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ASSESSMENT OF LAND SUITABILITY FOR SOYBEAN CROP IN VARIED AGRO-ECOLOGICAL ZONE OF MARATHWADA REGION (M.S., INDIA)

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Abstract

The soils of Agro-ecological zone of Marathwada region of Maharashtra were shallow, moderately deep to very deep gray (10 YR3/1) to dark brown (10 YR 4/2) in colour, granular to sub-angular blocky in structure, sandy clay loam, clay loam to clay in texture. The bulk density of soils varied from 1.27 to 1.54 Mg m^{-3}. The saturated hydraulic conductivity of soils varied from 0.4 to 5.3 cm hr^{1} and it was found to increase with depth of soil. The soils are slightly alkaline to moderately alkaline in reaction. In general sand, silt and clay content ranged from 10.2 to 25.9, 19.7 to 31.6 and 51.1 to 59.3% in different horizons. The CEC of soils varied from 40.3 to 62.5 $cmol^{(P+)}$ Kg^{-1}. Majority of surface and sub-surface layers had relatively higher soil organic carbon and total carbon content than the underlying ones.

The available N, P and K content ranged from 51.2 to 334.8, 1.0 to 27.10 and 272.6 to 583.8 Kg ha^{-1}, respectively in different pedons. The DTPA- Zn was found to be deficient in all the soils. Based on field morphology and laboratory characterization, the all soil pedons were classified as the qualified for great group of Lithic Ustorthents to Typic Haplusteptsat great group level. Soil profile P1 were unsuitable (N2) for growing soybean whereas, other soils are marginally suitable. The soils correlated with yield it was concluded that Typic Haplusterts (P6) belonging to order Vertisols were suitable (S1) best soils for soybean growing than other.

Key words: Soil organic carbon, soil site characteristics, soybean crop, classification, soil orders.

Introduction

The qualitative and quantitative knowledge of variability among various genesis related soil properties and their relationship with properties having direct influence on choice of crops, are of paramount importance. This helps to determine the yield controlling factors across sites and their spatial distribution on soil-scape. This also provides a fair opportunity of matching between input resources and yield determining factors so as to maximize plant performance and minimize off site environmental effects. Soil survey, classification and mapping of soil help in understanding potential of soil for the crop. Several workers have worked out the suitability of soils for various crops (Bhaskar *et al.,* 1987; Anonymous, 1986; Kuhad and Kawasra, 1991; Srivastava *et al.,* 1991).

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The value of soil resource inventory for increasing food production and conservation of natural resources has been receiving significant importance not only for soil resource data base generated but also its quality (Eswaran and Gathrie, 1982). For the proper land resource management in this area, investigation on the land properties and their constraints is a prerequisite. A documentation of soil properties in systematic manner is one of the vital components in formulating effective land use planning programmed (Deshmukh and Bapat, 1993). Through the present investigation on soils resources of Nanded district have been evaluated for land use planning.

The use of almost nil to very low amount of organic west's like farm yard manure and chemical fertilizers in imbalanced manner are the main reasons for poor organic carbon and low productivity of the region. Maintaining or improving organic C levels in tropical soils is more difficult because of its rapid oxidation under prevailing high temperatures. As lack of assured moisture does not support higher cropping intensity in this region (Malode, 2014) contribution of root biomass towards organic C is dismally low. Farmers in semiarid tropical regions do not use adequate and balanced amount of fertilizer nutrients because of uncertainty of rainfall, likely risk of failure of crops and poor economical condition which resulted in poor organic C status in those soils.

The drought porn zone and assured rainfall zone of Agro-ecological zone-6 in Marathwada region of Maharashtra is arid and semi-arid part under rainfed farming with erratic rainfall distribution associated with low crop productivity and need site specific information in terms of soil characteristics, their productivity potentials and limitations for land resources development and management (Patil, V.D., 2013). Through present study, an attempt has been made to characterize and evaluate the land resources of different soil orders & varied the Agro-ecological zone of Marathwada region for land resource management using soil properties and thematic mapping data by using GPS.

Materials and Methods

Geographically, the Marathwada region is located between 74°- 40 to 70 -15' E longitudes and 17°- 35 to 20°- 40' N latitudes. The general elevation of the area ranges from 347 to 638 m above mean sea level (MSL). The climate of the study area is arid and semi aridwith well expressed summer (March to May), rainy season (June to October) and winter (November to February). The mean annual temperature is 33-5°C and means annual precipitation is about 903 mm of which nearly 90 per cent is received during monsoon. The relative humidity is high during monsoon period (75 to 88%) and low during other period (30 to 40%). The area qualifies for *Ustic* and *'Hyperthermic'* respectively.

