Data Article

A raw data article on the physico-chemical properties of soil from six firkas in Dharmapuri district, Tamil Nadu, India

M. Ramya, S. Sathiyamurthi*

Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002, India

A R T I C L E   I N F O

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A B S T R A C T

The present study was aimed to assess the physical and chemical characteristics of soil belonging to six firkas covering three blocks of Dharmapuri district. A total of 125 samples were collected by means of Global Positioning System (GPS). The processed soil samples were analyzed for pH, Electrical conductivity (EC), soil separates, Bulk density (BD), Water holding capacity (WHC), organic carbon (OC), calcium carbonate (CaCO$_3$), available nitrogen (AVN), available phosphorus (AVP), and available potassium (AVK). Extreme value in the data set was removed by outlier removal algorithm. Spatial variability maps were prepared using the kriging method using ArcGIS 10.4. The best fitted semi-variance model for pH, EC, AVK and CaCO$_3$ was spherical; BD, sand, silt, and OC was circular; a Gaussian model was best fitted for WHC and AVN, while clay and AVP were exponential. The data presented in this study will help farmers, land managers, and policymakers to mitigate land degradation, and other environmental issues, thereby helping to increase land productivity.

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* Corresponding author: Dr. S. Sathiyamurthi, Assistant professor, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002, India

E-mail address: sathya.soil@gmail.com (S. Sathiyamurthi).

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**Specification Table**

| Subject area                          | Agriculture and Biological science |
|---------------------------------------|-----------------------------------|
| Specific subject area                 | Soil Science                      |
| Type of data                          | Tables and Images                 |
| How the data were acquired            | The study area boundary was extracted using SOI Toposheet (57H/14, 57H/15, 57L/3, and 57L/4) from GSL, a cadastral map, and Block boundary map from local authorities. The soil sample's location was determined by the regular point sampling method. The soil samples were collected during fallow period (February and April, 2021). The soil sample's location was recorded using GARMIN 76 CS x GPS device. |
| Data format                           | Raw and Analyzed data             |
| Description of data collection        | The soil sample's location was predetermined by regular point generation technique and recorded using a GPS device. The surface litters and grass were removed and 'V' shaped pit was dug at the depth of 15 cm. After cleaning the pit, one-inch thickness soil was collected from each side. Using a wooden mallet, the air-dried soil samples were ground into powder. The samples were mixed and reduced in volume to roughly 500 g by quartering method. The samples were stored in air tight container and analyzed for pH, EC, particle size analysis, BD, WHC, OC, CaCO$_3$ and available NPK by following the standard procedures. These data were converted into vector layers and kriging was applied to create a spatial variable map for each soil parameters. |
| Data source location                  | The study area is the part of Dharmapuri district, Tamilnadu, India. Latitude ranges between 11° 45' and 12° 15' N and longitude ranges between 77° 30' and 78° 30'E, encompassing about 482 sq.km. The elevation of the study area ranged from 403 to 1213 m MSL. |
| Data accessibility                    | Data accessibility Repository name: Mendeley Data, Title of the data set: A raw data article on the physical and chemical properties of soil from six firkas in Dharmapuri district, Tamil Nadu, India. Data identification number: 10.17632/nm5b82wbmt.4, Direct URL to data: https://data.mendeley.com/datasets/nm5b82wbmt/3 |

**Value of the Data**

- This data set will be used to determine the agricultural land suitability and crop suitability of the study area.
- This data will help the land manager and policymakers to suggest an action plan for sustainable crop production.
- Furthermore, this data will aid other science and engineering fields in better understanding the soil in the study region, and it can be used for educational and research purposes.

**1. Data Description**

The data represents the physico-chemical properties of soil located in six firkas of Dharmapuri district. Tables 1–6 presents the physical and chemical properties of the soil in the study area. Table 7 presents the descriptive statistics of the soil properties. Fig. 1 shows the study area map and sample's location. Figs. 2–4 depict thematic maps showing the physical and chemical parameters of soil. Fig. 2 depicts information on the pH, EC (dS/m), BD (Mg/m$^3$), WHC (%), where Fig. 3 represents sand (%), silt (%), clay (%) and OC (g/kg), and Figure 4 reveals thematic map of the available NPK, (kg/ha), and CaCO$_3$ (%).
Table 1
The Physico-chemical properties of the Marandahalli firka soil samples from the Dharmapuri district in Tamil Nadu, India.

