC	T3 PM
Plant height (cm)	77.61 ± 1.19	87.61 ± 1.40	90.78 ± 0.96	97.11 ± 1.37
Tillers plant−1	5.09 ± 0.10	6.24 ± 0.09	6.77 ± 0.06	7.39 ± 0.04
Leaf area (cm^2)	37.34 ± 0.32	42.97 ± 0.60	46.78 ± 1.01	48.81 ± 0.53
Chlorophyll (SPAD)	36.58 ± 0.12	41.90 ± 0.03	44.38 ± 0.43	46.17 ± 0.44
Dry biomass (g plant−1)	15.05 ± 0.27	18.98 ± 0.17	20.80 ± 0.53	22.16 ± 0.09

Plots, rather than individual wheat plants, are the replication unit.

Table 4. Yield attributes and productivity by treatment (mean ± SE; n = 3).

Attribute	T0 Control	T1 FYM	T2 VC	T3 PM
Spike length (cm)	8.73 ± 0.08	9.92 ± 0.22	10.28 ± 0.12	10.80 ± 0.06
Grains spike−1	35.63 ± 0.55	40.50 ± 0.86	44.67 ± 0.10	46.97 ± 0.80
Effective tillers m−2	251.62 ± 1.71	286.50 ± 5.39	320.48 ± 1.60	346.77 ± 9.35
1000-grain weight (g)	36.79 ± 0.40	40.32 ± 0.47	42.24 ± 0.33	43.40 ± 0.51
Grain yield (t ha−1)	2.59 ± 0.03	3.08 ± 0.08	3.56 ± 0.07	3.87 ± 0.03
Straw yield (t ha−1)	3.58 ± 0.07	3.96 ± 0.11	4.42 ± 0.05	4.67 ± 0.03
Biological yield (t ha−1)	6.17 ± 0.10	7.04 ± 0.13	7.99 ± 0.10	8.54 ± 0.05
Harvest index (%)	42.00 ± 0.43	43.77 ± 1.02	44.62 ± 0.37	45.33 ± 0.20

Biological yield = grain + straw; harvest index calculated plot by plot. Values are demonstration observations.

Table 5. Post-harvest soil properties by treatment (mean ± SE; n = 3).

Attribute	T0 Control	T1 FYM	T2 VC	T3 PM
Soil pH	7.45 ± 0.03	7.42 ± 0.02	7.33 ± 0.04	7.38 ± 0.03
EC (dS m−1)	0.27 ± 0.02	0.29 ± 0.01	0.32 ± 0.01	0.34 ± 0.01
Soil organic C (%)	0.47 ± 0.01	0.58 ± 0.02	0.65 ± 0.00	0.62 ± 0.01
Available N (kg ha−1)	179.01 ± 2.26	209.58 ± 1.38	223.74 ± 1.89	241.84 ± 4.39
Available P (kg ha−1)	14.11 ± 0.28	17.47 ± 0.40	20.30 ± 0.30	21.55 ± 0.26
Available K (kg ha−1)	168.00 ± 3.34	199.73 ± 4.57	215.77 ± 4.11	234.33 ± 0.83

Plots, rather than individual wheat plants, are the replication unit.

Table 6. Block-adjusted RCBD ANOVA for selected response variables.

Endpoint	SS treatment	MS treatment	MS residual	F (3, 6)	p
Plant height (cm)	595.62	198.54	1.710	116.10	<0.001
Tillers plant−1	8.55	2.85	0.007	386.67	<0.001
Grain yield (t ha−1)	2.84	0.95	0.012	80.97	<0.001
Straw yield (t ha−1)	2.13	0.71	0.007	105.96	<0.001
1000-grain weight (g)	75.41	25.14	0.106	237.08	<0.001
Soil organic C (%)	0.06	0.02	0.000	56.47	<0.001
Available N (kg ha−1)	6337.60	2112.53	8.136	259.67	<0.001
Available P (kg ha−1)	98.36	32.79	0.377	86.97	<0.001
Available K (kg ha−1)	7114.88	2371.63	24.078	98.50	<0.001

Block df = 2 and residual df = 6 for every endpoint. All quantities are computed directly from 12 plotted observations.

