*Short communication*

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# Soil-Site Suitability Evaluation for Commonly Growing Crops of Wardha District, Maharashtra

**R. M. Warhade, K. Karthikeyan*, P. Tiwary, D. Vasu, R.K. Naitam and N. Kumar**

[1] *ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur -440033*
[2] *Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola -444 104*

In the present study, seven typical pedons of Samudrapur block of Wardha district, Maharashtra were evaluated for their soil-site suitability to cotton, pigeon pea, soybean, sorghum, and chickpea. Soil resource inventory at 1:10,000 scale was developed by establishing the soil-landform relationship. Seven soil series were identified with phases from the eight landform units. Soil-site suitability evaluation for crops forms an essential part of land use planning programme. Several soil and site characteristics are used as parameters for assessing the suitability of land for crops in land evaluation exercise. As per the developed criteria Marda pedon was moderate to marginally suitable, Khursapar were marginally to not suitable, Sonegaon was marginally suitable, Tadgaon, Kora and Umri pedons were moderate to marginally suitable, Parda pedons were marginally to not suitable for above said five crops.

Soil is one of the most important natural resources. Its proper understanding in terms of its distribution on a landscape and knowledge of its nature and properties are essential for judiciousness, beneficial and optimal use on a sustainable basis. Indiscriminate use of land resources, in general, leads to their degradation and inturn, a decline in productivity. They need to be used according to their capacity to satisfy the needs of its inhabitants. This can be achieved through proper investigations of land resources and their scientific evaluation. Land suitability evaluation is the process of estimating the potential of land for land use planning (Sys

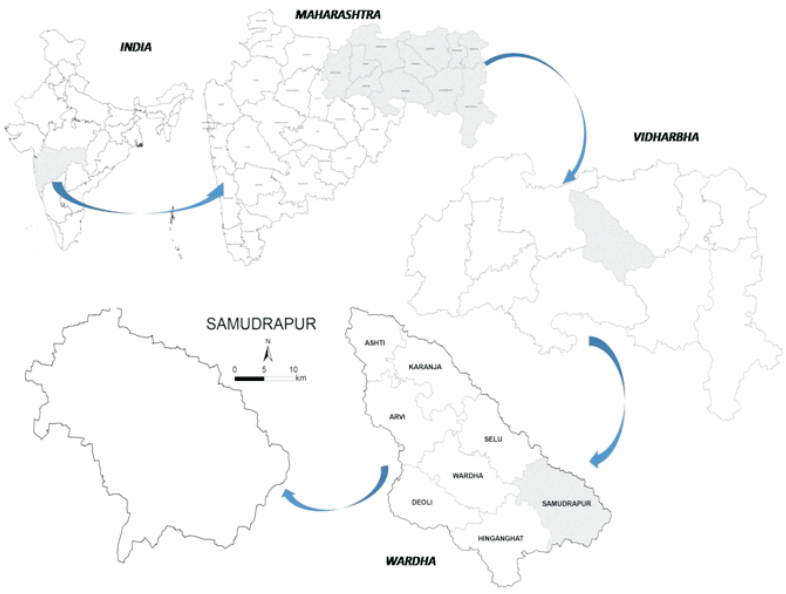


**Fig. 1.** Landform map of Samudrapur block, Wardha district, Maharashtra

*Corresponding author: (Email: k.karthikeyan@icar.gov.in)

*et al.* 1991). The information on soil-site suitability to crops is believed to improve the acceptability of the soil survey reports. Most of the evaluation exercises, particularly soil-site suitability evaluation, were FAO initiatives (FAO 1983). The land is given a suitability rating depending on how well its properties meet the requirement of the crop, and even not suitable depending upon the deviation of the land properties from the optimal growth requirement of the crops. Hence the present study deals with the suitability evaluation of the soils of the Wardha district for the major crops. This evaluation exercise may help the farmers in placing land under suitable crops.

The study site, Wardha district (20° 28' N and 21° 21' N; 78° 4' E and 79° 15' E) of Maharashtra (Fig 1) covers an area of 6,039 sq. km. The climate of the area is characterized by hot summers and a general dryness throughout the year except during the southwest monsoon. The average annual rainfall is1062.8 mm, out of which 85 per cent is received from June to September. But its distribution is erratic. (Aliza Pradhan *et al.* 2016).The major land use category in the tehsil is agriculture. *Kharif* and *rabi* are the two agricultural seasons. The major crops grown in *kharif* season are cotton, soybean, and pigeon pea as intercropping in both the crops. In the *rabi* season, wheat and gram are cultivated depending upon the availability of water. The average number of rainy days is spread around four months over 60 rainy days decreasing progressively to west 989.20 mm, indicating relative moist eastern and dry western sectors, and it is of regular nature. The annual temperature ranges from 25 °C to 27 °C (Thakre *et al.* 2012). After traversing, seven soil series were identified with phases from the eight landform units. The pedons were studied in the field for their morphological characteristics following the procedure outlined in Soil Survey Staff (1951). Horizon-wise soil samples collected from the typifying pedons were analysed for their physical and chemical properties following the standard procedures and soils were classified according to Soil Taxonomy (Soil Survey Staff 1999). These pedons were evaluated for their suitability using the limitation method regarding number and intensity of limitations (Sys *et al.* 1991). The landscape and soil requirements for these crops were matched with generated data at different limitation levels: no (0), slight (1), moderate (2), severe (3), very severe (4). The number and degrees of limitations suggested the suitability class of pedon for a particular crop (Sys *et al.* 1991). For soil-site suitability, the criteria suggested by Naidu *et al.* (2006) were followed.