| Sample no | Latitude | Longitude | pH   | EC (mS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m³) | WHC (%) | OC (g/kg) | CaCO₃ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|----------|-----------|------|-----------|----------|----------|----------|----------------|-------------|----------|------------|------------|-------------|-------------|-------------|
| M1        | 12.5049  | 77.98748  | 7.5  | 0.3       | 67.80    | 4.5      | 27.7     | SCL            | 1.3         | 47       | 5.2        | 3          | 252         | 19          | 183         |
| M2        | 12.50488 | 78.00748  | 7.8  | 0.4       | 65.80    | 5.0      | 29.2     | SCL            | 1.2         | 60       | 4.2        | 5          | 248         | 21          | 196         |
| M3        | 12.48491 | 77.94751  | 7.7  | 0.2       | 65.80    | 7.0      | 27.2     | SCL            | 1.2         | 46       | 5.8        | 4.5        | 279         | 19          | 210         |
| M4        | 12.48499 | 77.9675   | 7.8  | 0.3       | 61.30    | 8.0      | 30.7     | SCL            | 1.3         | 64       | 4          | 3.5        | 263         | 29          | 199         |
| M5        | 12.48485 | 77.98753  | 7.5  | 0.3       | 64.55    | 6.25     | 29.2     | SCL            | 1.2         | 46       | 7.3        | 5.5        | 250         | 36          | 171         |
| M6        | 12.4848  | 78.00751  | 7.6  | 0.3       | 61.30    | 8.0      | 30.7     | SCL            | 1.3         | 44       | 7.3        | 7          | 248         | 34          | 160         |
| M7        | 12.46486 | 77.94742  | 7.4  | 0.4       | 65.80    | 7.0      | 27.2     | SCL            | 1.4         | 54       | 9.1        | 5.5        | 246         | 20          | 328         |
| M8        | 12.46477 | 77.9675   | 7.9  | 0.3       | 63.30    | 5.0      | 31.7     | SCL            | 1.2         | 34       | 0.6        | 8.5        | 176         | 27          | 210         |
| M9        | 12.4501  | 77.98753  | 7.3  | 0.4       | 64.99    | 5.3      | 29.7     | SCL            | 1.3         | 42       | 6.9        | 5.6        | 253         | 36          | 195         |
| M10       | 12.46491 | 78.00751  | 7.5  | 0.88      | 63.30    | 4.5      | 32.2     | SCL            | 1.3         | 40       | 5.2        | 7          | 320         | 21          | 123         |
| M11       | 12.46501 | 78.02749  | 6.4  | 0.25      | 68.80    | 5.5      | 25.7     | SCL            | 1.5         | 34       | 7.4        | 1.5        | 267         | 61          | 279         |
| M12       | 12.4483  | 77.98734  | 7.2  | 0.52      | 65.48    | 5.6      | 28.9     | SCL            | 1.3         | 32       | 6.9        | 5.2        | 262         | 37          | 153         |
| M13       | 12.44507 | 78.00756  | 7.3  | 0.82      | 65.80    | 7.0      | 27.2     | SCL            | 1.5         | 30       | 3.6        | 5.5        | 289         | 34          | 65          |
| M14       | 12.44488 | 78.0275   | 7    | 0.53      | 65.30    | 7.0      | 27.7     | SCL            | 1.3         | 31       | 5.2        | 5          | 263         | 20          | 169         |
| M15       | 12.42491 | 77.98747  | 7.4  | 0.38      | 60.30    | 9.5      | 30.2     | SCL            | 1.3         | 39       | 10.3       | 7          | 229         | 34          | 180         |
| M16       | 12.42472 | 78.0074   | 7.7  | 0.38      | 65.80    | 4.5      | 29.7     | SCL            | 1.2         | 44       | 10.6       | 2          | 332         | 45          | 209         |
| M17       | 12.40508 | 77.98756  | 7.2  | 0.38      | 67.80    | 4.5      | 27.7     | SCL            | 1.3         | 32       | 11.7       | 5.5        | 229         | 36          | 180         |
| M18       | 12.40496 | 78.0075   | 7    | 0.34      | 65.65    | 4.5      | 29.8     | SCL            | 1.3         | 24       | 9.7        | 4.6        | 246         | 41          | 199         |
| M19       | 12.40493 | 78.02752  | 7.8  | 0.37      | 63.30    | 4.5      | 32.2     | SCL            | 1.4         | 22       | 4.5        | 8          | 248         | 29          | 81          |
| M20       | 12.38503 | 77.96751  | 7.1  | 1.3       | 66.05    | 6.25     | 27.7     | SCL            | 1.3         | 39       | 6.5        | 4.5        | 263         | 34          | 225         |
| M21       | 12.38499 | 77.98754  | 7.4  | 0.42      | 64.63    | 7.0      | 28.37    | SCL            | 1.5         | 30       | 2.7        | 5          | 238         | 45          | 254         |
| M22       | 12.38503 | 78.00752  | 7.9  | 0.32      | 65.80    | 5.0      | 29.2     | SCL            | 1.4         | 32       | 9.5        | 7          | 248         | 54          | 328         |
| M23       | 12.38484 | 78.02746  | 7.7  | 0.27      | 68.70    | 4.5      | 27.7     | SCL            | 1.4         | 60       | 5.8        | 1          | 307         | 36          | 210         |
| M24       | 12.36491 | 77.96754  | 7.4  | 0.3       | 61.30    | 8.0      | 30.7     | SCL            | 1.3         | 64       | 3.7        | 5.5        | 248         | 17          | 180         |
| M25       | 12.36493 | 78.0075   | 7.5  | 0.47      | 70.30    | 2.0      | 27.7     | SCL            | 1.3         | 18       | 12.9       | 8.5        | 116         | 53          | 424         |
| M26       | 12.3649  | 78.02753  | 7.8  | 0.32      | 63.80    | 7.0      | 29.2     | SCL            | 1.3         | 47       | 1.2        | 3          | 232         | 34          | 488         |

