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Status of nutrients in the soil of beed Jhunjhunu (A reserve forest area of Rajasthan, India)

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Abstract

This Study was carried out on soil pH, EC, P, N and W H C of four sites and directions (East, West, North, and South) of Beed Jhunjhunu. The soils were alkaline in reaction and within the safer limits of electrical conductivity. These soils were not suitable for growth of plants due to low range in organic content, low to medium in available P, low range in available N and the most of the soils samples were low range in water holding capacity also.

Keywords: beed jhunjhunu, water holding capacity, alkaline, nitrogen, phosphorus

Introduction

Slightly higher EC in some soil samples indicates that accumulation & salts which may be due to restricted drainage and irrigation with poor quality water (Singh and Sharma 1970; Paliwal and Maliwal 1971) ^[1-2]. As reported by Roy *et al.* (1967) ^[3] that Rajasthan has wide spread problem of saline alkali soils in district of Jodhpur, Pali, Bhilwara, Jaipur, Ajmer, Bhartpur, Alwar, Chittorgarh, Jalore, Nagaur, Tonk and Sirohi constituting roughly 15 percent of the cultivated area. Quality of irrigation water is an important thing in any appraised of salinity or alkali condition in an irrigate area (Richard 1954) ^[4]. Accumulation of salts takes place in soils due to irrigation with saline water, evaporation and impeded internal drainage. Accumulation of salts in the soil is dependent on soil type, temperature and salts composition of irrigation water (Muhr *et al.* 1965) ^[5]. Soil has many characteristics, which make them different from other materials. The most striking of these is the large change in soil properties which change in water content. Properties such as strength, compressibility, plasticity and hydraulic conductivity change markedly with changing water content (Khan 2012) ^[6]. The physical condition of the soil is related to pH and has an important effect on plant growth. Plant growth is markedly reduced where colloids are dispersed and is completely eliminated where the condition is severe. The most universal effect of pH on the development of plants is nutritious, the soil pH influence the rate of plant nutrient release by weathering. Solubility of all the cultures in the soil and the amount of nutrient ions are stored on the cation exchange rate (Troeh & Thompson 1993) ^[7].

