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Physical and chemical properties of soils in Banaskantha district under groundnut cultivation

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Abstract
The current investigation was aimed to study the physical and chemical properties of soils of Banaskantha district under groundnut cultivation, Gujarat, India. One hundred forty surface soil samples (0-15 cm) from various groundnut growing fields (Ten samples from each taluka) of Banaskantha were collected during May, 2018 by using multistage stratified random sampling. The collected soil samples were analyzed for various physical and chemical properties *viz.*, soil texture, electrical conductivity, soil reaction, organic carbon, available P_2O_5 and K_2O by adopting standard analytical procedure. The majority of soils of this tract were found loamy sand and their texture varied from sandy to sandy loam. The soils of Banaskantha district were neutral to mildly alkaline in reaction and no salinity hazards (more than 98 per cent samples were categorized under normal range of soil salinity having EC < 1.0 dSm^{-1}). The soils of Banaskantha district were low in organic carbon (> 83 per cent soil samples were categorized under low organic carbon content). On the basis of nutrient index, the soils of this region were found low in organic carbon (1.171), marginal in available phosphorus (1.821) and adequate in available potassium (2.221).

Keywords: Groundnut, Banaskantha, soil properties

Introduction
Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops of the world. India is the second largest producer of groundnut in the world. It is a species in the legume or "bean" family. The name *Arachis hypogaea* L. is derived from the Greek word *Arachis* means the legume and *hypogaea* means below ground. Groundnut is self-pollinated, allotetraploid legume with the chromosome number (2n = 40). The groundnut originated in South America from where, it spread to Asia, Africa, Sudan, Nigeria, U.S.A. and other parts of the world. It is commercially grown in more than hundred countries like India, China, U.S.A. and West Africa. Groundnut was probably introduced in India in the middle of nineteenth century on east coast of the South Aricot district in Tamil Nadu and large scale cultivation was taken up by the middle to late nineteenth century.

In India, groundnut is grown on 4.56 million hectare land and the production of 6.77 million tones with an average productivity of 1486 kg ha^{-1} (DAC and FW, 2016) [1]. Majority (80 per cent) of the groundnut area and 84 per cent of the production is confined to the states of Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. Among these, Gujarat ranks first both in area and production. During 2017-18 the Gujarat has the area under *kharif* and summer groundnut was 1.599 million ha and 0.063 million ha with the production of 3.77 and 0.13 M.T., respectively. The average productivity of groundnut was 2360 kg ha^{-1} in *kharif* and 2140 kg ha^{-1} in summer (DOA, 2018) [2]. Among various district of Gujarat, groundnuts is largely cultivated in Junagadh, Jamnagar, Rajkot, Amreli, Bhavnagar, Sabarkantha and Banaskantha. The hand-picked selected (HPS) groundnut is mainly exported from Saurashtra region of Gujarat, looking to the demand of the edible oil seeds, groundnut cultivation has extended to *rabi* and summer season depending upon the existing temperature regimes.

The yield potentially of summer groundnut as observed under North Gujarat Agro-climatic condition is more than 2 t ha^{-1} (Dodia, 1998) [3]. The productivity of summer groundnut is considerably higher than the *kharif* groundnut due to favourable condition such as high temperature, more sunshine hours, assured irrigation under controlled condition and comparatively low incidence of disease and pests (Sabale and Khuspe, 1986) [9].

Knowledge about the fertility status of the soils is of prime importance for the optimum use of land. Proper understanding of nutrients availability in soils and extent of their deficiency is prerequisite for efficient management of fertilizers to sustain the groundnut productivity. Soil surveying from groundnut field provides information regarding availability of nutrients in soil and presence of various forms which provides the basis for the fertilizer recommendations

for maximizing groundnut yields. Soil fertility provides the information for highlighting the nutrient needs. Obviously, a soil fertility status for a particular area can be proved highly beneficial in guiding the farmers, manufactures and planner in ascertaining the requirement of various fertilizers in a season / year and making projections for increasing requirement based on cropping pattern and intensity. Thus, present survey work was planned to conduct systematic soil survey and find out the soil physical and chemical properties of Banaskantha district under groundnut cultivation.