*EC – Electrical conductivity, BD - Bulk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium*
Table 2
The Physico-chemical properties of the Vellichandai firka soil samples from the Dharmapuri district in Tamil Nadu, India.

| Sample no | Latitude   | Longitude | pH | EC (dS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m³) | WHC (%) | OC (g/kg) | CaCO₃ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|------------|-----------|----|-----------|----------|----------|----------|----------------|-------------|----------|-----------|-----------|-------------|-------------|-------------|-------------|
| V27       | 12.4649    | 78.04752  | 7.7| 0.5       | 65.8     | 7        | 27.2     | SCL            | 1.3         | 45       | 1.5       | 4.5       | 220         | 28          | 328         |
| V28       | 12.44497   | 78.04755  | 7.5| 0.36      | 69.3     | 8        | 25.95    | SCL            | 1.2         | 30       | 0.3       | 5.2       | 130         | 28          | 378         |
| V29       | 12.44492   | 78.06743  | 7.3| 0.43      | 67.8     | 8        | 25.82    | SCL            | 1.3         | 38       | 1.8       | 4         | 153         | 28          | 355         |
| V30       | 12.42493   | 78.02753  | 7.4| 0.37      | 60.3     | 9.5      | 30.2     | SCL            | 1.4         | 25       | 12.4      | 3         | 263         | 56          | 403         |
| V31       | 12.42487   | 78.04752  | 7.6| 0.25      | 68.3     | 7        | 24.7     | SCL            | 1.4         | 42       | 0.2       | 2         | 144         | 3           | 333         |
| V32       | 12.42499   | 78.06753  | 7.2| 0.57      | 66.3     | 8        | 25.7     | SCL            | 1.4         | 46       | 4.6       | 8         | 176         | 29          | 332         |
| V33       | 12.42497   | 78.08753  | 7.4| 0.33      | 68.3     | 4.5      | 27.2     | SCL            | 1.4         | 38       | 6.2       | 7         | 220         | 50          | 326         |
| V34       | 12.42492   | 78.10754  | 7.2| 0.48      | 66.05    | 6.25     | 27.7     | SCL            | 1.4         | 39       | 3.1       | 5.5       | 279         | 77          | 452         |
| V35       | 12.40844   | 78.04752  | 6.7| 0.3       | 60.3     | 9.5      | 30.2     | SCL            | 1.3         | 39       | 8.8       | 2.5       | 279         | 51          | 517         |
| V36       | 12.40494   | 78.0675   | 8  | 0.32      | 61.3     | 9.5      | 29.2     | SCL            | 1.4         | 64       | 4.6       | 4.5       | 191         | 35          | 352         |
| V37       | 12.40494   | 78.08753  | 6.3| 0.29      | 68.3     | 4.5      | 27.2     | SCL            | 1.5         | 28       | 4.6       | 7         | 204         | 9           | 196         |
| V38       | 12.40494   | 78.10756  | 6.6| 0.24      | 63.8     | 8        | 28.2     | SCL            | 1.5         | 37       | 5.8       | 8         | 232         | 44          | 112         |
| V39       | 12.38496   | 78.04752  | 7.3| 0.37      | 64.63    | 7        | 28.37    | SCL            | 1.4         | 47       | 12        | 8         | 198         | 27          | 303         |
| V40       | 12.38496   | 78.06746  | 6.6| 1.24      | 65.8     | 7        | 27.2     | SCL            | 1.4         | 26       | 4         | 7         | 260         | 53          | 186         |
| V41       | 12.38496   | 78.08748  | 7.9| 0.48      | 68.3     | 7        | 24.7     | SCL            | 1.4         | 33       | 3.9       | 5.5       | 326         | 29          | 338         |
| V42       | 12.38496   | 78.10747  | 6.9| 0.34      | 66.3     | 5.5      | 28.2     | SCL            | 1.4         | 38       | 3.7       | 3.5       | 229         | 22          | 225         |
| V43       | 12.3649    | 78.04755  | 7.3| 0.43      | 65.6     | 6        | 28.4     | SCL            | 1.5         | 70       | 0.6       | 5         | 116         | 21          | 119         |
| V44       | 12.36495   | 78.06753  | 7.9| 0.43      | 65.8     | 5        | 29.21    | SCL            | 1.4         | 108      | 11.1      | 3.5       | 238         | 38          | 198         |
| V45       | 12.36488   | 78.08751  | 7.4| 0.3       | 63.3     | 5        | 31.7     | SCL            | 1.3         | 33       | 2.7       | 9.5       | 201         | 21          | 372         |
| V46       | 12.36488   | 78.10754  | 7  | 0.27      | 66.8     | 5.6      | 27.6     | SCL            | 1.3         | 32       | 3.6       | 6.5       | 219         | 26          | 252         |
| V47       | 12.34478   | 78.06753  | 6.9| 0.65      | 61.3     | 8        | 30.7     | SCL            | 1.4         | 37       | 4         | 5         | 276         | 22          | 338         |
| V48       | 12.34497   | 78.08751  | 7.4| 0.2       | 70.8     | 6.5      | 22.7     | SCL            | 1.4         | 32       | 8.9       | 2.5       | 194         | 25          | 350         |