Study Area

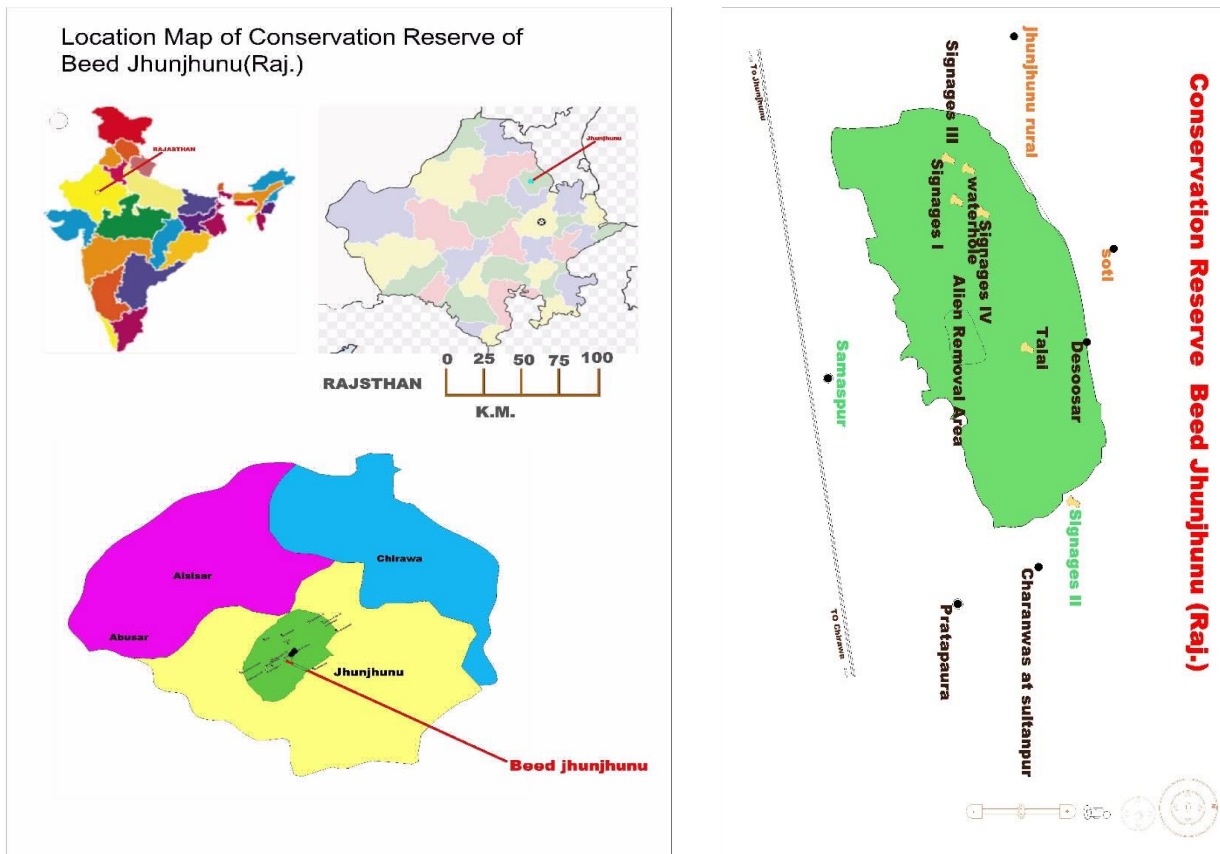
Jhunjhunu District is located at North-Eastern part of Rajasthan State and is located between 27°38' and 28°31' North latitudes and 75°02' and 76°06' Eastern longitudes and covers 5928 Km² of geographical area. Jhunjhunu Beed is the conserve area which is situated at 1K.m. far from the city of Jhunjhunu on the Jaipur–Pilani highway in the east. Jhunjhunu Beed is surrounded by Desasur village in the north; Samaspur village in south; Charanwas village in the east; nearby agricultural land and Jhunjhunu city in the west. The temperature is very high in summer and reached upto 48°C and in winter, it falls below the cooling point. The average annual rainfall is ranged from 300-400 mm. In the rainy season, the forest becomes luxurious and rich in vegetation and enriched many rare as well as local medicines and threatened plants. Total area of Jhunjhunu Beed is 1047.48 hectare. Jhunjhunu Beed has been declared as a 'Protected Desert' by the state Government's notification vide F3 (47) VAN/2008 Date 09-03-2012. This reserved area is the heart or lungs of Jhunjhunu City. Due to the location near by headquarter, this reserved area is the heart or lungs of the Jhunjhunu city. The area's major soil types are sand, sandy and salt-affected black soil. The Beed area is a home for special species as well as for more than three hundred species of plants, most of which are representative of semi-arid and arid type vegetation of Western India. The main plant's species such as - *Salvadora oleoides*, *S. persica*, *Prosopis cineraria*, *Capparis decidua*, *Laptadenia pyrotechnica*, *Acacia tortilis*, *A. leucophloea*, *Maytenus emarginata*, *Opuntia elatior*, *Tephrosia purpurea*, *Aerva persica*, *Cenchrus ciliaris*, *C. sagittarius*, *Tribulus terrestris*,

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Pedaliium murex etc. Due to absence of sewage treatment plant in Jhunjhunu city, a wetland is formed inside the Beed and the city's sewage channel is towards the Beed area, as a

result, it is negatively affects the native vegetation in Beed (Anonymous 2015) [8].



Location Map of Jhujhunu Beed of Rajasthan, India

Methodology

The present investigation deals with various parameters of soil components of Jhunjhunu Beed. These samples were collected periodically from each region. Soil samples were taken from 5 to 10cm depth at east, west, north and south regions in different seasons (Winter, summer and rainy).The samples were dried to constant weight at 80 C in hot air oven for 24 hrs; and stored in the poly bags. The dried soil was grounded and sieved through 80 mesh size sieve before storage. Year-wise chemical analysis (pH, electric conductivity, water holding capacity, phosphorus, nitrogen etc.) of soil samples were determined as per standard methods (Jackson 1967; Olsen *et al.* 1954; Piper 1942; Richard 1954) [9-12].