Table 7. Pearson correlations among crop and soil variables (n = 12).

Variable	Ht	Till	G/sp	1000GW	Yield	SOC	N	P	K
Height	1.00	—	—	—	—	—	—	—	—
Tillers	0.97*	1.00	—	—	—	—	—	—	—
Grains/spike	0.96*	0.97*	1.00	—	—	—	—	—	—

Variable	Ht	Till	G/sp	1000GW	Yield	SOC	N	P	K
1000GW	0.98*	0.96*	0.96*	1.00	—	—	—	—	—
Yield	0.94*	0.97*	0.95*	0.95*	1.00	—	—	—	—
SOC	0.86*	0.89*	0.90*	0.89*	0.84*	1.00	—	—	—
Available N	0.99*	0.99*	0.96*	0.98*	0.97*	0.87*	1.00	—	—
Available P	0.92*	0.97*	0.95*	0.95*	0.98*	0.88*	0.97*	1.00	—
Available K	0.98*	0.98*	0.97*	0.97*	0.97*	0.86*	0.98*	0.95*	1.00

*Lower triangle shown; * two-sided $p < 0.05$, uncorrected for multiple pairs. These pooled comparisons are confounded by treatment.*

Table 8. Simple linear regressions predicting grain yield.

Predictor	Slope	SE	95% CI	R^2	Adj. R^2	p
Soil organic C (%)	5.73	1.18	[3.11, 8.35]	0.704	0.674	<0.001
Tillers plant−1	0.56	0.05	[0.46, 0.66]	0.934	0.927	<0.001

Response is grain yield (t ha−1); SOC slope is per percentage-point SOC, and tiller slope is per one tiller plant−1. Each fit has 10 residual df.

