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Dataset paper

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Dataset: Cowpea Cultivars with Residual Organomineral Fertilizers from Corn Crop Cultivation

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Abstract: Cowpea is a critical dietary staple, especially in tropical and subtropical regions, due to its high protein content, essential amino acids, and other nutrients. This study aimed to assess the impact of residual organomineral fertilizers from a preceding corn crop on cowpea cultivars in southern Maranhão, Brazil. Two cowpea cultivars, BRS Tucumaque and BRS Nova Era, were evaluated using a randomized block design with three replications. This study incorporated two organomineral fertilizers derived from cattle manure and natural phosphates a simple superphosphate at a 50 kg ha^{-1} dose, and a control without phosphorus fertilization. The key agronomic traits measured included the number of nodes, pod per plant, grains per pod, thousand-grain weight, and grain yield. This research underscores the potential of organomineral fertilizers to enhance cowpea yield while minimizing environmental impact, offering a viable alternative to conventional fertilization methods. These findings advocate broader adoption of organomineral fertilizers in cowpea cultivation, potentially increasing yield and reducing costs. The database derived from this research is composed of 48 samples. Four types of fertilization were considered: control, simple superphosphate and two organomineral fertilizers; two planting systems with and without *Urochloa ruziensis* straw; and two cultivars.

Keywords: *Vigna unguiculata* (L.) Walp.; *Urochloa ruziensis*; natural phosphates; superphosphate.

1. Introduction

Cowpea (*Vigna unguiculata* (L.) Walp.), also known as black-eyed pea or southern pea, is a significant food staple in the diet of many people worldwide, especially in tropical and subtropical regions. It is an excellent source of plant-based protein that contains essential amino acids and is easily digested. Additionally, cowpea grains are rich in potassium, a crucial mineral for heart and muscle health, and have low fat levels, making them a healthy and nutritious dietary option (Perina et al., 2014).

In 2019, the largest producers of cowpea were India, Myanmar, and Brazil, which collectively produced 19 million tons (FAOSTAT, 2019). In Brazil, during the 2022/2023 season, approximately 1,275,700 hectares were cultivated, yielding 669,600 tons with an average grain yield of 525 kg ha^{-1} (CONAB, 2022). To increase grain yield, proper fertilization is essential. Soil fertility adjustments for specific crops typically involve soil analyses and the application of corrective agents such as lime and soluble mineral fertilizers (NPK formulations) at the sowing and topdressing (Vale et al., 2017). According to Barbieri et al. (2013), providing adequate and balanced nutrients can enhance crop yield and initial development, as well as improve the vigor and physiological quality of the seeds produced for subsequent crops.

The use of suitable organomineral fertilizers is becoming increasingly important in agricultural production due to their excellent soil-nourishing properties. Organomineral fertilizers that combine organic and mineral compounds were developed to replace organic fertilizers with concentrated mineral fertilizers (Crusciol et al., 2020). Gradual nutrient application via organomineral fertilizers improves soil fertility, reduces costs, and mitigates environmental losses (Fernandes, 2020). Coelho et al. (2023) reported that organomineral fertilizers positively affect the physiological quality of soybean seeds.

Despite its importance, cowpea productivity is often low, averaging approximately 450 kg ha^{-1} nationally, largely due to inadequate weed control (Freitas et al., 2017). Proper weed management is essential for optimizing production components, as weeds compete for water, nutrients, sunlight, and space. Phytosociological studies, which assess the distribution and composition of plant species within a community, are critical for effective weed management (Concenço et al., 2013).

Crop rotation, permanent cover, and minimal soil disturbance are fundamental principles of no-till farming systems and help mitigate weed infestations and maintain soil health. These practices influence weed frequency and species composition in cultivated areas (Soares et al., 2017).

This study aimed to evaluate the impact of residual organomineral fertilizers from the first corn crop on the performance of cowpea plants grown in the southern Maranhense region, focusing on soil fertility, grain yield, and quality, while promoting sustainable agriculture. As a result, we made available to the scientific community a database with 48 samples related to four types of fertilization: control, simple superphosphate and two organomineral fertilizers; two planting systems with and without *Urochloa ruziensis* straw; and two cultivars cowpea: BRS Tucumaque and BRS Nova Era.