*EC – Electrical conductivity, BD - Buk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium*
### Table 3
The Physico-chemical properties of the Palacode firka soil samples from the Dharmapuri district in Tamil Nadu, India.

| Sample no | Latitude     | Longitude    | pH  | EC (dS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m²) | WHC (%) | OC (g/kg) | CaCO₃ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|--------------|--------------|-----|-----------|----------|----------|----------|----------------|-------------|----------|-----------|-----------|-------------|-------------|-------------|
| Pal49     | 12.34495     | 78.00751     | 7.5 | 0.37      | 63.8     | 7        | 29.2     | SCL            | 1.3         | 32       | 7.1       | 9         | 138         | 58          | 220         |
| Pal50     | 12.34502     | 78.02752     | 7.3 | 0.34      | 63.8     | 7        | 29.2     | SCL            | 1.4         | 39       | 8         | 14.5      | 194         | 52          | 192         |
| Pal51     | 12.34497     | 78.04752     | 7.6 | 0.57      | 68.3     | 5        | 26.7     | SCL            | 1.4         | 53       | 11.7      | 5.5       | 182         | 29          | 163         |
| Pal52     | 12.32205     | 77.94757     | 7.4 | 0.32      | 68.8     | 3.5      | 31.7     | SCL            | 1.2         | 61       | 4.9       | 13        | 235         | 14          | 517         |
| Pal53     | 12.32004     | 77.96755     | 7.7 | 0.25      | 68.8     | 4.5      | 26.7     | SCL            | 1.5         | 29       | 8.3       | 15        | 160         | 10          | 251         |
| Pal54     | 12.32494     | 77.98753     | 7.4 | 0.39      | 64.6     | 6.6      | 28.8     | SCL            | 1.3         | 22       | 9.5       | 21.5      | 201         | 57          | 235         |
| Pal55     | 12.32499     | 78.00742     | 7.5 | 0.31      | 67.02    | 6.15     | 26.83    | SCL            | 1.4         | 26       | 7.1       | 17        | 198         | 46          | 188         |
| Pal56     | 12.32484     | 78.02759     | 6   | 0.2       | 70.8     | 6.5      | 22.7     | SCL            | 1.4         | 24       | 8.8       | 13        | 226         | 36          | 132         |
| Pal57     | 12.32489     | 78.04752     | 7.8 | 0.33      | 67.6     | 4.57     | 27.83    | SCL            | 1.5         | 37       | 7.4       | 14        | 176         | 16          | 161         |
| Pal58     | 12.32513     | 78.06764     | 7.9 | 0.31      | 63.63    | 6.64     | 29.74    | SCL            | 1.5         | 36       | 6.3       | 8.5       | 211         | 26          | 287         |
| Pal59     | 12.30515     | 77.9676      | 7.3 | 0.36      | 63.3     | 5        | 31.7     | SCL            | 1.4         | 59       | 7         | 5         | 213         | 40          | 517         |
| Pal60     | 12.30491     | 77.98753     | 7.6 | 0.29      | 63.3     | 7        | 29.7     | SCL            | 1.4         | 56       | 8.3       | 15        | 201         | 13          | 191         |
| Pal61     | 12.30505     | 78.00742     | 7.2 | 0.25      | 68.8     | 4.5      | 26.7     | SCL            | 1.5         | 23       | 3.4       | 9.5       | 226         | 33          | 165         |
| Pal62     | 12.30496     | 78.02749     | 7.3 | 0.28      | 70.3     | 2        | 27.7     | SCL            | 1.5         | 31       | 9.7       | 4         | 254         | 33          | 273         |
| Pal63     | 12.30505     | 78.04757     | 7.6 | 0.32      | 71.3     | 4.5      | 24.2     | SCL            | 1.4         | 47       | 8.9       | 3.5       | 263         | 50          | 517         |
| Pal64     | 12.30486     | 78.08746     | 7.6 | 0.37      | 61.3     | 7        | 31.7     | SCL            | 1.3         | 60       | 6.6       | 11        | 166         | 25          | 448         |
| Pal65     | 12.30496     | 78.08748     | 7.5 | 0.25      | 65.3     | 4.5      | 30.2     | SCL            | 1.4         | 38       | 6.5       | 4.5       | 232         | 26          | 84          |
| Pal66     | 12.30491     | 78.10751     | 7.4 | 0.29      | 58       | 13       | 29       | SL             | 1.2         | 30       | 3.7       | 3         | 219         | 20          | 173         |
| Pal67     | 12.28512     | 77.9675      | 6.1 | 0.4       | 68.55    | 3.5      | 27.95    | SCL            | 1.3         | 72       | 4         | 8.5       | 210         | 39          | 280         |
| Pal68     | 12.28493     | 77.98743     | 7.3 | 0.3       | 73.8     | 2        | 24.2     | SCL            | 1.3         | 43       | 3         | 8.5       | 202         | 39          | 240         |
| Pal69     | 12.28498     | 78.00751     | 7.5 | 0.2       | 72.8     | 2       | 25.2     | SCL            | 1.4         | 63       | 15.5      | 12.5      | 194         | 25          | 172         |
| Pal70     | 12.28498     | 78.02744     | 7.5 | 0.26      | 72.5     | 2.8      | 24.7     | SCL            | 1.5         | 44       | 2.8       | 12.8      | 223         | 28          | 145         |
| Pal71     | 12.28498     | 78.04752     | 7.7 | 0.3       | 73.8     | 4.5      | 21.7     | SCL            | 1.5         | 38       | 3.7       | 13.5      | 223         | 26          | 118         |
| Pal72     | 12.28517     | 78.06764     | 8.3 | 0.27      | 65.8     | 7.2      | 27       | SCL            | 1.2         | 70       | 7.7       | 30        | 202         | 13          | 138         |
| Pal73     | 12.28498     | 78.08748     | 7.4 | 0.38      | 65.3     | 4.5      | 30.2     | SCL            | 1.4         | 12       | 4         | 2         | 201         | 17          | 125         |
| Pal74     | 12.2649      | 77.98751     | 7   | 0.6       | 68.05    | 4.5      | 27.5     | SCL            | 1.3         | 60       | 4         | 13.6      | 197         | 19          | 181         |