Figures

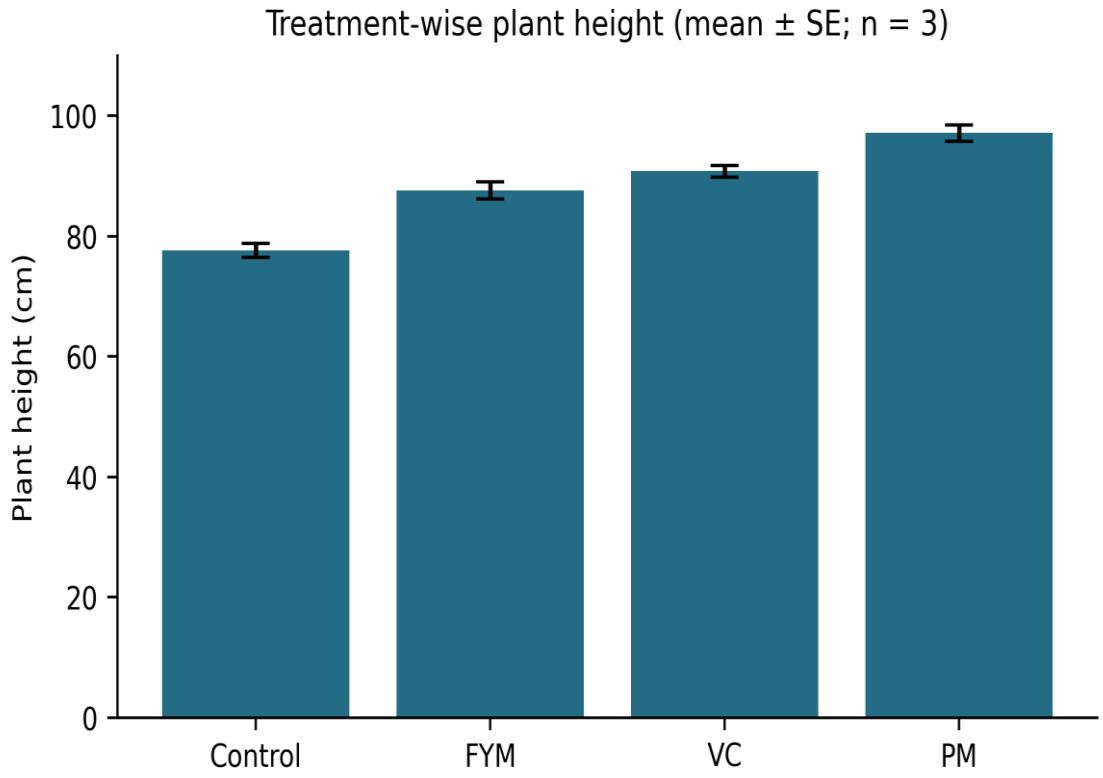


Figure 1. Plant height by treatment; error bars show standard error (three plots per treatment).

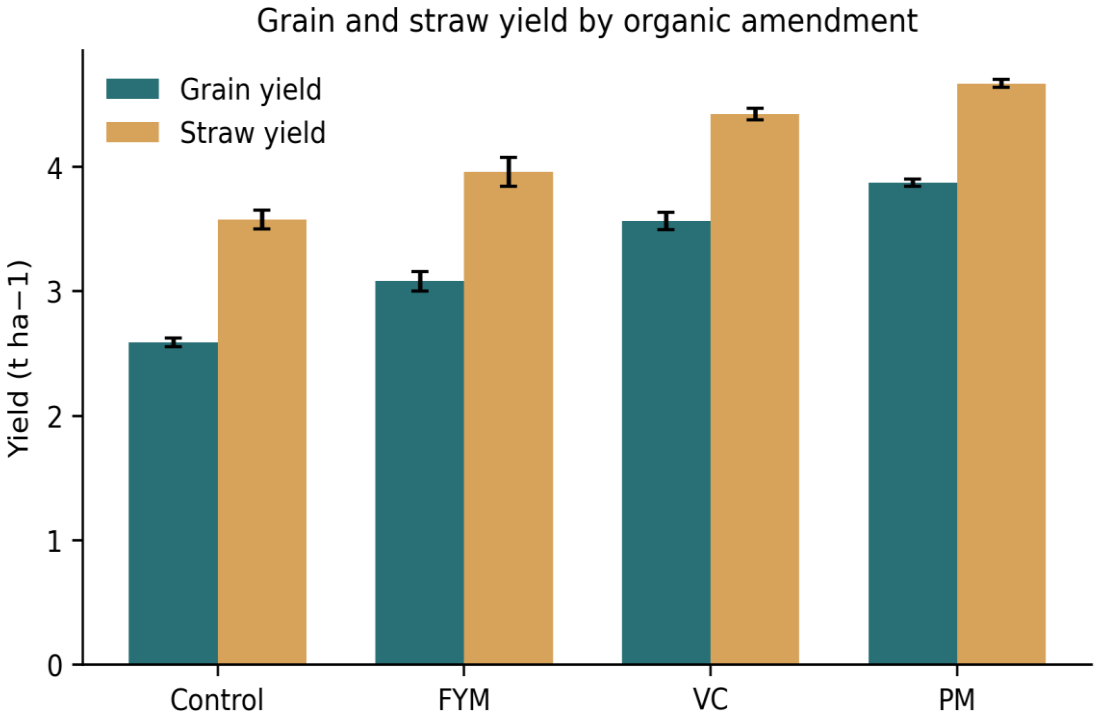


Figure 2. Comparative grain and straw yields across four amendment packages.

