Supplementary Material

# Supplementary Tables

Table S1. Physicochemical characteristics of surface (0-20cm) soils.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Field | Clay | Silt | Sand | MC | SOM | pH | EC | H2O-PCol | CA-PCol | M3-PCol | M3-Ca | M3-K | M3-PICP | M3-Fe | M3-Al | Al;Fe | PSI | SPSC-1 | SPSC-2 |
| ---------------------%---------------- | - | μScm-1 | ----------------------------------------------------mg kg-1---------------------------------------- | Ratio | % | mg kg-1 |
| F1 | 20.7 | 52.4 | 26.9 | 49.7 | 10.6 | 6.9 | 238 | 0.7 | 67.4 | 15.6 | 3598 | 129 | 20.7 | 215 | 1380 | 13.32 | 1.2 | 150 | 218 |
| F2 | 20.7 | 50.1 | 29.2 | 55.4 | 12.4 | 6.6 | 183 | 0.7 | 110.4 | 22.4 | 2753 | 281 | 28.1 | 192 | 1478 | 15.99 | 1.6 | 152 | 224 |
| F3 | 16.7 | 53.7 | 29.6 | 42.0 | 12.7 | 6.6 | 273 | 1.1 | 111.4 | 25.6 | 3098 | 243 | 30.6 | 150 | 1344 | 18.55 | 1.9 | 132 | 197 |
| F4 | 18.7 | 55.7 | 25.6 | 66.4 | 15.0 | 6.2 | 243 | BDL | 103.5 | 26.8 | 2892 | 124 | 32.2 | 225 | 1327 | 12.23 | 2.0 | 133 | 199 |
| F5 | 16.7 | 51.7 | 31.6 | 44.9 | 12.7 | 6.5 | 239 | 0.9 | 147.7 | 42.5 | 2958 | 264 | 46.4 | 197 | 1362 | 14.37 | 2.8 | 121 | 188 |
| F6 | 18.7 | 52.1 | 29.2 | 44.9 | 12.4 | 6.4 | 197 | 1.0 | 147.2 | 38.8 | 2485 | 186 | 41.5 | 184 | 1404 | 15.82 | 2.4 | 130 | 198 |
| F7 | 20.7 | 51.2 | 28.2 | 41.2 | 9.1 | 6.6 | 347 | 1.9 | 383.9 | 123.3 | 3297 | 359 | 118.0 | 260 | 1338 | 10.69 | 7.0 | 50 | 117 |
| F8 | 16.7 | 53.2 | 30.2 | 48.8 | 11.3 | 6.6 | 230 | 1.0 | 131.2 | 33.5 | 2931 | 261 | 37.8 | 209 | 1321 | 13.10 | 2.3 | 125 | 191 |
| F9 | 14.7 | 51.9 | 33.4 | 69.3 | 15.8 | 6.7 | 280 | BDL | 119.4 | 27.8 | 3894 | 177 | 35.4 | 199 | 1328 | 13.83 | 2.2 | 128 | 194 |
| F10 | 20.0 | 52.4 | 27.6 | 39.4 | 10.6 | 6.2 | 166 | 0.8 | 165.2 | 40.9 | 2105 | 109 | 40.6 | 196 | 1396 | 14.75 | 2.4 | 131 | 199 |
| F11 | 16.0 | 42.4 | 41.6 | 59.8 | 16.3 | 6.2 | 190 | 1.2 | 114.1 | 33.5 | 2187 | 130 | 41.3 | 190 | 1410 | 15.40 | 2.4 | 131 | 200 |