Materials and Methods

Geographically, Banaskantha district is situated in northern part of Gujarat and falls under North Gujarat Agro Climatic Zone. It lies between 23º 30' to 24º 45'N latitudes and 71º 03' to 73º 02' E longitudes with an elevation of 154.52 Mt. above the mean sea level. It is surrounded by Barmer and Sirohi area of Rajasthan in north, Patan district in south, Sabarkantha district in east and Kutch district in the west. The district comprises of 6.58 per cent of total geographical area of the state. The total geographical area of district is 10,400 sq. km. having 14 talukas. Geographically, it is divided into two main parts *i.e.* Northeast hilly portion and western plains.

The region is characterized by arid and semi arid climate with extreme cold winter, hot and dry summer, rainfall is erratic and uneven involving intermittent long dry spell and late onset and early withdrawal of monsoon. In general monsoon commences in the last week of June or first week of July and retreats by the middle of September. Most of the precipitation is received from South-West monsoon concentrating in the month of July and August. The average annual rainfall of the season is about 600 mm. The minimum temperature of season is observed in the month of December and January. The rising in temperature starts from middle of February and reaches maximum in the month of May. It ranges from 30º to 45º C.

Geological area has different types of geological formation from archean to recent alluvium. In general, the soils of Banaskantha district are sandy to sandy loam in texture, having very low organic matter with poor moisture retention capacity. The soils are highly prone to water as well wind erosion. Fertile alluvial soil type is found in middle part of the district *i.e.* Deesa, Dantiwada and Deodar talukas, while clay to clay loam soils are found in eastern part of the district *i.e.* Danta and Amirgadh talukas. Salt affected soils are also present in western part of Banaskantha *i.e.* Tharad, Vav, Suigam and Bhabhar talukas.

Collected 140 representative surfaces (0-15 cm) soil samples from groundnut growing fields of Banaskantha district, in which ten soil samples from each taluka of district were collected by using multistage stratified random sampling method (Singh *et al.*, 1982). The soil samples were drawn with the help of stainless steel auger. The collected soil samples were air dried in shade. The dried soil samples were ground with the help of wooden mortar and pestle and pass through 2.0 mm sieve. The prepared samples were stored in polyethylene lined cloth bags for detailed analysis. During the course of sample processing all the precautions were taken to avoid any contamination. The soil samples were brought to laboratory for further analysis. The prepared soil samples were analyzed for their various physicochemical properties *viz.*, mechanical analysis, soil reaction, electrical conductivity, organic carbon, available phosphorus and potassium. The standard analytical methods used for the analysis of soil samples are given in Table 1.

Results and Discussions

Physical and chemical properties of soil

Mechanical analysis

Mechanical analysis gives the percentage of sand, silt and clay fraction in soils and which are used for their textural classification. The data related to mechanical composition revealed that sand content in different soils of Banaskantha district was ranged between 78.50 to 95.00 per cent with a mean value of 88.22 per cent. The minimum and maximum sand content were found in soils of Deesa and Bhabhar taluka, respectively. Further the data indicated that maximum silt content (11.00 per cent) was recorded in soil of Kankrej taluka whereas, minimum silt content (2.50 per cent) was recorded in soils of Amirgadh, Bhabhar, Danta, Dantiwada, Deesa, Dhanera, Deodar, Lakhani and Palanpur talukas of Banaskantha with a mean value of 5.29 per cent. Clay content in soils of Banaskantha district ranged from 2.50 per cent to 13.00 per cent with a mean value of 6.49 per cent. Minimum clay content (2.50 per cent) was found in soils of Bhabhar, Danta and Vav talukas, while maximum clay (13.00 per cent) content was noted in soils of Deesa taluka. Similar results were obtained by Patel *et al.* (2011) [6] in the soils of Banaskantha district.