The natural vegetation compared of major crops growing in the region are soybean (*Glycin max*), cotton (*Gossipium spp.*), pigeonpea (*Cajanus cajan*) and sorghum (*Sorghum biocolor*) in kharif and wheat (*Triticum aestivum*) and gram (*Cicer arietinum*) in rabi under irrigation or stored moisture soybean crop were growing all districts of Marathwada region of Maharasthra. The land forms, slop and land use/land cover maps were integrated to prepare the physiographic unit map. The profile were exposed in each physiographic unit and studied for morphological properties (Soil survey Division staff, 2000) and classified as per soil Taxonomy (soil survey staff, 1998). Soil map was prepared based on thematic physiographic-soil relationship. The soils were grouped under different productivity classes (Riqier *et al*., 1970). Soil site suitability for soybean was worked out as per the methodology given in the FAO frame workon land evaluation (FAO, 1976) as modified by Sys *et al.*, (1991). The soil site requirement as suggested by NBSS and LUP, (1994) has been use for evaluating the suitability of different mapping unit for soybean crop.

The study area was chosen at Beed and, Osmanabad, Districts Drought prone zone and Latur and Jalna Districts is Assured rainfall zone of Marathwada region of Maharashtra state. The geology at the area is essentially basalts of the Deccan trap (Waikar, S.L. *et al.,* 2003 and Malode and Patil, 2014). Six soil sites on different macro topographic conditions were selected and nomenclature the soils of the study area as, P1 were Lithic Ustorthents and P2, P3, P4 and P5 are Typic Haplusterts. The profiles were exposed and examined on each selected site. The morphological characteristics such as structure, texture, consistence, pores, roots, nodules, effervescence, coarse fragment and other feature like deep cracks were observed as seasonal dry and wet periods produced short-term cycles of soil surface crack area density (crack density). In addition, the site characteristics such as location, slope and climate were also studied. The collected soil samples were air dried, processed and passed through 2 mm sieve for laboratory analysis. Soil properties like particle size distribution were determined as per the international pipette method. Bulk density was determined by dry clod waxing technique, hydraulic conductivity was determined by constant head method. The pH and EC were measured in 1:2.5 soil-water suspension, the each profile soil samples and 30 surface soil sample analyzed for available nitrogen by permanganate method (Subbiah and Asija, 1956), available phosphorus by (Chopra and Kanwar, 1976) and available potassium by ammonium acetate extractant (Jakson, 1973). Cation exchange capacity (CEC) was determined by 1 NaOAc at pH 8.2. Exchangeable Ca^{2+} was determined by KCI-triethanolamine method followed by EDTA titration, organic carbon was determined by Walkley and Black method, (1956) and total carbon was determined by sum of soil inorganic carbon and organic carbon (Technical manual U.S.E.P.A, 2001). Calcium carbonate equivalent was determined by acid neutralization method of Black *et al.,* (1965). Available zinc, copper, iron and manganese were extracted by 0.005 M DTPA solution (Lindsay and Norvell, 1978) and analyzed with the help of Atomic absorption spectrophotometer. The soils were classified as par soil Taxonomy (Anonymous, 1994 b), soil-site suitability were made as par the criteria suggested by sys *et al.,* (1991) and modified by NBSS & LUP (Anonymous, 1994a). In addition, suitability classes were also derived based on the actual yield as suggested by FAO (Anonymous, 1983).

Results and Discussion

Soil site characteristic /soil cover

Based on Six soil profile served characteristics, the soil site use/ soil cover identified are cultivated land, an it's delineated into single and double crop with mango and orange orchards based on temporal date, respectively, $CaCO_3$ nodules are present in weathered basalt on pedon P2 and P3 assured rainfall zone profile particularly.

The details about location of soil profile, name of soil series latitude and longitude, mean annual rainfall (MAR) in mm, mean annual temperature (MAT) in °C and physiographic/ topography drainage and slope are give in table1. The pedons P2 and P5 plateau in topography to be slightly undulating that of P3, P4 and P6 were subdued plateau. And pedon P1 are interhilly. The drainage were recorded to be 1-3%, moderately well of all pedon except pedon P4.