| F12 | 18.0 | 46.4 | 35.6 | 39.2 | 10.2 | 6.4 | 234 | 0.8 | 158.3 | 46.0 | 2850 | 177 | 49.4 | 199 | 1299 | 13.53 | 3.1 | 111 | 175 |
| F13 | 18.0 | 45.2 | 36.9 | 35.1 | 9.2 | 6.3 | 166 | 0.9 | 247.5 | 62.1 | 2094 | 165 | 59.9 | 210 | 1367 | 13.52 | 3.6 | 109 | 176 |
| F14 | 19.0 | 46.2 | 34.9 | 39.6 | 12.2 | 6.0 | 240 | BDL | 77.4 | 12.8 | 2322 | 54 | 17.3 | 178 | 1444 | 16.86 | 1.0 | 158 | 229 |
| F15 | 20.0 | 44.4 | 35.6 | 42.3 | 10.9 | 6.3 | 297 | 0.8 | 187.3 | 40.2 | 2164 | 306 | 42.7 | 165 | 1453 | 18.31 | 2.4 | 133 | 204 |
| F16 | 22.0 | 44.4 | 33.6 | 42.2 | 12.1 | 6.5 | 240 | 0.8 | 119.6 | 36.5 | 2584 | 186 | 40.5 | 190 | 1444 | 15.73 | 2.3 | 136 | 206 |
| F17 | 20.0 | 50.4 | 29.6 | 66.0 | 12.9 | 5.0 | 88 | BDL | 18.1 | 1.0 | 447 | 114 | 6.8 | 219 | 1949 | 18.43 | 0.3 | 229 | 323 |
| F18 | 15.0 | 46.2 | 38.9 | 53.5 | 15.3 | 5.6 | 322 | 1.4 | 366.4 | 117.5 | 2051 | 276 | 130.7 | 162 | 1513 | 19.38 | 7.2 | 52 | 125 |
| F19 | 13.0 | 46.2 | 40.9 | 51.4 | 14.6 | 6.4 | 419 | 1.2 | 55.9 | 21.9 | 3244 | 221 | 30.3 | 171 | 1177 | 14.27 | 2.1 | 114 | 172 |
| F20 | 16.7 | 53.6 | 29.8 | 83.6 | 20.0 | 6.1 | 338 | 0.8 | 157.6 | 26.6 | 2713 | 114 | 34.5 | 159 | 1482 | 19.29 | 1.9 | 145 | 216 |
| F21 | 16.7 | 43.6 | 39.8 | 40.8 | 12.1 | 6.1 | 137 | 0.8 | 382.9 | 87.1 | 2221 | 166 | 86.6 | 237 | 1509 | 13.20 | 4.6 | 100 | 174 |
| F22 | 18.7 | 43.6 | 37.8 | 36.9 | 11.7 | 6.2 | 262 | 1.1 | 365.2 | 94.0 | 2338 | 206 | 94.0 | 197 | 1474 | 15.50 | 5.2 | 86 | 158 |
| F23 | 16.7 | 63.6 | 19.8 | 70.4 | 9.2 | 6.1 | 175 | 0.5 | 88.3 | 39.4 | 1910 | 76 | 54.9 | 364 | 1092 | 6.22 | 3.8 | 91 | 149 |
| Average | 18.0 | 49.6 | 32.4 | 52.4 | 12.6 | 6.3 | 239 | 1.0 | 166.3 | 44.2 | 2571 | 188 | 48.7 | 203 | 1404 | 14.88 | 2.8 | 123 | 193 |
| STD | 2.3 | 5.0 | 5.5 | 17.5 | 2.6 | 0.4 | 75 | 0.3 | 108.3 | 32.0 | 701 | 78 | 30.8 | 44 | 155 | 3.00 | 1.7 | 34 | 40 |
| Median | 18.0 | 50.4 | 31.6 | 44.9 | 12.2 | 6.3 | 239 | 0.9 | 131.2 | 36.5 | 2584 | 177 | 40.6 | 197 | 1396 | 14.75 | 2.4 | 130 | 197 |