Based on the results obtained from the mechanical analysis of soil samples, out of 140 surface soil samples, one sample falls in sandy loam, fifty one samples in sandy and eighty eight samples under loamy sand category (Table 2). The soil texture of Banaskantha district ranged from sandy to sandy loam, but majority of soils are covered under loamy sand (62.85 per cent of total soils).

Soil Reaction (pH)

Soil reaction is one of the most important properties of soil because it controls the availability of nutrients, microbial activities and physical conditions of soil up to a great extent. Soil reaction indicates the activities of H^+ and OH^- ions in soil solutions. Data presented in Table 3 revealed that the overall pH of the soils varied from 6.81 to 7.90 with a mean value of 7.38. The lowest (6.81) pH was recorded in the soils of Benap village of Suigam taluka, whereas the highest value (7.90) was recorded in Salpura village of Deodar taluka. The lowest (7.21) and highest (7.55) mean values were noted in Suigam and Bhabhar talukas, respectively. The results of study indicated that the soils of Banaskantha district are alkaline in reaction. The relative high pH in these soils might be due to high degree of base saturation of Banaskantha soils. Similar results were noted by Patel *et al.* (2011) [6] for soils of Banaskantha district and Patel *et al.* (2017) [4] for soils of Gandhinagar district of Gujarat. Out of 140 samples, only one sample falls under moderately alkaline category, but remaining soils samples falls under neutral to mildly alkaline condition (Table 4). The percentage distribution of soil samples as indicated in Table 4 revealed that the 52.14 per cent soils samples falls under normal category, 47.14 per cent soil samples have mildly alkaline reaction and only one sample has moderately alkaline reaction.

Electrical conductivity

Electrical conductivity measures the total concentration of soluble salts. Overall, EC of soils in Banaskantha district ranged from 0.02 to 1.80 dSm^{-1} with a mean value of 0.24 dSm^{-1} (Table 3). The lowest (0.02 dSm^{-1}) EC value was recorded in Anapuranani village of Dhanera taluka, whereas the highest (1.80 dSm^{-1}) value was recorded in Khampa

village of Amirgadh taluka. The data further revealed that the lowest (0.10 dSm^{-1}) mean value was observed in soils of Deesa taluka and the highest (0.50 dSm^{-1}) mean value was registered in soils of Suigam taluka. The low EC of these soils might be due to high leaching of soils afforded by their light texture as well as high permeability of the soils. Similar findings were observed by Meena *et al.* (2006) for soils of Tonk district of Rajasthan, Patel *et al.* (2011) [6] for soils of Banaskantha district, Sutaria *et al.* (2016) [10] for soils of Rajkot district. Out of total 140 soil samples collected from groundnut growing field of Banaskantha district indicated that the majority (138) of the soil samples have EC value less than 1.0 dSm^{-1} and categorised under normal range of soluble salt but only two soil samples fall under slightly saline status (Table 4).

Organic Carbon

Soil organic carbon is considered as index of fertility. The data presented in Table 3 indicated that the majority of soil samples of Banaskantha district are low in organic carbon content. The overall organic carbon content of the district ranged from 0.02 to 0.83 per cent with a mean value of 0.39 per cent. The lowest organic carbon content (0.02 per cent) was recorded in Jasali village of Deodar taluka and the highest (0.83 per cent) content was in Deri village of Amirgadh taluka with a mean value of 0.32 per cent and 0.61 percent, respectively. Such low values for organic carbon content in the soils of Banaskantha district are expected due to arid and semi-arid climate. Most of the organic matter burnt at high temperature and it coupled with occasional addition of organic matter to the soils resulted in the soils of Banaskantha is poor in organic carbon. Similar results were obtained by Patel *et al.* (2016) [5] for soils of Patan district of Gujarat and Wagh *et al.* (2016) [13] for soils of Nagpur district of Maharashtra and Patel *et al.* (2017) [4] for soils of Gandhinagar district of Gujarat. Table 5 and 6 indicated that the majority (83.57 per cent) of the soil samples were categorised under low soil organic carbon content, whereas only 22 (15.71 per cent) samples belonged to medium soil organic carbon status and only one soil sample was categorised under high organic carbon content. The overall organic carbon content of the district is poor except the Amirgadh and Danta taluka which contain medium (0.61 and 0.52 per cent, respectively) organic carbon. The results are in close conformity with the findings of Vijayakumar *et al.* (2011a) [13] for soils of Nagapattinum taluka of Tamil Nadu.