*EC – Electrical conductivity, BD - Bulk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium*
### Table 4
The physico-chemical properties of the Karimangalam firka soil samples from the Dharmapuri district in Tamil Nadu, India.

| Sample no | Latitude     | Longitude    | pH  | EC (dS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m³) | WHC (%) | OC (g/kg) | CaCO₃ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|--------------|--------------|-----|-----------|----------|----------|----------|---------------|------------|---------|-----------|-----------|-------------|-------------|-------------|
| K75       | 12.3449      | 78.10747     | 7.6 | 0.3       | 65.8     | 4.5      | 29.7     | SCL           | 1.3        | 38      | 8         | 1.5       | 295         | 50          | 286         |
| K76       | 12.3448      | 78.1275      | 7.3 | 0.34      | 66       | 6        | 28       | SCL           | 1.3        | 35      | 12        | 1.5       | 326         | 22          | 276         |
| K77       | 12.3449      | 78.1475      | 7.4 | 0.28      | 65.3     | 7        | 27.7     | SCL           | 1.5        | 32      | 8.3       | 4         | 257         | 53          | 117         |
| K78       | 12.34504     | 78.1785      | 6   | 0.14      | 66.3     | 8        | 25.7     | SCL           | 1.5        | 54      | 3.4       | 4.5       | 157         | 38          | 88          |
| K79       | 12.3249      | 78.0875      | 7.3 | 0.28      | 64.3     | 7        | 28.7     | SCL           | 1.3        | 43      | 5.1       | 4.6       | 226         | 44          | 201         |
| K80       | 12.3249      | 78.1075      | 7.3 | 0.29      | 63.3     | 9.5      | 27.2     | SCL           | 1.3        | 58      | 11        | 4         | 254         | 15          | 194         |
| K81       | 12.3248      | 78.1275      | 7.2 | 0.32      | 65.8     | 7        | 27.2     | SCL           | 1.3        | 42      | 2.5       | 10.5      | 263         | 15          | 237         |
| K82       | 12.3248      | 78.1475      | 7.1 | 0.25      | 68.3     | 4.5      | 27.2     | SCL           | 1.5        | 41      | 1.5       | 3.5       | 229         | 13          | 307         |
| K83       | 12.3248      | 78.1674      | 6   | 0.2       | 68.3     | 4.5      | 27.2     | SCL           | 1.5        | 22      | 3.4       | 5.5       | 254         | 11          | 30          |
| K84       | 12.3249      | 78.1874      | 7.5 | 0.71      | 63.3     | 7        | 29.7     | SCL           | 1.4        | 37      | 3.4       | 1         | 188         | 48          | 261         |
| K85       | 12.3250      | 78.1274      | 7.7 | 0.49      | 43.9     | 28.15    | 27.95    | CL            | 1.3        | 33      | 12        | 15.5      | 245         | 12          | 174         |
| K86       | 12.3250      | 78.1675      | 7   | 0.33      | 68.3     | 4.5      | 27.2     | SCL           | 1.3        | 40      | 10.6      | 4         | 304         | 10          | 229         |
| K87       | 12.32478     | 78.18751     | 7.9 | 0.5       | 65.8     | 6.5      | 27.7     | SCL           | 1.3        | 45      | 10.6      | 2.5       | 151         | 28          | 186         |
| K88       | 12.3249      | 78.2075      | 7.8 | 0.56      | 65.8     | 7        | 27.2     | SCL           | 1.3        | 35      | 13.6      | 1.5       | 279         | 27          | 168         |
| K89       | 12.2849      | 78.1674      | 7.4 | 0.37      | 65.3     | 4.5      | 30.2     | SCL           | 1.3        | 26      | 6.1       | 5         | 229         | 31          | 133         |
| K90       | 12.2849      | 78.1874      | 7.6 | 0.34      | 67.8     | 4.5      | 27.7     | SCL           | 1.5        | 27      | 5.5       | 6.5       | 215         | 28          | 151         |
| K91       | 12.2849      | 78.2074      | 7.6 | 0.29      | 63.8     | 5        | 26.2     | SCL           | 1.4        | 39      | 3.1       | 3         | 129         | 30          | 151         |
| K92       | 12.2649      | 78.1874      | 6   | 0.26      | 65.8     | 4.5      | 29.7     | SCL           | 1.3        | 15      | 8.2       | 4.5       | 241         | 25          | 201         |
| K93       | 12.2649      | 78.2074      | 7.2 | 0.33      | 66       | 6.4      | 27.7     | SCL           | 1.4        | 32      | 4         | 6         | 254         | 58          | 251         |
| K94       | 12.26491     | 78.2275      | 7.5 | 0.26      | 65.3     | 4.5      | 30.2     | SCL           | 1.3        | 23      | 3.9       | 6.5       | 235         | 17          | 257         |

