

## Research Article

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# Physical properties of irrigated soils of Dev Bhumi Dwarka district of Gujarat

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**Summary**

Thirty surface (0-15 cm) soil samples were collected from each talukas of Dev Bhumi Dwarka district viz., Kalyanpur, Dwarka, Khambhalia and Bhanvad. The physical characteristics of the soils were determined by using standard methods. The soils of Dev Bhumi Dwarka have overall values of bulk density, particle density, total porosity, MWHC and expansion varied from 1.21 to 1.57, 2.20 to 2.79 Mg m<sup>-3</sup>, 34.82 to 53.51, 32.03 to 55.34 and 6.52 to 22.65 per cent with mean value of 1.36, 2.44 Mg m<sup>-3</sup>, 44.09, 43.76 and 13.53 per cent, respectively.

**Key words :** Physical properties of soils, Bulk density, Particle density, Porosity, MWHC

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**Introduction**

Maintenance of favourable physical environment in soil is a prerequisite in soil management for the better plant growth in sustainable agriculture. The soil physical condition consisting of different parameters like bulk density, particle density, porosity, MWHC and expansion are the reflections of moisture content and genetic characteristics.

Many of these soils have suitable topography and physical as well as chemical conditions for irrigated agriculture, but are still under-utilized. Little is known about the morphology and physico-chemical properties of these soils. The soils of sand dune fields have been ignored because of being low in productivity and due to their weak manifestation of pedogenic development compared to the other soils. Such information for newly formed Dev Bhumi Dwarka district of Saurashtra region

of Gujarat was lacking. Therefore, an attempt has been made to study the some important physical properties of cultivated farmer's field of coastal Dev Bhumi Dwarka district.

**Resource and Research Methods**

Thirty surface soil samples (0-15 cm) were collected from each of the four talukas of Dev Bhumi Dwarka district, viz., Kalyanpur, Dwarka, Khambhalia and Bhanvad during May, 2015. Soil samples were air dried, ground carefully with a wooden mortar and pestle to break soil samples and passed through 2 mm sieve. The bulk density, particle density, total porosity were determined as per methods described by Richards (1954), while maximum water holding capacity and expansion were determined as per methods described by Chopra and Kanwar (2011) and Piper (1950), respectively.

Name of taluka	Bulk density (Mg m <sup>-3</sup> )	Particle density (Mg m <sup>-3</sup> )	Porosity (%)	MWHC (%)	Expansion (%)
Kalyanpur	1.21-1.52 (1.34)*	2.22-2.75 (2.44)	39.13-49.66 (44.97)	37.12-54.15 (45.31)	7.17-22.65 (14.44)
Dwarka	1.23-1.49 (1.39)	2.26-2.65 (2.48)	38.42-49.26 (43.95)	32.03-46.67 (38.46)	10.12-15.59 (12.07)
Khambhalia	1.24-1.57 (1.36)	2.22-2.62 (2.41)	34.82-48.95 (43.47)	34.27-54.13 (45.38)	6.52-21.95 (13.58)
Bhanvad	1.29-1.49 (1.37)	2.20-2.79 (2.44)	39.62-53.51 (43.97)	33.44-55.34 (45.81)	9.18-21.67 (14.18)
Overall	1.21-1.57 (1.36)	2.20-2.79 (2.44)	34.82-53.51 (44.09)	32.03-55.34 (43.76)	6.52-22.65 (13.53)

\* Values in parenthesis are mean values

## Research Findings and Discussion

The data on bulk density, particle density, porosity, MWHC and expansion obtained from the present investigation are presented in Table 1. The bulk density values is commonly used as an index of soil physical conditions. The bulk density values of the soils for the entire district ranged from 1.21 to 1.57 with a mean value of 1.36 Mg m<sup>-3</sup>. The lowest bulk density (1.21 Mg m<sup>-3</sup>) was recorded in a sample collected from Kalyanpur taluka. The data further revealed that the lowest (1.34 Mg m<sup>-3</sup>) and highest (1.39 Mg m<sup>-3</sup>) mean value of bulk density were recorded in Kalyanpur and Dwarka talukas, respectively. The overall particle density varied from 2.20 to 2.79 with mean value of 2.44 Mg m<sup>-3</sup>. The lowest (2.20 Mg m<sup>-3</sup>) and highest (2.79 Mg m<sup>-3</sup>) values were recorded in a samples collected from Bhanvad talukas. The data further revealed that the lowest (2.41 Mg m<sup>-3</sup>) and highest (2.48 Mg m<sup>-3</sup>) mean values of particle density were obtained in the soils of Khambhalia and Dwarka talukas, respectively. These results are in conforming with an earlier work repoted by Ogunwale and Isa (2004); Savalia *et al.* (2009); Shirgire (2012); Gandhi (2013) and Chauhan and Polara (2015).

The overall pore space ranged from 34.82 to 53.51 with a mean value of 44.09 per cent. The lowest (34.82 %) and highest (53.51 %) pore space value was recorded in a sample collected from Dwarka and Bhanvad talukas, respectively. The data further revealed that the lowest (43.47 %) and the highest (44.97 %) mean value were recorded in the samples collected from Khambhalia and Kalyanpur talukas. These finding are parallel to those of Savalia (2005) who suggested that the total porosity less than 40 per cent in the soils indicates the poor air-moisture regime. The overall MWHC of soils of Dev Bhumi Dwarka district varied from 32.03 to 55.34 with a mean value of 43.76 per cent. The lowest (32.03 %) and highest (55.34 %) MWHC values were recorded in the samples collected from Dwarka and Bhanvad talukas,

respectively. The lowest (38.46 %) and highest (45.81 %) mean values for MWHC were obtained in the soils of Dwarka and Bhanvad talukas, respectively. Similar results were reported for Savalia (2005) and Gandhi (2013). The overall expansion of soils of Dev Bhumi Dwarka varied from 6.52 to 22.65 with a mean value of 13.53 per cent. The lowest (6.52 %) and highest (22.65 %) values for expansion of soil were recorded in Khambhalia and Kalyanpur talukas, respectively. The lowest (12.07 %) and highest (14.44 %) mean values were observed in Dwarka and Kalyanpur talukas, respectively. These differences were due to the variation in depth, clay, silt and organic carbon content in soils (Thangasamy *et al.*, 2005). These results are in conformity with an earlier reportes of Ogunwale and Isa (2004); Savalia *et al.* (2009) and Chauhan and Polara (2015).

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