Available P_2O_5

Talukawise range and mean values of available P_2O_5 are presented in Table 3. The available P_2O_5 content in soil samples of Banaskantha district varied widely from 5.2 to 99.5 kg ha^{-1} with a mean value of 37.42 kg ha^{-1}. The highest available phosphorus (99.5 kg ha^{-1}) was recorded in Khampa village of Amirgadh taluka whereas the lowest content (5.2 kg ha^{-1}) was obtained in Navapura village of Deodar taluka. The highest mean value of available P_2O_5 was found in Vadgam taluka (61.34 kg ha^{-1}) which was followed by Danta (60.24 kg ha^{-1}) taluka and the lowest mean value (15.24 P_2O_5kg ha^{-1}) was found in Vav taluka followed by Tharad (15.51 kg ha^{-1}) taluka. Looking to the nutrient index (Table 5) of available phosphorus in Banaskantha district was 1.821 and categorized in marginal category. The medium content of available phosphorus in these soils might be due to regular application of phosphatic fertilizers to realize the higher yields of principal crops of the region *i.e.* groundnut and castor. Similar results were observed by Polara *et al.*, (2006) [7] for soils of North West agro climatic zone of Gujarat, Rajput and Polara, (2012) for soils of Bhavnagar district of Gujarat and Patel *et al.*, (2016) for soils of Patan district of Gujarat. Out of total 140 soil samples, 28 (20.0 per cent) soil samples were categorized in high category, 59 soil samples (42.14 per cent) were medium in available phosphorus content and 53 soil samples (37.85 per cent) were fall an under low category (Table 6).

Table 1: Standard analytical methods used for the analysis of soil samples

Sr. No.	Parameter	Method	Reference
1.	Mechanical analysis	International pipette method	Piper (1950)
2.	pH	Potentiometric	Jackson (1973)
3.	EC	Conductometric	Jackson (1973)
4.	Organic carbon	Walkley and Black's wet digestion method	Jackson (1973)
5.	Available P_2O_5	Extraction with 0.5M $NaHCO_3$ (pH 8.5) Colorimetric	Olsen *et al*. (1954)
6.	Available K_2O	Extraction with 1N NH_4OAc (pH 7.0) Flame photometric	Jackson (1973)

Table 2: Classification of soils of Banaskantha district according to their texture

Sr. No	Taluka	No of samples	Sandy	Loamy sand	Sandy loam
1	Amirgadh	10	0	10	0
2	Bhabhar	10	7	3	0
3	Danta	10	3	7	0
4	Dantiwada	10	1	9	0
5	Deesa	10	2	7	1
6	Dhanera	10	6	4	0
7	Deodar	10	7	3	0
8	Kankrej	10	1	9	0
9	Lakhani	10	4	6	0
10	Palanpur	10	2	8	0
11	Suigam	10	5	5	0
12	Tharad	10	5	5	0
13	Vadgam	10	2	8	0
14	Vav	10	6	4	0
Total		140	51	88	1

Table 3: Taluka wise range and mean value of soil properties in surface soil samples of Banaskantha district