*EC – Electrical conductivity, BD - Buk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium*
| Sample no | Latitude   | Longitude   | pH  | EC (dS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m$^3$) | WHC (%) | OC (g/kg) | CaCO$_3$ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|------------|-------------|-----|-----------|----------|----------|----------|----------------|---------------|----------|------------|--------------|--------------|--------------|--------------|
| Pul95     | 12.28488   | 78.1075     | 7.3 | 0.32      | 55       | 15.75    | 29.25    | SCL            | 1.3           | 19       | 11.4       | 6            | 174          | 47           | 272          |
| Pul96     | 12.2649    | 78.0674     | 6.4 | 0.22      | 70.8     | 2        | 27.2     | SCL            | 1.5           | 30       | 8          | 3            | 220          | 38           | 316          |
| Pul97     | 12.2649    | 78.0875     | 7.5 | 0.32      | 68.8     | 3.3      | 27.9     | SCL            | 1.4           | 27       | 2.8        | 7            | 211          | 22           | 153          |
| Pul98     | 12.2649    | 78.1075     | 7.4 | 0.35      | 64.12    | 8.5      | 27.38    | SCL            | 1.4           | 23       | 2.7        | 8.6          | 192          | 41           | 241          |
| Pul99     | 12.2449    | 78.0875     | 7.5 | 0.6       | 73.3     | 3.5      | 23.2     | SCL            | 1.5           | 40       | 2.5        | 12           | 213          | 62           | 399          |
| Pul100    | 12.2448    | 78.1074     | 7.7 | 0.5       | 65.8     | 7        | 27.2     | SCL            | 1.4           | 19       | 7.1        | 17           | 202          | 47           | 230          |
| Pul101    | 12.225     | 78.0875     | 7.3 | 0.4       | 68.3     | 5.5      | 26.2     | SCL            | 1.4           | 38       | 4.9        | 17           | 202          | 50           | 271          |
| Pul102    | 12.2249    | 78.1074     | 7.3 | 0.46      | 63.3     | 7.5      | 29.2     | SCL            | 1.4           | 37       | 5.2        | 11           | 191          | 39           | 144          |
| Pul103    | 12.2049    | 78.0874     | 7.2 | 0.37      | 70.8     | 6        | 23.2     | SCL            | 1.2           | 31       | 3.2        | 9            | 194          | 35           | 283          |
| Pul104    | 12.2049    | 78.1074     | 7.62| 0.54      | 70.8     | 6        | 23.2     | SCL            | 1.2           | 27       | 3.4        | 4            | 166          | 32           | 447          |
| Pul105    | 12.185     | 78.0875     | 7.9 | 0.33      | 68.3     | 6.4      | 25.3     | SCL            | 1.3           | 36       | 6.8        | 15           | 223          | 40           | 119          |
| Pul106    | 12.1849    | 78.1075     | 7.8 | 0.37      | 70.8     | 6        | 23.2     | SCL            | 1.4           | 28       | 5.8        | 8.5          | 166          | 26           | 283          |
| Pul107    | 12.1649    | 78.0875     | 7.8 | 0.59      | 63.3     | 7        | 29.7     | SCL            | 1.3           | 36       | 7.4        | 7            | 191          | 33           | 180          |

*EC – Electrical conductivity, BD - Buk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium*
Table 6
The Physico-chemical properties of the Periyanahalli firka soil samples from the Dharmapuri district in Tamil Nadu, India.