Material

Chemical Analyses of soil: Physico-chemical properties of

soil collected from east, west, north and south regions of the Jhunjhunu Beed during different seasons are described below:

1. Soil pH

Soil pH is the most important chemical property of plant's growth. Soil pH was measured by preparing 1: 2 soil water suspension and values were calculated by digital pH water following the method as suggested by (Jackson 1967) [9]. The results revealed that pH values were slightly different at various sites of Jhunjhunu Beed and seasonal variations were also not observed significantly. The result indicate that the soil of Jhunjhunu Beed is alkaline in nature and ranged from 7.20 to 8.99 the maximum (8.99) pH value was observed in soil collected from west region during winter season, while minimum (7.20) from north region during the winter season.

Table 1: Soil pH from different regions of Jhunjhunu Beed during 2017-2018

Sites	Year 2017						Year 2018					
	Winter		Summer		Rainy		Winter		Summer		Rainy	
	S	D	S	D	S	D	S	D	S	D	S	D
East	8.62	8.21	8.52	8.44	8.46	8.40	8.01	7.99	7.64	8.11	8.09	7.84
West	8.62	8.75	8.02	8.74	9.18	9.18	8.99	8.11	7.71	7.95	7.89	7.82
North	7.20	7.94	8.82	8.74	8.98	8.71	7.99	7.78	7.76	7.96	7.73	7.76
South	8.63	8.84	8.33	8.84	8.55	8.93	8.80	8.77	8.12	8.37	8.02	8.06

Where, S-Surface; D-Depth

2. Electrical conductivity

For measurement of electric conductivity, suspension of 1:2 soil water ratio was prepared and values were measured by

digital conductivity meter as per method described by (Jackson 1967) [9]. The reading of the soil supernatant was taken by dipping the conductivity meter maximum (.62 mm

hascm⁻¹) electric conductivity was found in soil collected from east site and minimum (.11 mmhasem⁻¹) in east region.

Table 2: Electrical conductivity (mmhos cm⁻¹) in the soil collected from different site of Jhunjhunu Beed 2017-18.

Sites	Year 2017						Year 2018					
	Winter		Summer		Rainy		Winter		Summer		Rainy	
	S	D	S	D	S	D	S	D	S	D	S	D
East	.14	.12	.15	.20	.23	.20	.13	.12	.14	.11	.18	.13
West	.14	.16	.14	.16	.16	.20	.15	.14	.62	.18	.53	.57
North	.25	.14	.13	.14	.14	.14	.24	.16	.20	.22	.16	.12
South	.15	.19	.21	.19	.17	.16	.17	.13	.16	.24	.12	.19

Where, S-Surface; D-Depth

3. Phosphorus

The value of available phosphorus was determined by extraction with sodium bicarbonate solution as suggested by (Olsen *et al.* 1954)^[10]. In the present study it was found that

maximum (40 kg Ha⁻¹) value from east site during rainy season and minimum (9.3 Kg ha⁻¹) in summer season from west site of the Jhunjhunu Beed.

Table 3: Phosphorus (kg ha⁻¹) in the soil collected from different sites of Jhunjhunu Beed during 2017-18.

Sites	Year 2017						Year 2018					
	Winter		Summer		Rainy		Winter		Summer		Rainy	
	S	D	S	D	S	D	S	D	S	D	S	D
East	26	15	13	35	30	40	30	29.5	12.5	9.4	21	18.5
West	33	12	28	21	26	21	28	29	11.6	9.3	22.9	22.9
North	36	26	20	26	18	15	26	24.7	14.1	11.7	27.4	25.6
South	23	15	34	32	31	16	37.4	33	14.6	11.6	27.9	27.4

Where, S-Surface; D-Depth

4. Nitrogen

Total nitrogen present in the soil was calculated by micro-kjeldahl method. A fix amount of dried soil was digested in concentrated sulphuric acid in the micro-kjeldahl flask using selenium, copper sulphate and potassium sulphate mixture as

catalyst (Piper 1942)^[11], after the digestion, it highest during summer season and it was titrated with 0.01 N hydrochloric acid. The maximum (291 kg ha⁻¹) quantity was found in the soil from East site during rainy while minimum (117.7 Kg ha⁻¹) in winter from south site of the Jhunjhunu Beed.

Table 4: Nitrogen content (Kg ha⁻¹) in the soil collected from different site of Jhunjhunu Beed during 2017-18.