Sr. No.	Name of taluka	pH (1:2.5)	EC (dS m^{-1}) (1:2.5)	Sand (%)	Silt (%)	Clay (%)	OC (%)	Av. P_2O_5 (kg ha^{-1})	Av. K_2O (kg ha^{-1})
1	**Amirgadh**								
	Minimum	7.08	0.07	81.50	2.50	6.00	0.39	25.90	212.35
	Maximum	7.48	1.80	87.75	10.00	11.50	0.83	99.50	533.03
	Mean	7.36	0.44	85.03	6.10	8.88	0.61	48.34	349.80
2	**Bhabhar**								
	Minimum	7.21	0.15	87.50	2.50	2.50	0.24	24.60	184.13
	Maximum	7.89	0.39	95.00	6.75	7.50	0.74	54.30	464.22
	Mean	7.55	0.25	91.90	3.95	4.15	0.38	35.59	300.11
3	**Danta**								
	Minimum	7.05	0.17	85.25	2.50	2.50	0.44	29.30	125.13
	Maximum	7.48	0.36	91.50	5.00	10.50	0.68	95.70	351.86
	Mean	7.23	0.27	87.98	4.00	8.03	0.52	60.24	263.18
4	**Dantiwada**								
	Minimum	7.20	0.06	81.00	2.50	4.50	0.30	5.80	100.53
	Maximum	7.81	0.40	90.00	8.50	11.50	0.74	67.20	871.45
	Mean	7.36	0.19	85.95	6.18	7.88	0.44	24.34	278.36
5	**Deesa**								
	Minimum	7.15	0.06	78.50	2.50	6.00	0.38	19.40	235.20
	Maximum	7.35	0.14	90.00	8.50	13.00	0.59	84.00	340.84
	Mean	7.23	0.10	86.50	5.05	8.45	0.44	48.86	281.30
6	**Dhanera**								
	Minimum	7.08	0.02	88.00	2.50	3.50	0.21	22.00	117.20
	Maximum	7.48	0.31	92.00	6.00	7.50	0.71	55.60	329.15
	Mean	7.31	0.16	89.90	4.50	5.60	0.39	28.48	247.90
7	**Deodar**								
	Minimum	7.30	0.09	85.00	2.50	5.00	0.02	5.20	141.66
	Maximum	7.90	0.23	92.00	8.50	7.50	0.47	45.20	391.37
	Mean	7.48	0.16	89.80	4.35	5.85	0.32	19.65	289.86
8.	**Kankrej**								
	Minimum	7.42	0.07	82.00	5.00	5.00	0.33	9.00	194.61
	Maximum	7.77	0.22	90.00	11.00	8.50	0.44	60.80	335.72
	Mean	7.54	0.15	85.40	7.30	7.30	0.40	39.30	251.40
9	**Lakhani**								
	Minimum	7.30	0.28	88.00	2.50	3.50	0.30	14.20	197.70
	Maximum	7.50	0.45	91.50	7.00	7.50	0.47	62.00	288.69
	Mean	7.41	0.39	89.55	4.88	5.58	0.40	44.99	237.11
10	**Palanpur**								
	Minimum	7.10	0.08	86.50	2.50	5.00	0.18	28.40	163.70
	Maximum	7.88	0.19	90.00	7.50	7.50	0.45	67.20	318.26
	Mean	7.46	0.14	88.10	5.50	6.40	0.31	46.27	254.66
11	**Suigam**								
	Minimum	6.81	0.39	87.50	3.50	4.50	0.25	24.60	175.93
	Maximum	7.53	0.66	91.00	7.50	7.00	0.53	60.80	274.04
	Mean	7.21	0.50	89.35	5.00	5.65	0..35	36.46	217.53
12	**Tharad**								
	Minimum	7.33	0.11	87.50	3.00	4.00	0.20	6.50	107.39
	Maximum	7.51	0.25	92.00	7.50	6.00	0.38	20.70	271.22
	Mean	7.44	0.18	89.65	5.35	5.00	0.27	15.51	190.28
13	**Vadgam**								
	Minimum	7.30	0.05	82.00	3.00	5.00	0.27	34.90	150.31
	Maximum	7.59	0.38	90.00	9.50	12.50	0.48	85.30	278.75
	Mean	7.47	0.15	86.13	6.25	7.63	0.35	61.34	189.71
14	**Vav**								
	Minimum	7.08	0.08	86.50	5.00	2.50	0.15	6.50	133.06
	Maximum	7.48	1.21	92.50	8.50	5.50	0.47	27.10	271.22
	Mean	7.29	0.31	89.83	5.65	4.53	0.29	15.24	213.19
Banaskantha district									
Minimum		6.81	0.02	78.50	2.5	2.5	0.02	5.2	100.53
Maximum		7.90	1.80	95.00	11.0	13.00	0.83	99.50	871.45
Mean		7.38	0.24	88.22	5.29	6.49	0.39	37.42	254.55