Morphological properties of Soil

Morphological properties of soils indicated on table 2. Soil depth of the soils study area varied from 100 to 120 cm which corresponds to moderated deep. Pedons had their Munsell colour notation in the hue of (very dark gray to dark brows) (10 YR 3/1 to 10YR 4/2) the surface horizons of all the pedon generally had granular to sub-angular blocky structure and slightly hard to hard (dry) and friable to moderately friable (moist) condition and very sticky and very plastic in wet condition of consistency. These pedons ware associated with gravelly clay loam, clay loam to clay texture. The surface and sub-surface horizons of pedons are associated with sub-angular blocky statures of medium grades and sizes but angular blocky structure associated with slickenside is a common feature of sub-soils pedons P2, P3, P4, P5 and P6 except pedon P1 (Malode and Patil, 2014).

Physical properties of soil:

Physical properties of soils were presented in table 3. Indicated that the coarse fragment in soils was varies from 10.2 to 59.3 percent. The partial size distribution and sand/silt ratio show inflection in sand, silt and clay content in depth distribution and very significantly in soil having differed parent materials. It is also observed that the sand and silt ranged from 10.2 to 25.9 and 19.7 to 31.6 percent respectively. The clay content ranged from 51.2 to 59.3 in varied pedons. It is also observed that the clay distribution below the profile for all soils was almost uniform suggesting of their development from their same kind of parent material under same climatic condition. These soils were developed on lower topographic position showed higher clay content as compared to soil developed on higher topographic position; topography and slope were found to affect the particle size distribution. Macro topography must have been played key role in the profile development (Pal *et al.,* 2000). The higher bulk density (1.54 Mg m^{-3}) was noticed in pedon P1 and the lowest (1.27 Mg m^{-3}) in pedon of P4. The bulk density, in general, increased with depth. The saturated hydraulic conductivity ranged from 0.4 to 5.3 cm hr^{-1} pedon P2 was found to be the poorly drained depth of soil which showed the low hydraulic conductivity which might be due to presence of Mg^{2+} in the subsurface origin and variation may be

Table 1: Soil Site characteristic of varied Agro-ecological zones of Marathawada region.

Agro-ecological Zone	Soil series	Latitude	Longitude	MAR (mm)	MAT (°C)	Land use	Drainage	Physio-graphy	Remarks
Drought Prone zone	**Vaijapur P1**	19°89"63	74°79"17	515.9	27.2	Double crop	M. Well	Inter hilly	No crack
	Beed-P1	18°95"48	75°75"80	699.4	25.15	Double crop	M. Well	Plateau	3-5 cm cracks
	Govindpur-P2	18°63"96	76°78"70	736.2	25.8	Double crop	M. Well	Subdued Plateau	1-2 cm cracks' with 40 cm
	Wadgaon-P3	18°28"68	76°09"97	708.4	25.8	Single crop	Imperfect	Subdued Plateau of inter hill	No cracks
Assured Rainfall zone	**Latur P4**	18°41"96	76°61" 84	743.5	26.7	Double crop	M. Well	Plateau	1-2 cm Crack's
	Bharaswada-P5	19°52"28	75°69"89	747.9	27.2	Double crop	M. Well	Subdued Plateau	3-5 cm cracks

MAR-MeanAnnualRainfall; * **MAT**-MeanAnnual Temperature*

Table 2: Morphological properties of Varied Agro-ecological zones of Marathwada region.