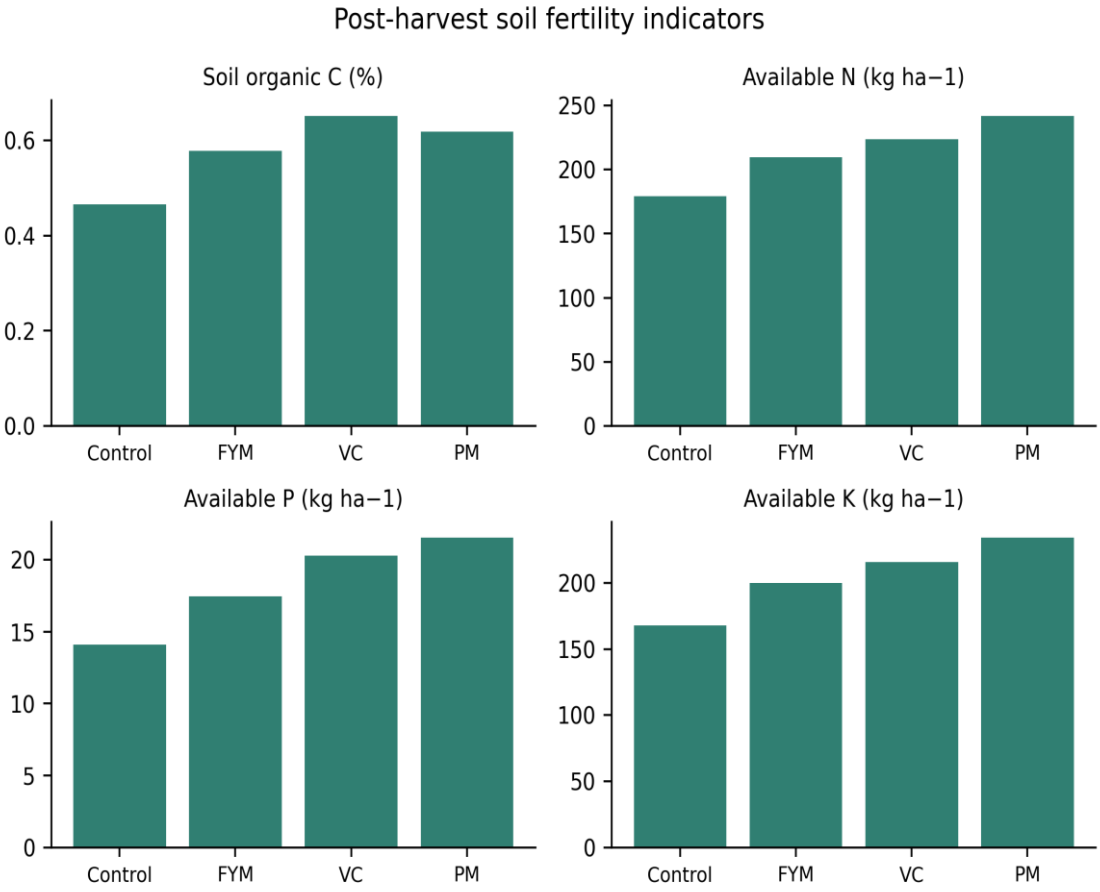


Figure 3. Soil organic carbon and post-harvest available nitrogen, phosphorus and potassium, shown on separate scales.