2. The experiment

2.1 Location and characterization of the experimental area

The field experiment was conducted at the Experimental Station of "Accert Agricultural Research and Consulting" located in Balsas, Maranhão, Brazil (07°31'57" S, 46°02'08" W, and altitude of 283 m) during the 2023/2024 growing season (Figure 1). Balsas is situated in the southern region of Maranhão State, within the Gerais de Balsas microregion, with Balsas being the main city (Passos et al., 2017).

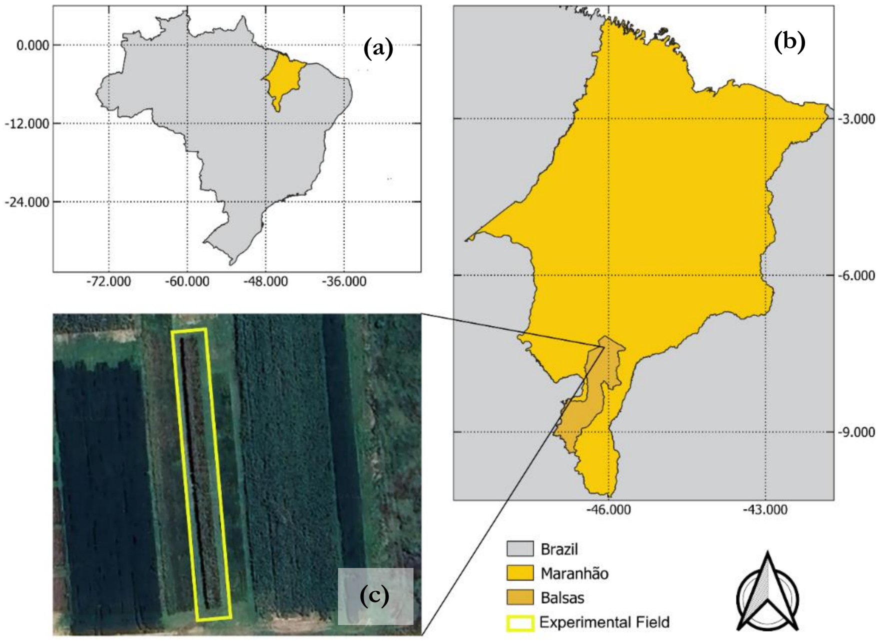

Figure 1. Maps of Brazil (a), Maranhão State (b) and the location of the experimental area (c).

According to Köppen's classification, the region's climate is hot and humid tropical (Aw), characterized by rainy summers and dry winters (Maranhão, 2002). The average annual rainfall is 1175 mm (Passos et al., 2017). The soil of the experimental area was classified as sandy clay loam Oxisol based on the Brazilian soil classification system (Santos et al., 2018). Before initiating the experiment, soil samples were collected from the 0-20 cm and 20-40 cm layers. The chemical and physical properties of these soil samples are detailed in Table 1.

Table 1. Main chemical properties of the soils used in the experiment.

Depth	pH	OM	$P_{Mehlich-1}$	H+Al	Al^{3+}	Ca^{2+}	Mg^{2+}	K^{+}	CEC	B
cm	H_2O	dag/kg	mg dm^{-3}		--------------------- cmol$_c$ dm^{-3} -----------------------					%
0-20	6.00	1.29	54.95	1.20	0.01	2.15	0.71	136.00	4.41	72.78
20-40	4.65	0.23	20.72	1.80	0.54	0.95	0.30	70.00	3.23	44.26
	B	**Cu**	**Fe**	**Mn**	**Zn**	**S**	**TOC**	**Clay**	**Silt**	**Sand**
		------------------------mg dm^{-3}------------------------					dag/kg		------------%------------	
0-20	0.22	0.44	113.21	14.28	0.73	6.30	0.75	24.24	9.26	66.49
20-40	0.23	0.40	81.98	4.25	0.37	12.60	0.13			

OM: organic matter. CEC: cation exchange capacity at pH 7.0. B: base saturation. TOC: total organic carbon.