Sites	Year 2017						Year 2018					
	Winter		Summer		Rainy		Winter		Summer		Rainy	
	S	D	S	D	S	D	S	D	S	D	S	D
East	118.7	118.7	118.7	118.7	291	118.7	118.8	117.8	118.2	117.9	118.3	117.8
West	118.7	118.7	257.7	118.7	118.7	118.7	118.4	118.7	180	119.1	290	118.3
North	252.1	118.7	118.7	118.7	118.7	118.7	118.1	117.9	117.8	118.2	252	118
South	117.7	118.7	118.7	118.7	118.7	118.7	119	119.1	119.2	118	119	118

Where, S-Surface; D-Depth

5. Water holding capacity

Seasonal variations in the water holding capacity of soil were determined by preparing saturation paste of soil as suggested by (Richard 1954)^[12]. For determination, the soil samples were filled in perforated bottom standard brass cups which were later immersed in large petri dishes with water to saturate for 12 hrs. The excess water was allowed to drain out from the cups. The cups were weighed and thereafter, dried in a hot air oven at 110^oc for 24 hrs. Water holding capacity was calculated as percent of moisture held by soil on dry weight basis.

$$\text{WHC (\%)} = \frac{(W_2 - W_1) - (W_1 - W_0) \times 100}{(W_1 - W_0)}$$

Where, WHC- Water holding capacity, W0-weight of empty cup (g); W1-weight of cup with water (g); W2-weight of cup with dried soil (g) results revealed that there were no marked seasonal variations in water holding capacity of the soil collected from several of Jhunjhunu Beed. In general, it was slightly higher at East region during rainy season.

Table 5: Water holding capacity (%) in the soil collected from different sites of Jhunjhunu Beed 2017-18.

Sites	Year-2017						Year-2018					
	Winter		Summer		Rainy		Winter		Summer		Rainy	
	S	D	S	D	S	D	S	D	S	D	S	D
East	31.2	55.6	35.5	31.2	52	60.0	32.4	33.6	34.1	33.4	19.5	35.9
West	30.4	55.5	35.6	39.2	42.8	31.6	34.2	33.3	34.9	35.5	34.5	37.2
North	59.6	34.4	30	27.6	32	31.5	58.7	48.8	34.8	34.6	30.4	33.5
South	34.8	34.0	43.2	32.8	35.6	27.5	46.7	40.6	32.8	34.3	32.8	33.5

Where, S-Surface; D-Depth

Result

Results revealed that pH value were slightly differed at various sites of Jhunjhunu Beed and seasonal variations were also not found at visited sites. The result indicate that the pH of soil of Jhunjhunu Beed is alkaline in nature and ranged from 7.20 to 8.99. Electrical conductivity (mmhos cm^{-1}) in the soil collected from different site of Jhunjhunu Beed ranged from 0.11 to 0.62 so the most soil sample were saline in nature. Therefor it is recommended to incorporate organic and use of salt tolerant variety of plants to achieve maximum growth and to reduce to adverse effect on Beed flora. The available phosphorus in these soils were found from 9.3 to 40 kg ha^{-1} ; where available nitrogen ranged from 117.7 Kg ha^{-1} to 291 kg ha^{-1} . The most of soils samples of Beed were medium to normal in available phosphorus and the most of soils samples of Beed were low range in available nitrogen. Therefor it is recommended to increase additional dose of nitrogen and phosphorus fertilizers in area of low category. Water holding capacity (%) in the soil collected from different sites of Jhunjhunu Beed is ranged from 19.58 to 60. The most soils samples of Beed were low range in Water holding capacity. The most of soil sample were sandy loamy.

Conclusion

The many sample of soils were taken and it was investigated that the nitrogen contents ranged low and low status of water holding capacity. The soil of Jhunjhunu Beed is alkaline in reaction.

The low content of available nitrogen and phosphorus in this region is associated with hot and dry climate complex due to low content of organic matter and reported nitrogen deficiency in soils. The climate is going to change negatively in the reference of plants natural growth due to the low content of available nitrogen, phosphorus in the concerned area.

The less content of N and low range of water holding capacity are not suitable for growing flora of Jhunjhunu Beed. Therefore Govt. authorities should provide proper fertilizer along with required nitrogen and phosphorus for the conservation of concerned flora namely "Jhunjhunu Beed".

It is hoped that the present study will aware to the better understanding of the composition of soil in the Beed Jhunjhunu conserve region of Rajasthan.

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