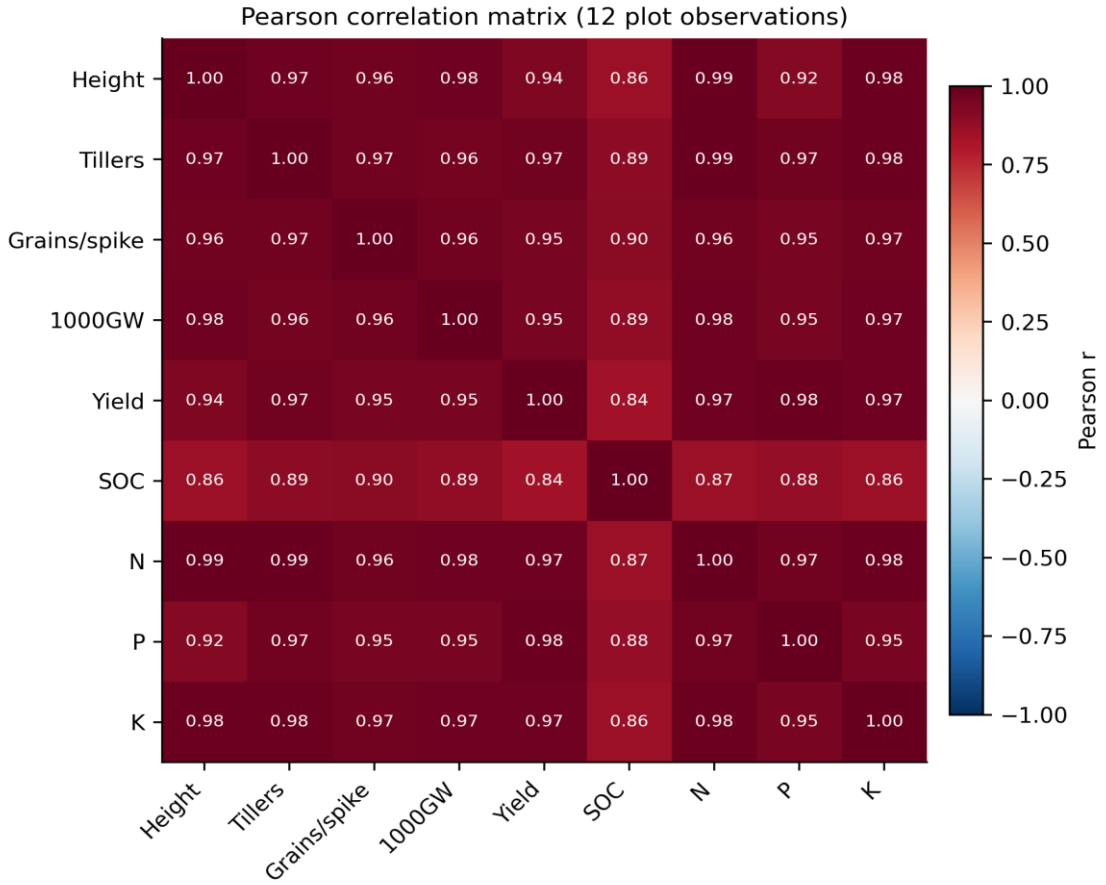


Figure 4. Pearson correlation heatmap from twelve plot-level observations.