Table 4: Percentage distribution of EC and pH of the soils of Banaskantha district

Name of Taluka	No. of Soil Samples	Electrical Conductivity (dSm^{-1})				Soil Reaction (pH)			
		Normal	Slightly saline	Saline	Highly saline	Slightly acidic	Neutral	Mildly alkaline	Moderately alkaline
		< 1.0	1.0-2.0	2.0-3.0	> 3.0	6.1-6.5	6.6-7.3	7.4-7.8	7.9-8.4
Amirgadh	10	90.0	10.0	0.00	0.00	0.00	50.0	50.0	00.0
Bhabhar	10	100	0.00	0.00	0.00	0.00	30.0	70.0	00.0
Danta	10	100	0.00	0.00	0.00	0.00	80.0	20.0	00.0
Deesa	10	100	0.00	0.00	0.00	0.00	80.0	20.0	00.0
Dantiwada	10	100	0.00	0.00	0.00	0.00	100.0	00.0	00.0
Dhanera	10	100	0.00	0.00	0.00	0.00	70.0	30.0	00.0
Deodar	10	100	0.00	0.00	0.00	0.00	30.0	60.0	10.0
Kankrej	10	100	0.00	0.00	0.00	0.00	0.00	100.0	00.0
Lakhani	10	100	0.00	0.00	0.00	0.00	50.0	50.0	00.0
Palanpur	10	100	0.00	0.00	0.00	0.00	50.0	50.0	00.0
Suigam	10	100	0.00	0.00	0.00	0.00	70.0	30.0	00.0
Tharad	10	100	0.00	0.00	0.00	0.00	30.0	70.0	00.0
Vadgam	10	100	0.00	0.00	0.00	0.00	20.0	80.0	00.0
Vav	10	90.0	10.0	0.00	0.00	0.00	70.0	30.0	00.0
District	**140**	**98.57**	**1.43**	**0.00**	**0.00**	**0.00**	**52.14**	**47.14**	**0.71**

Table 5: Nutrient index for the soils of Banaskntha district of Gujarat

Name of Taluka	No. of Soil Samples	Organic carbon			Available P_2O_5			Available K_2O		
		L	M	H	L	M	H	L	M	H
Amirgadh	10	2	7	1	2	5	3	0	4	6
Bhabhar	10	10	0	0	3	7	0	0	6	4
Danta	10	4	6	0	0	6	4	1	5	4
Dantiwada	10	9	1	0	7	2	1	2	5	3
Deesa	10	7	3	0	1	5	4	0	6	4
Dhanera	10	8	2	0	6	4	0	1	6	3
Deodar	10	10	0	0	9	1	0	0	6	4
Kankrej	10	9	1	0	3	3	4	0	6	4
Lakhani	10	10	0	0	1	7	2	0	9	1
Palanpur	10	10	0	0	0	7	3	0	6	4
Suigam	10	9	1	0	1	8	1	0	10	0
Tharad	10	10	0	0	10	0	0	1	9	0
Vadgam	10	10	0	0	0	4	6	0	10	0
Vav	10	9	1	0	10	0	0	1	9	0
District	140	117	22	1	53	59	28	6	97	37
Nutrient index		1.17			1.82			2.22		