2.2 Experimental design and treatments

The experimental design was a randomized block design with a split-split plot arrangement comprising three replications. The main plots were assigned to two cowpea cultivars (Cultivar 1: BRS Tucumaque; Cultivar 2: BRS Nova Era). The subplots included residues from three phosphate fertilizers [two organomineral fertilizers and one mineral phosphate fertilizer (superphosphate)]. The subsubplots received two P application rates: 0 and 50 kg ha^{-1} of P_2O_5.

The organomineral fertilizers were produced by granulating cattle manure from local feedlots with natural phosphates (NP) and superphosphate (SS). Two organomineral fertilizers were created: ORG1 (manure + NP) and ORG2 (manure + NP + SS). Chemical analyses of NP and SS were performed prior to fertilizer production. Each experimental unit consisted of four rows spaced 0.50 m apart and 3.0 m long, totaling an area of 6.0 m². The effective area included the two central rows, excluding 1 m at each end, resulting in a net area of 1.5 m².

In the first crop cycle, corn was sown, followed by cowpea cultivation in the second crop cycle. Cowpea sowing was conducted mechanically using a no-tillage planter with a furrow opening mechanism at a depth of approximately 3 cm, with a spacing of 0.50 m and 12 cowpea seeds per meter. Throughout the crop cycle, weed, pest, and disease control are managed using chemical pesticides.

At cowpea harvest, five plants per plot were sampled to assess the following variables: number of nodes on the main stem at maturity, number of pods per plant, number of grains per pod, and thousand-grain weight. Additionally, yield was measured in kg ha^{-1}, adjusted to 13% moisture content.

2.3 Assessment of production components and grain yield

At harvest (R_8 stage), the following variables were obtained from 10 plants per plot:

- **ND:** number of nodes (unit) – through manual counting;
- **GD:** grains per pod (unit) – through manual counting;
- **PP:** pod per plant (unit) – through manual counting;
- **TG:** Thousand grain weight (g) – according to the methodology described in Brazil (2009);
- **GY:** Grain yield (kg ha^{-1}) – determined by harvesting the useful area of the plot and standardized to a grain moisture level of 13%.

3. Data Description

For each cultivar, there were 3 repetitions within each harvest system (with and without *U. ruziensis* straw) and each fertilization scheme (ORG1, ORG2, SS, or control). This setup results in a total of 3×2×2×4 = 48 data samples. The data are organized in tabular format with columns labeled "System," "Cultivar," "Fertilizing," "Repetition," "ND" (number of nodes), "GP" (grains per pod), "PP" (pod per plant), "TG" (thousand-grain weight), and "GY" (grain yield). Table 2 outlines the data types. Table 3 provides the full dataset, and Table 4 provides the statistical summary.

Table 2. Data types and values assumed in the dataset.

Column	Data type	Values
System	Categorial	Without or With
Cultivar	Categorical	Tucumaque or Nova Era
Fertilizing	Categorical	Org1, Org2, SS or Control
Repetition	Integer	1, 2 or 3
ND, GP, PP, TG, GY	Continuous	Ranging from 1.38 to 4166.66

Table 3. Full dataset.

System	Cultivar	Fertilizing	Repetition	ND	GP	PP	TG	GY
Without	Tucumaque	Org1	1	20	5.10	2.2	623.50	3150
Without	Tucumaque	Org1	2	31	3.61	6.2	618.76	2717
Without	Tucumaque	Org1	3	18	1.39	4.4	482.32	1867
Without	Nova Era	Org1	1	32	5.00	3.6	508.87	2217
Without	Nova Era	Org1	2	30	6.40	4.4	498.58	2533
Without	Nova Era	Org1	3	38	4.47	4.2	487.07	1967