Moisture content (MC), soil organic matters (SOM), electrical conductivity (EC); *H2O-P*Col*, CA-P*Col*, and M3-P*Col *represent soluble reactive P determined in deionized water, 1% citric acid, and Mehlich-3 extraction followed by ascorbic acid colorimetric analysis;* M3-Ca, M3-K, M3-P, M3-Fe, and M3-Al are calcium (Ca), potassium (K), phosphorus (P), iron (Fe), and aluminum (Al) analysed by ICP-OES in Mehlich-3 (M3) extract, P saturation index (PSI), soil P sorption capacity (SPSC-1 and SPSC-2 represent agronomic and environmental purposes, respectively), below the detection limit (BDL) of 0.01 mg P kg-1.

Table S2. Physicochemical characteristics of subsurface (20-40cm) soils.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Field | Clay | Silt | Sand | MC | SOM | pH | EC | H2O-PCol | CA-PCol | M3-PCol | M3-Ca | M3-K | M3-PICP | M3-Fe | M3-Al | Al:Fe | PSI | SPSC-1 | SPSC-2 |
| ---------------------%---------------- | - | μScm-1 | -----------------------------------------------mg kg-1---------------------------------------- | ratio | % | mg kg-1 |
| F1 | 16.7 | 40.1 | 43.2 | 38.0 | 8.5 | 6.9 | 130 | BDL | 48.2 | 3.8 | 2207 | 34 | 6.5 | 189 | 1650 | 18.14 | 0.3 | 193 | 273 |
| F2 | 14.7 | 37.7 | 47.6 | 36.1 | 8.9 | 6.4 | 159 | BDL | 78.6 | 6.1 | 1559 | 60 | 8.8 | 144 | 1809 | 26.00 | 0.4 | 207 | 293 |
| F3 | 14.7 | 37.7 | 47.6 | 32.7 | 9.0 | 6.6 | 162 | BDL | 82.7 | 12.8 | 1857 | 45 | 15.7 | 108 | 1613 | 30.90 | 0.8 | 176 | 252 |
| F4 | 12.7 | 41.7 | 45.6 | 37.0 | 10.7 | 6.2 | 83 | 0.7 | 68.6 | 6.6 | 1437 | 39 | 9.5 | 186 | 1677 | 18.68 | 0.5 | 193 | 274 |
| F5 | 14.7 | 41.7 | 43.6 | 34.9 | 10.2 | 6.6 | 148 | BDL | 90.1 | 12.8 | 1975 | 81 | 15.1 | 146 | 1593 | 22.70 | 0.8 | 176 | 252 |
| F6 | 16.7 | 54.4 | 28.9 | 38.9 | 10.8 | 6.4 | 151 | BDL | 117.3 | 14.9 | 2193 | 77 | 17.8 | 168 | 1602 | 19.80 | 0.9 | 175 | 253 |
| F7 | 18.7 | 48.8 | 32.5 | 36.0 | 10.1 | 6.6 | 331 | 0.9 | 314.4 | 82.5 | 2936 | 239 | 78.7 | 207 | 1406 | 14.08 | 4.6 | 94 | 163 |
| F8 | 15.7 | 50.2 | 34.2 | 42.3 | 12.0 | 6.6 | 163 | BDL | 119.0 | 22.6 | 2628 | 105 | 25.5 | 189 | 1388 | 15.22 | 1.5 | 144 | 212 |
| F9 | 12.7 | 35.2 | 52.2 | 37.0 | 10.1 | 6.5 | 125 | BDL | 60.6 | 5.1 | 1675 | 52 | 8.6 | 137 | 1786 | 27.04 | 0.4 | 204 | 289 |