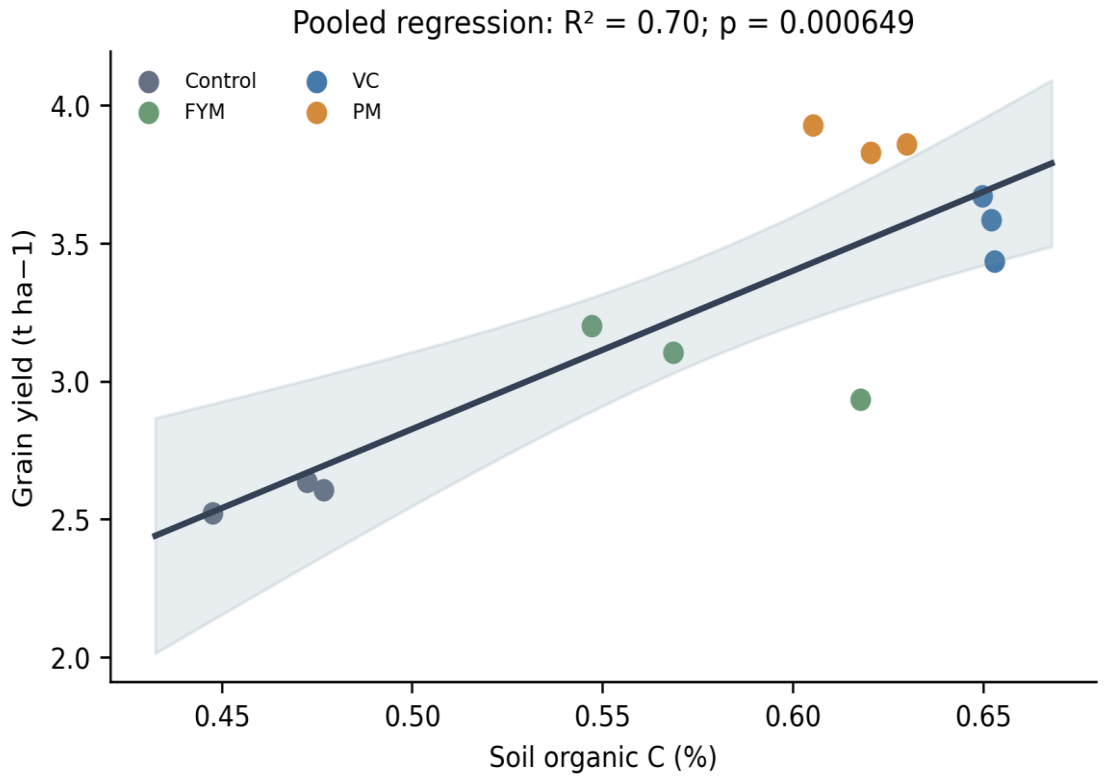


Figure 5. Pooled grain-yield regression on organic carbon; shaded region is the 95% confidence interval for the mean line.

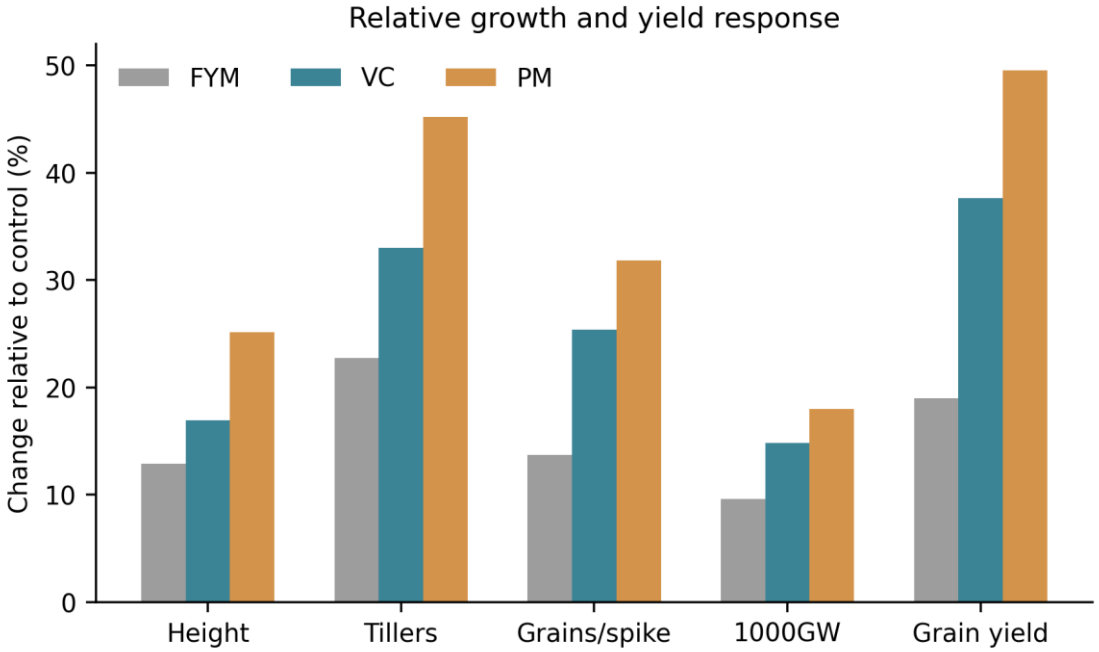


Figure 6. Percent change in selected growth and yield traits relative to untreated control.