Where, L=Low, M=Medium, H=High fertility class

Table 6: Per cent distribution of soil samples for organic carbon and macronutrients in different talukas of Banaskantha district

Name of Taluka	No. of Soil Samples	Organic carbon			Available P_2O_5			Available K_2O		
		L	M	H	L	M	H	L	M	H
Amirgadh	10	20.00	70.00	10.00	20.00	50.00	30.00	0.00	40.00	60.00
Bhabhar	10	90.00	10.00	0.00	30.00	70.00	0.00	0.00	60.00	40.00
Danta	10	40.00	60.00	0.00	0.00	60.00	40.00	10.00	50.00	40.00
Dantiwada	10	90.00	10.00	0.00	70.00	20.00	10.00	20.00	50.00	30.00
Deesa	10	70.00	30.00	0.00	10.00	50.00	40.00	0.00	60.00	40.00
Dhanera	10	80.00	20.00	0.00	60.00	40.00	0.00	10.00	60.00	30.00
Diyodar	10	100	0.00	0.00	90.00	10.00	0.00	0.00	60.00	40.00
Kankrej	10	90.00	10.00	0.00	30.00	30.00	40.00	0.00	60.00	40.00
Lakhani	10	100	0.00	0.00	10.00	70.00	20.00	0.00	90.00	10.00
Palanpur	10	100	0.00	0.00	0.00	70.00	30.00	0.00	60.00	40.00
Suigam	10	90.00	10.00	0.00	10.00	80.00	10.00	0.00	100	0.00
Tharad	10	100	0.00	0.00	100	0.00	0.00	10.00	90.00	0.00
Vadgam	10	100	0.00	0.00	0.00	40.00	60.00	0.00	10.00	0.00
Vav	10	90.00	10.00	0.00	100	0.00	0.00	10.00	90.00	0.00
District	140	83.57	15.71	0.71	37.85	42.14	20.00	4.28	69.28	26.42

Where, L=Low, M=Medium, H=High fertility class

Available K_2O

Talukawise range and mean values of available K_2O are given in Table 3. The available potassium content in soil varied widely from 100.53 to 871.45 K_2O kg ha^{-1} with an average value of 254.55 kg ha^{-1}. The highest available potassium (871.45 kg ha^{-1}) was recorded in Chodungri village of Dantiwada taluka and the lowest content (100.53 kg ha^{-1}) was also obtained in Gandh village of Dantiwada taluka. The highest mean value for available K_2O was found in Amirgadh taluka (349.80 kg ha^{-1}) and followed by Bhabhar taluka (300.11 kg ha^{-1}). The lowest mean value of available K_2O content in soil was found in Vadgam taluka (189.71 kg ha^{-1})

followed by Tharad taluka (190.28 kg ha^{-1}). The nutrient index (Table 5) of available potassium in soils of Banaskantha district was 2.214 and categorized in adequate category. The high available potassium content in these soils might be attributed to the prevalence of potassium rich minerals like feldspars and muscovite in parent material of the soil. Similar results were also obtained for salt affected soils of North-West agro climatic zone of Gujarat (Polara *et al.*, 2006) [7], Santalpur taluka in Patan district of North Gujarat (Vashi *et al.*, 2014) [11] and for soils of Patan district of Gujarat (Patel *et al.*, 2016) [5]. Looking to the percentage distribution of available potassium content in soil, out of 140 soil samples, 37 soil samples (26.42 per cent) were categorized in high category, 97 soil samples (69.28 per cent) were medium in available potassium content and six soil samples (4.28 per cent) falls under low category (Tables 6).

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