| F10 | 16.0 | 40.4 | 43.6 | 33.4 | 7.2 | 6.3 | 100 | BDL | 144.0 | 30.2 | 1538 | 105 | 30.9 | 175 | 1515 | 17.96 | 1.7 | 153 | 226 |
| F11 | 14.0 | 36.4 | 49.6 | 39.4 | 8.5 | 6.4 | 80 | BDL | 61.1 | 8.6 | 814 | 28 | 12.1 | 136 | 1675 | 25.47 | 0.6 | 188 | 268 |
| F12 | 16.0 | 41.2 | 42.9 | 32.4 | 10.3 | 6.2 | 196 | BDL | 126.0 | 22.3 | 2100 | 64 | 24.0 | 144 | 1482 | 21.28 | 1.3 | 154 | 226 |
| F13 | 16.0 | 43.2 | 40.9 | 29.3 | 8.8 | 6.3 | 126 | BDL | 185.0 | 47.5 | 1595 | 66 | 46.8 | 191 | 1506 | 16.39 | 2.6 | 137 | 210 |
| F14 | 15.0 | 42.2 | 42.9 | 35.6 | 11.3 | 5.9 | 164 | BDL | 60.3 | 4.9 | 1584 | 33 | 8.3 | 128 | 1667 | 26.92 | 0.4 | 190 | 270 |
| F15 | 14.0 | 36.4 | 49.6 | 31.7 | 9.0 | 6.2 | 228 | BDL | 138.6 | 28.5 | 1426 | 109 | 29.7 | 125 | 1603 | 26.66 | 1.6 | 161 | 238 |
| F16 | 18.0 | 42.4 | 39.6 | 37.9 | 9.4 | 6.5 | 172 | 0.7 | 101.2 | 14.2 | 2111 | 92 | 18.1 | 151 | 1619 | 22.29 | 0.9 | 176 | 254 |
| F17 | 17.0 | 42.2 | 40.9 | 34.2 | 7.9 | 5.1 | 50 | BDL | 37.6 | 1.9 | 98 | 48 | 6.2 | 120 | 2169 | 37.43 | 0.2 | 250 | 352 |
| F18 | 17.0 | 40.2 | 42.9 | 39.9 | 10.0 | 5.7 | 175 | 0.9 | 200.6 | 73.0 | 1499 | 140 | 78.3 | 116 | 1587 | 28.40 | 4.1 | 110 | 186 |
| F19 | 19.0 | 54.9 | 26.2 | 30.1 | 9.1 | 6.4 | 190 | 0.9 | 24.4 | 9.2 | 1903 | 78 | 13.8 | 178 | 1359 | 15.81 | 0.8 | 152 | 218 |
| F20 | 18.7 | 47.6 | 33.8 | 49.5 | 13.5 | 5.8 | 135 | BDL | 67.1 | 5.6 | 801 | 34 | 9.5 | 110 | 1731 | 32.52 | 0.5 | 195 | 277 |
| F21 | 13.7 | 36.6 | 49.8 | 28.8 | 7.6 | 6.1 | 83 | 0.2 | 289.1 | 31.5 | 1257 | 77 | 31.9 | 188 | 1782 | 19.69 | 1.5 | 183 | 269 |
| F22 | 15.7 | 38.6 | 45.8 | 30.0 | 8.8 | 6.1 | 146 | 0.4 | 247.5 | 47.1 | 1541 | 95 | 47.0 | 196 | 1656 | 17.53 | 2.3 | 154 | 234 |
| F23 | 12.7 | 51.6 | 35.8 | 24.1 | 2.7 | 6.0 | 61 | 0.2 | 27.5 | 10.9 | 490 | 24 | 14.8 | 296 | 1147 | 8.03 | 1.0 | 133 | 192 |
| Average | 15.6 | 42.7 | 41.7 | 35.2 | 9.3 | 6.3 | 146 | 0.6 | 116.9 | 21.9 | 1618 | 75 | 24.2 | 162 | 1610 | 22.13 | 1.3 | 170 | 247 |
| STD | 1.9 | 5.8 | 7.0 | 5.3 | 2.1 | 0.4 | 60 | 0.3 | 80.9 | 21.9 | 650 | 47 | 20.7 | 42 | 196 | 6.79 | 1.1 | 34 | 41 |
| Median | 15.7 | 41.7 | 42.9 | 35.6 | 9.1 | 6.3 | 148 | 0.7 | 90.1 | 12.8 | 1584 | 66 | 15.7 | 151 | 1613 | 21.28 | 0.9 | 176 | 252 |