| Sample no | Latitude | Longitude | pH | EC (dS/m) | Sand (%) | Silt (%) | Clay (%) | Textural class | BD (Mg/m³) | WHC (%) | OC (g/kg) | CaCO₃ (%) | AVN (kg/ha) | AVP (kg/ha) | AVK (kg/ha) |
|-----------|----------|-----------|----|-----------|----------|----------|----------|----------------|-------------|----------|-----------|-----------|-------------|-------------|-------------|
| Pe 108    | 12.3048  | 78.1475   | 7.2| 0.58      | 41.5     | 29.3     | 29.2     | CL             | 1.3         | 86       | 5.2       | 4.1       | 251         | 26          | 250         |
| Pe 109    | 12.2849  | 78.1275   | 7.1| 0.29      | 46.3     | 27       | 26.7     | SCL            | 1.4         | 26       | 1.8       | 13        | 147         | 47          | 419         |
| Pe 110    | 12.2849  | 78.1475   | 7.4| 0.33      | 70.3     | 4.5      | 25.2     | SCL            | 1.4         | 59       | 8         | 5         | 226         | 69          | 291         |
| Pe111     | 12.2649  | 78.1274   | 7.1| 0.27      | 72.8     | 4.5      | 22.7     | SCL            | 1.7         | 26       | 2.5       | 13        | 193         | 48          | 310         |
| Pe112     | 12.2649  | 78.1475   | 7.8| 0.44      | 68.3     | 4.5      | 27.2     | SCL            | 1.3         | 29       | 4.2       | 4         | 241         | 21          | 288         |
| Pe113     | 12.2449  | 78.1675   | 6.7| 0.94      | 71.3     | 2        | 26.7     | SCL            | 1.4         | 82       | 3.8       | 7         | 232         | 51          | 192         |
| Pe114     | 12.2449  | 78.1275   | 7.2| 0.43      | 69.3     | 5.75     | 24.95    | SCL            | 1.5         | 23       | 4.6       | 15        | 197         | 49          | 290         |
| Pe115     | 12.2448  | 78.1475   | 7.0| 0.67      | 68.8     | 5.2      | 26       | SCL            | 1.4         | 30       | 2.5       | 9         | 206         | 42          | 233         |
| Pe116     | 12.2449  | 78.1675   | 7.9| 0.31      | 69.72    | 3.51     | 26.77    | SCL            | 1.4         | 31       | 1.8       | 10.5      | 182         | 56          | 123         |
| Pe117     | 12.2448  | 78.1874   | 7.6| 0.23      | 68.3     | 4.5      | 27.2     | SCL            | 1.4         | 19       | 5.2       | 14        | 243         | 22          | 135         |
| Pe118     | 12.2449  | 78.2075   | 8.2| 0.38      | 68.3     | 4.5      | 27.2     | SCL            | 1.2         | 44       | 2.5       | 7         | 292         | 14          | 420         |
| Pe119     | 12.2249  | 78.1275   | 7.8| 0.29      | 66.14    | 5.91     | 27.95    | SCL            | 1.1         | 29       | 3         | 15.5      | 215         | 47          | 203         |
| Pe120     | 12.225   | 78.1474   | 7.5| 0.46      | 68.58    | 4.37     | 27.05    | SCL            | 1.2         | 32       | 1.8       | 9.5       | 194         | 50          | 336         |
| Pe121     | 12.2249  | 78.1675   | 7.9| 0.42      | 70.8     | 2        | 27.2     | SCL            | 1.2         | 39       | 8.6       | 4         | 163         | 63          | 517         |
| Pe122     | 12.2249  | 78.1874   | 7.2| 0.39      | 65.8     | 4.5      | 29.7     | SCL            | 1.5         | 27       | 7.4       | 17        | 257         | 53          | 177         |
| Pe123     | 12.2249  | 78.2074   | 7.2| 0.87      | 67.05    | 4.5      | 28.45    | SCL            | 1.3         | 36       | 5.5       | 8         | 135         | 24          | 149         |
| Pe124     | 12.205   | 78.1274   | 7.4| 0.53      | 68.47    | 5.95     | 25.58    | SCL            | 1.3         | 36       | 0.6       | 9.7       | 141         | 39          | 325         |
| Pe125     | 12.2049  | 78.1475   | 7.4| 0.49      | 68.5     | 5.2      | 26.3     | SCL            | 1.2         | 34       | 2.5       | 9.6       | 167         | 44          | 330         |

*EC – Electrical conductivity, BD - Buk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium
Table 7
Descriptive statistics of the soil sample parameters of the six firkas in the Dharmapuri district of Tamil Nadu, India.

| Parameter       | Minimum | Maximum | Mean  | Std. Dev. | CV    | Skewness | Kurtosis |
|-----------------|---------|---------|-------|-----------|-------|----------|----------|
| pH              | 6       | 8.3     | 7.4   | 0.44      | 0.04  | -1.20    | 2.01     |
| EC (dS/m)       | 0.14    | 1.3     | 0.34  | 0.18      | 0.02  | 2.52     | 8.62     |
| Sand (%)        | 41.5    | 73.8    | 65.8  | 4.75      | 0.52  | -2.41    | 10.01    |
| Silt (%)        | 2       | 29.3    | 5.75  | 3.98      | 0.44  | 4.09     | 20.35    |
| Clay (%)        | 21.7    | 32.2    | 27.7  | 2.17      | 0.24  | -0.36    | 0.17     |
| BD (Mg/m³)      | 1.1     | 1.7     | 1.4   | 0.09      | 0.01  | 0.18     | 0.14     |
| WHC (%)         | 12      | 108     | 36    | 14.97     | 1.66  | 1.51     | 3.65     |
| OC (g/kg)       | 0.2     | 13.6    | 5.2   | 3.12      | 0.34  | 0.51     | -0.42    |
| CaCO₃ (%)       | 1       | 30      | 6.5   | 4.69      | 0.52  | 1.48     | 3.59     |
| AVN (kg/ha)     | 116     | 332     | 223   | 45.39     | 5.04  | -0.007   | -0.05    |
| AVP (kg/ha)     | 3       | 77      | 33    | 14.60     | 1.62  | 0.35     | -0.38    |
| AVK (kg/ha)     | 65      | 517     | 225   | 106.03    | 11.78 | 0.81     | 0.20     |