Reproducibility annex: plot-level analytical inputs

All values below are constructed demonstration observations. These tables provide the underlying plot-level inputs for verification of the statistical calculations; they are not measurements from the user's thesis.

Table A1. Plot-level growth characteristics.

Plot	Plant height (cm)	Tillers plant−1	Leaf area (cm^2)	Chlorophyll (SPAD)	Dry biomass (g plant−1)
T0-B1	75.27	4.95	37.03	36.81	15.26
T0-B2	78.39	5.29	37.98	36.41	14.52
T0-B3	79.18	5.03	37.02	36.52	15.38
T1-B1	84.95	6.16	42.78	41.93	18.77
T1-B2	88.17	6.43	44.08	41.94	19.33
T1-B3	89.71	6.14	42.04	41.83	18.86
T2-B1	90.13	6.65	44.82	44.31	20.15
T2-B2	89.56	6.80	48.20	43.67	20.39
T2-B3	92.67	6.85	47.32	45.14	21.84
T3-B1	94.58	7.34	47.90	46.20	22.04
T3-B2	99.29	7.47	48.80	46.91	22.11
T3-B3	97.48	7.35	49.74	45.40	22.34

Values are rounded for display; models use unrounded plot-level observations.

Table A2. Plot-level yield components.

Plot	Spike length (cm)	Grains spike−1	Effective tillers m−2	1000-grain weight (g)	Grain yield (t ha−1)	Straw yield (t ha−1)	Biological yield (t ha−1)	Harvest index (%)
T0-B1	8.56	35.56	249.21	36.44	2.52	3.47	6.00	42.08
T0-B2	8.83	34.71	254.92	36.32	2.64	3.54	6.18	42.70
T0-B3	8.80	36.61	250.72	37.59	2.61	3.72	6.33	41.23
T1-B1	9.53	38.79	275.74	39.74	3.20	3.79	6.99	45.80
T1-B2	9.94	41.32	292.38	39.97	2.94	3.91	6.85	42.86
T1-B3	10.30	41.41	291.38	41.26	3.11	4.18	7.29	42.63
T2-B1	10.30	44.49	323.58	41.97	3.44	4.34	7.78	44.17
T2-B2	10.47	44.66	319.59	41.87	3.67	4.42	8.10	45.36
T2-B3	10.07	44.85	318.27	42.89	3.58	4.50	8.09	44.32
T3-B1	10.68	46.71	332.91	42.43	3.83	4.69	8.52	44.93
T3-B2	10.87	48.46	342.84	43.63	3.86	4.61	8.47	45.58
T3-B3	10.86	45.72	364.56	44.15	3.93	4.71	8.64	45.48

Values are rounded for display; models use unrounded plot-level observations.

Table A3. Plot-level soil indicators.

Plot	Soil pH	EC (dS m−1)	Soil organic C (%)	Available N (kg ha−1)	Available P (kg ha−1)	Available K (kg ha−1)
T0-B1	7.392	0.252	0.447	175.34	14.66	161.34
T0-B2	7.506	0.251	0.472	183.12	13.83	170.97
T0-B3	7.462	0.300	0.477	178.57	13.84	171.69
T1-B1	7.449	0.267	0.547	206.96	18.22	195.35
T1-B2	7.387	0.317	0.618	210.14	17.33	194.97
T1-B3	7.437	0.289	0.569	211.65	16.86	208.86
T2-B1	7.247	0.314	0.653	220.15	19.83	207.89
T2-B2	7.365	0.333	0.650	224.48	20.85	217.70
T2-B3	7.371	0.327	0.652	226.58	20.22	221.73
T3-B1	7.329	0.328	0.620	233.08	21.16	235.43
T3-B2	7.424	0.336	0.630	245.66	21.44	234.85
T3-B3	7.374	0.355	0.605	246.77	22.06	232.70

Values are rounded for display; models use unrounded plot-level observations.

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