As per the criteria outlined by Naidu *et al.* (2006), soils were evaluated for the major crops of the region for their soil suitability. The mean values of the relevant soil characteristics is given in table 1. The kind and degree of limitations of soils for growing crops in the Wardha district are presented in table 2. The soils with no or slight limitations were grouped under highly suitable (S1); the soils with moderate limitations under the moderately suitability class (S2); the soils with severe limitations under marginally suitable class (S3), and the soils with very severe limitations were categorised under non-suitable class (N). This method also identifies the dominant limitations that restrict crop growth in the sub-class symbol, such as wetness (w), physical soil characteristics (s), soil fertility (f) and soil salinity/alkalinity (n). The most limiting soil characteristics decide the suitability class and sub-classes. The Marda pedon is clay in texture, moderately alkaline in reaction (pH), low electrical conductivity (EC), very high cation exchange capacity (CEC), low to medium inorganic carbon content, and moderate in $CaCO_3$ content (Table 1).

Marda soils found moderately to marginally suitable for all the five major crops grown in the block. The major limitations are soil organic carbon (OC), soil texture and soil fertility characteristics. For all the five crops, organic carbon is a major limiting factor and the organic carbon status in soils can be improved by the application of farmyard manure, green manuring, biochar and inclusion of legumes in rotation Leelavathi *et al.* (2010). Khursapar soils are loamy sand in texture neutral in soil reaction, very low in organic carbon content, and mildly calcareous. These soils are marginally suitable for soybean, chickpea and not

suitable for cotton, pigeon pea and sorghum. The major limitations of these soil are soil depth, soil fertility and organic carbon. Shweta *et al.* (2010) also reported soil depth as the limitation for the cultivation of cotton, sorghum and soybean in soils of Khapri village of Nagpur district of Maharashtra. Sonegaon soils areclay, moderately alkaline, medium in organic carbon and moderately calcareous in nature. Sonegaon soils are marginally suitable for all the major crops grown in the region. Soil depth was the limiting factor for pigeon pea and cotton cultivation (Karthikeyan *et al*. 2019). Tadgaon soils are sandy clay loam in texture, neutral in soil reaction, and high in organic carbon content, with very high CEC. Tadgaon soils are highly suitable for sorghum and moderately suitable for soybean, cotton and chickpea and marginally suitable for pigeaon pea. The common limitations for all crops were texture, soil depth, AWC and organic carbon. Kora and Umri soils were moderate to very deep, clay in texture, moderately alkaline, medium to low inorganic carbon having the hazard of ESP. These soils are marginally suitable for cotton, pigeon pea, soybean, sorghum, and chickpea. Major limitations were the pH, sodicity and slight limitation of organic carbon for all the crops. For all crops organic carbon is a limiting factor. So, the organic carbon status in these soils can be improved by the application of farmyard manure, green manuring, and the inclusion of legumes in rotation. Parda soils are shallow, clayey, moderately alkaline, medium in organic carbon. These soils are marginally suitable for cotton, soybean, sorghum, and chickpea and not suitable for pigeon pea. The limitation for all common crops is pH, soil depth and AWC.

**Table 1**. Site and soil characteristics of pedons

| **Pedon** | **Drainage** | **Soil depth (cm)** | **Texture** | **$CaCO_3$ (g $kg^{-1}$)** | **CEC (cmol ($P^+$) $kg^{-1}$)** | **BS %** | **pH (1:2.5)** | **OC (g $kg^{-1}$)** | **EC dS $m^{-1}$** | **ESP %** |
|---|---|---|---|---|---|---|---|---|---|---|
| Marda | Mod. Well drained | 150 | C | 4.76 | 62.45 | 90.33 | 8.03 | 0.58 | 0.20 | 0.68 |
| Khursapar | Well drained | 38 | LS | 1.65 | 37.82 | 97.53 | 7.05 | 0.22 | 0.07 | 0.42 |
| Sonegaon | Well drained | 47 | C | 3.95 | 61.45 | 80.31 | 8.05 | 0.71 | 0.26 | 0.25 |
| Tadgaon | Well drained | 76 | SCL | 2.09 | 62.09 | 83.40 | 6.47 | 0.82 | 0.07 | 0.27 |
| Kora | Mod. Well drained | 150 | C | 3.18 | 55.86 | 99.55 | 8.69 | 0.37 | 0.38 | 14.09 |
| Umri | Well drained | 81 | C | 2.54 | 54.07 | 98.51 | 8.50 | 0.48 | 0.31 | 11.62 |
| Parda | Well drained | 36 | C | 4.41 | 59.63 | 99.13 | 8.19 | 0.61 | 0.24 | 2.04 |

**Table 2.** Soil–site suitability evaluation for commonly growing crops

| Pedon | Cotton | Pigeon pea | Soybean | Sorghum | Chickpea |
|---|---|---|---|---|---|
| Marda | S3f | S3f | S3f | S2f | S3f |
| Khursapar | Nsf | Nsf | S3sf | Nsf | S3sf |
| Sonegaon | S3sf | S3sf | S3sf | S3sf | S3sf |
| Tadgaon | S2sf | S3sf | S2sf | S1sf | S2sf |
| Kora | S3fnw . | S3fnw | S3fnw | S3fnw | S3fnw |
| Umri | S3sfn | S3sfn | S3sfn | S3sfn | S3sfn |
| Parda | S3sf . | Ns | S3sf | S3sf | S3sf |

Limitations: 1 – Slight; 2 – moderate; 3 – severe; N – Very severe

The Sys's method of soil-site suitability for major soil series of Samudrapur block, for major crops (cotton, pigeon pea, soybean, sorghum, and chickpea), are classified under marginally suitable (S3) to moderately suitable (S2) due to the severe limitations of pH, soil depth, AWC and slope. Khursapar series is exceptional, which falls under non-suitable (N) for most of the crop due to the shallow soil depth as a major limitation.

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