Moisture content (MC), soil organic matters (SOM), electrical conductivity (EC); *H2O-P*Col*, CA-P*Col*, and M3-P*Col *represent soluble reactive P determined in deionized water, 1% citric acid, and Mehlich-3 extraction followed by ascorbic acid colorimetric analysis;* M3-Ca, M3-K, M3-P, M3-Fe, and M3-Al are calcium (Ca), potassium (K), phosphorus (P), iron (Fe), and aluminum (Al) analysed by ICP-OES in Mehlich-3 (M3) extract, P saturation index (PSI), soil P sorption capacity (SPSC-1 and SPSC-2 represent agronomic and environmental purposes, respectively), below the detection limit (BDL) of 0.01 mg P kg-1.

*Table S3. Mineralogical composition of soil collected from D1 (0-20cm) and D2 (20-40cm) of SJRDC.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Field  | Depth (cm)  | Quartz  | Albite | Muscovite | Clinochlore | Kaolinite  | Berlinite  |
| F3 | 0-20 | ++ | + | + | + | + | + |
| F3 | 20-40 | ++ | + | ++ | + | + | - |
| F23 | 0-20 | ++ | + | ++ | + | + | - |
| F23 | 20-40 | ++ | + | ++ | + | + | - |

+++ abundant, ++ moderately abundant, + slightly abundant, - absent.

Table S4. The point P sorption capacity of soils collected from the surface (0-20 cm, n = 23) and subsurface (20-40 cm, n = 23) in 23 managed SJRDC fields. The soils were treated with 150 and 500 mg P L-1 initial concentrations. The values in the table are presented as mean and standard error (SE) (n = 3). Results reported as mg P g-1 of dry soil.

|  |  |  |
| --- | --- | --- |
| Field | Treated with 150 mg P L-1 | Treated with 500 mg P L-1 |
| 0-20 cm  | 20-40 cm  | 0-20 cm  | 20-40 cm  |
| Mean (SE) | Mean (SE) | Mean (SE) | Mean (SE) |
| F1 | 1.37 (0.005) | 1.41 (0.006) | 2.64 (0.082) | 3.15 (0.130 |
| F2 | 1.40 (0.001) | 1.42 (0.015) | 2.87 (0.064) | 2.93 (0.061) |
| F3 | 1.35 (0.006) | 1.33 (0.009) | 2.57 (0.032) | 2.76 (0.022) |
| F4 | 1.37 (0.004) | 1.39 (0.012) | 2.86 (0.075) | 2.99 (0.090) |
| F5 | 1.32 (0.006) | 1.32 (0.006) | 2.33 (0.067) | 2.80 (0.170) |
| F6 | 1.34 (0.002) | 1.36 (0.004) | 1.97 (0.039) | 2.87 (0.094) |
| F7 | 1.30 (0.002) | 1.28 (0.006) | 1.66 (0.037) | 2.51 (0.080) |
| F8 | 1.33 (0.000) | 1.32 (0.002) | 1.66 (0.210) | 2.46 (0.028) |
| F9 | 1.39 (0.002) | 1.38 (0.007) | 2.65 (0.173) | 2.75 (0.040) |
| F10 | 1.33 (0.001) | 1.28 (0.002) | 1.83 (0.018) | 2.26 (0.180) |
| F11 | 1.36 (0.004) | 1.34 (0.008) | 2.51 (0.075) | 2.79 (0.135) |
| F12 | 1.33 (0.004) | 1.32 (0.002) | 2.09 (0.039) | 2.74 (0.135) |
| F13 | 1.32 (0.004) | 1.29 (0.003) | 1.81 (0.144) | 2.38 (0.170) |
| F14 | 1.39 (0.009) | 1.41 (0.006) | 2.50 (0.093) | 3.11 (0.111) |
| F15 | 1.35 (0.007) | 1.27 (0.010) | 2.32 (0.044) | 2.08 (0.006) |
| F16 | 1.33 (0.006) | 1.33 (0.004) | 1.86 (0.082) | 2.79 (0.054 |
| F17 | 1.41 (0.001) | 1.34 (0.010) | 2.68 (0.241) | 2.56 (0.057) |
| F18 | 1.30 (0.001) | 1.25 (0.009) | 1.98 (0.096) | 2.01 (0.091) |
| F19 | 1.30 (0.006) | 1.23 (0.005) | 2.04 (0.224) | 1.90 (0.159) |
| F20 | 1.41 (0.001) | 1.36 (0.011) | 2.97 (0.041) | 2.89 (0.059) |
| F21 | 1.36 (0.019) | 1.29 (0.006) | 2.27 (0.061) | 2.09 (0.084) |
| F22 | 1.30 (0.001) | 1.27 (0.002) | 1.86 (0.059) | 1.98 (0.057) |
| F23 | 1.20 (0.004) | 1.16 (0.001) | 1.80 (0.078) | 0.58 (0.070) |
| Range  | 1.20-1.41 | 1.16-1.42 | 1.66-2.97 | 0.46-3.38 |
| Mean (SE) | 1.34 (0.010) | 1.32 (0.013) | 2.25 (0.087) | 2.50 (0.117) |
| Median | 1.34 | 1.32 | 2.27 | 2.74 |