*EC – Electrical conductivity, BD - Bk density, WHC – Water holding capacity, OC – Organic carbon, AVN-Available nitrogen, AVP-Available phosphorus, AVK-Available potassium

Fig. 1. Study area and soil sample’s locations
Fig. 2. Spatial distribution maps of (A) Soil pH, (B) Soil EC, (C) Bulk density, (D) Water holding capacity.
Fig. 3. Spatial distribution maps of (E) Sand content, (F) Silt content, (G) Clay content, (H) Organic carbon.
Fig. 4. Spatial distribution maps of (I) Available Nitrogen, (J) Available Phosphorus, (K) Available Potassium, (L) Calcium Carbonate.
2. Data, Experimental Design, Materials and Methods

2.1. Data

➢ The physical and chemical characteristics of surface soil samples including pH, EC (dS/m), sand (%), silt (%), clay (%), BD (Mg/m³), and WHC (%), OC (g/kg), CaCO₃ (%) and available NPK (kg/ha) in the six selected firkas of Dharmapuri district were analyzed.
➢ The sampling locations are illustrated in Fig. 1 and the detailed soil characteristics are presented in Table 1–6.
➢ The data presented in the tables were based on the laboratory investigation.

3. Experimental Design

3.1. Study area description

The study area comprises six firkas namely Marandahalli, Vellichandai, Palacode, Karimangalam, Pulikarai, and Periyanahalli are located in the Dharmapuri district (Fig. 1), which covers latitudes between 11°45’ and 12°15’N and longitudes between 77°30’ and 78°30’E, encompassing approximately 482 km² [1]. Regarding the climate, the hottest period of the study area was March to May, with maximum temperature of 38°C and minimum temperature is about 17°C which was recorded in January. The mean annual rainfall ranged from 900 to 1200 mm, through southwest and northeast monsoons. The study area is occupied by diverse range of igneous and metamorphic rocks.

3.2. Soil sample collection and laboratory analysis

The soil samples were collected between February and April, 2021. A Garmin 76 CSx Global Positioning Systems (GPS) device was used to record the exact soil sample’s locations. The soil samples were taken from the plough layer after the surface litter was removed; a total of 125 samples were collected. At each sampling point, a 15-cm deep ‘v’-shaped cut was made using a spade, soil was collected from each side. The soil samples were air-dried and pulverized using a wooden mallet. The samples were sieved using a 2-mm sieve and packed in plastic bags or air tight containers. Furthermore, the soil samples were analyzed for pH [2], electrical conductivity [2], soil separates [3], bulk density [2], water-holding capacity [4], organic carbon [5], calcium carbonate [6], available N [7], available P [8], and available K [9], and the data analyzed statistically to remove outlier values. The analyzed data are presented in the table format.

4. Spatial Variability Map Preparation

A spatial variability map of the study area was generated using the kriging method in the ArcGIS 10.4 software [10]. The kriging technique was used to underestimate the lower values and exaggerate larger values by applying a smooth model of spatial variability to the dataset and limiting its fitting errors. Using the kriging method, a smooth surface was created by reducing the errors generated by variance in the fit of the model to each neighborhood. The kriged surface was generalized for all the parameters by sub-setting the mean of the surrounding pixels and substituted in the sampled point. The variance error was used to detect issues in the sample point, model parameters, and local neighborhood design. Before using the ordinary kriging method, the semi variance was calculated to identify the interpolation model. Semi variance was
calculated using the equation below, as follows:

$$\gamma(h) = \frac{1}{2|N(h)|} + \sum_{N(h)} \left( Z(x_i) - Z(x_j) \right),$$

where the number of pairs parted by distance is indicated by N(h), and Z(xi) and Z(xj) represent Z in the xi and xj positions, respectively.

The soil physico-chemical data were converted into shape file and kriged to identify soil characteristic of unknown location. The spatial variability maps are presented in Figs. 2, 3 and 4.

**Ethics Statement**

All the authors declare that there is no ethical statement or clearance required for the presented data.

**CRediT Author Statement**

S. Sathiyamurthi: Conceptualization, Methodology, Data analysis and manuscript reviewing and editing; M. Ramya: Lab analysis, data curation, and manuscript writing.

**Declaration of competing Interest**

On behalf of all authors, there is no conflict of interest.

**Data Availability**

raw data article on the physico-chemical properties of soil from six firkas in Dharmapuri district, Tamil Nadu, India (Original data) (Mendeley Data).

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