System	Cultivar	Fertilizing	Repetition	ND	GP	PP	TG	GY
Without	Tucumaque	Org2	1	25	5.00	3.4	583.18	2383
Without	Tucumaque	Org2	2	29	4.45	3.8	574.13	2550
Without	Tucumaque	Org2	3	19	2.47	4.4	467.56	1833
Without	Nova Era	Org2	1	41	4.41	4.2	498.93	2533
Without	Nova Era	Org2	2	52	4.50	4.0	505.06	2217
Without	Nova Era	Org2	3	36	5.22	4.4	478.99	1850
Without	Tucumaque	SS	1	32	5.31	4.6	580.34	2500
Without	Tucumaque	SS	2	14	9.00	6.0	568.12	2667
Without	Tucumaque	SS	3	24	4.21	3.4	578.76	2600
Without	Nova Era	SS	1	38	4.45	4.6	510.90	2600
Without	Nova Era	SS	2	38	4.42	4.8	500.01	1883
Without	Nova Era	SS	3	47	4.30	4.2	517.11	2617
Without	Tucumaque	Control	1	39	3.59	5.6	580.27	2600
Without	Tucumaque	Control	2	27	2.37	5.8	576.50	1667
Without	Tucumaque	Control	3	20	3.50	3.8	501.19	3167
Without	Nova Era	Control	1	43	3.81	4.0	484.32	2433
Without	Nova Era	Control	2	33	5.15	4.8	462.02	2100
Without	Nova Era	Control	3	32	5.88	3.2	488.13	2633
With	Tucumaque	Org1	1	24	2.50	5.8	592.42	1667
With	Tucumaque	Org1	2	27	3.70	4.8	584.68	3150
With	Tucumaque	Org1	3	34	3.79	3.4	605.32	3167
With	Nova Era	Org1	1	28	6.36	4.4	497.75	2000
With	Nova Era	Org1	2	25	8.00	5.6	509.36	3333
With	Nova Era	Org1	3	64	3.31	8.0	510.85	2083
With	Tucumaque	Org2	1	31	3.55	5.8	586.14	2217
With	Tucumaque	Org2	2	33	5.03	6.2	585.61	2917
With	Tucumaque	Org2	3	24	6.17	6.6	590.09	2867
With	Nova Era	Org2	1	50	5.24	5.6	512.35	3833
With	Nova Era	Org2	2	24	7.50	6.0	513.43	3667
With	Nova Era	Org2	3	32	7.94	5.0	513.51	2217
With	Tucumaque	SS	1	24	4.83	7.4	575.55	2000
With	Tucumaque	SS	2	39	5.28	5.6	600.50	3500
With	Tucumaque	SS	3	20	6.50	3.8	593.77	2917
With	Nova Era	SS	1	52	2.31	5.2	503.16	2600
With	Nova Era	SS	2	31	3.16	7.6	495.79	3167
With	Nova Era	SS	3	40	3.00	6.0	510.55	2550
With	Tucumaque	Control	1	24	2.00	7.2	612.02	1833
With	Tucumaque	Control	2	28	2.96	6.6	565.78	2050
With	Tucumaque	Control	3	42	6.00	7.0	603.63	4167
With	Nova Era	Control	1	87	3.84	5.0	490.41	2333
With	Nova Era	Control	2	36	3.00	6.2	513.11	1833
With	Nova Era	Control	3	29	1.59	6.4	501.23	1883

Table 4. Dataset summary.

	ND	GP	PP	TG	GY
mean	33.45	4.49	5.10	538.36	2525.69
std	12.72	1.68	1.29	47.94	590.46
min	14.00	1.38	2.20	462.02	1666.66
25%	24.75	3.45	4.20	499.73	2037.50
50%	31.50	4.43	4.90	513.27	2533.33
75%	38.25	5.25	6.00	583.55	2879.16
max	87.00	9.00	8.00	623.49	4166.66

Std. means standard deviation.

4. Availability

The database is available in .xlsx format and in a Colab Jupyter Notebook, with instructions in the Python (Van Rossum and Drake, 1995) Pandas (McKinney, 2010) library for reading the file (on GitHub only). The dataset is available at

- https://archive.ics.uci.edu/dataset/1012/cowpea+cultivars+with+residual+organomineral+fertilizers+from+crop+corn+cultivation
- https://github.com/brunobro/dataset-cowpea-cultivars-with-residual-organomineral-fertilizers-from-crop-corn-cultivation

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6. Additional Information

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6.3 Conflicts of Interest

We declare that there are no conflicts of interest.