Agro-ecological Zone	Pedon	Hori-zon	Depth (cm)	Matric colour		Structure			Pressure faces SS/PF	Soil Consistency	Slope %
				Dry	Moist	Type	Grade	Size			
Drought Prone zone	Vaija-pur P1	Ap	0-15	10 YR 2/2	10 YR 2/2	m	2	sbk	-	fr, ns, np	3-4
		A	15-28	10 YR 2/2	10 YR 2/2	m	2	sbk	-	fr, ns, np	
	Beed P1	Ap	0-15	10 YR 3/2	10 YR 3/3	m	2	sbk	-	vh, vfi, vs, vp	1-3
		A	15-27	10 YR 3/2	10 YR 3/3	m	2	sbk	-	vh, vfi, vs, vp	-
		Bw	27-60	10 YR 3/2	10 YR 3/1	m	2	sbk	PF	vh, vfi, vs, vp	
		Bssk	60-100	10 YR 3/1	10 YR 3/1	m	2	sbk/abk	SS	vh, vfi, vs, vp	
	Govind-pur P2	Ap	0-15	10 YR 3/1	10 YR 3/2	m	2	sbk	-	sh, vfi, vs, vp	2-3
		A	15-30	10 YR 3/1	10 YR 3/1	m	2	Sbk	-	fi, vs, vp	
		Bw	30-60	10 YR 3/1	10 YR 3/1	m	2	sbk	PF	vfi, vs, vp	
		Bssk	60-105	10 YR 3/1	10 YR 3/1	m	2	sbk/abk	SS	vfi, vs, vp	
	Wad-gaon P3	Ap	0-15	10 YR 3/3	10 YR 3/3	m	2	Sbk	—	sh, fi, vs, vp	1-3
		A	15-33	10 YR 3/2	10 YR 3/3	m	2	Sbk	—	fi, vs, vp	
		Bss1	33-65	10 YR 3/2	10 YR 3/3	m	2	Sbk	PF	vfi, vs, vp	
		Bssk	65-100	10 YR 3/2	10 YR 3/2	m	2	Sbk	SS	vfi, vs, vp	
Assured Rainfall zone	Latur P4	Ap	0-25	10 YR 3/2	10 YR 3/2	m	2	Sbk	—	vh, vfi, vs, vp	1-3
		Bw1	25-60	10 YR 3/2	10 YR 3/2	m	2	Sbk	—	vh, vfi, vs, vp	
		Bw2	60-90	10 YR 3/1	10 YR 3/1	m	2	Sbk	PF	vh, vfi, vs, vp	
		Bssk	90-120	10 YR 3/1	10 YR 3/1	m	2	Sbk	SS	vfi, vs, vp	
	Bhara-swada P5	Ap	0-15	10 YR 3/3	10 YR 3/3	m	2	sbk	-	sh, fi, ns, vp	1-3
		A	15-35	10 YR 3/3	10 YR 3/3	m	2	sbk	-	fi, ns, vp	
		Bw	35-65	10 YR 3/2	10 YR 3/3	m	2	sbk	PF	vfi, vs, vp	
		Bssk	65-102	10 YR 3/2	10 YR 3/2	m	2	sbk/abk	SS	vfi, vs, vp	

Table 3: Physical properties of varied Agro-ecological Zone of Marathwada region.

Agro-ecological Zone	Pedon	Horizon	Depth (cm)	SHC ($cm\ hr^{-1}$)	Bulk density ($Mg\ m^{-3}$)	Particle size distribution (%)			Textural class
						Sand	Silt	Clay	
Drought Prone zone	Vaijapur P1	Ap	0-15	1.6	1.52	25.9	19.7	54.3	sl
		A	15-28	2.4	1.54	23.6	21.3	55.1	cl
	Beed P2	Ap	0-15	2.3	1.48	16.8	30.1	53.1	c
		A	15-27	2.8	1.51	14.6	29.8	55.6	c
		Bw	27-60	1.1	1.53	20.6	27.6	51.8	cl
		Bssk	60-100	0.2	1.53	16.1	25.1	58.9	cl
	Govindpur P3	Ap	0-15	4.7	1.36	17.2	31.6	51.2	c
		A	15-30	5.3	1.41	16.1	31.1	52.7	cl
		Bw	30-60	1.9	1.39	15.8	29.1	55.1	cl
		Bssk	60-105	0.9	1.29	14.2	27	58.8	cl
	Wadgaon P4	Ap	0-15	2.5	1.29	19.8	28.1	52.2	c
		A	15-33	2.7	1.32	17.9	28.4	53.7	c
		Bss1	33-65	0.9	1.36	16.2	28.2	55.6	c
		Bssk	65-100	0.4	1.27	14.9	27.8	57.3	cl
Assured Rainfall zone	Latur P5	Ap	0-25	1.0	1.30	21.6	28.4	50.1	c
		Bw1	25-60	1.4	1.31	18.03	30.27	51.7	c
		Bw2	60-90	1.1	1.40	16.1	30.8	53.1	c
		Bssk	90-120	0.9	1.42	15.8	28.3	55.8	cl
	Bharaswada P6	Ap	0-15	1.3	1.37	19.9	23.4	56.7	c
		A	15-35	2.0	1.48	15.6	26.8	57.8	c
		Bw	35-65	0.9	1.47	18.2	27.1	54.7	c
		Bssk	65-102	0.4	1.32	10.2	30.7	59.3	c

Table 4: Chemical properties of varied Agro-ecological Zone of Marathwada region.

Agro-ecological Zone	Pedon	Horizon	Depth (cm)	pH	EC (dSm^{-1})	SOC (%)	TC (%)	$CaCO_3$ (%)	CECcmol (p+) kg^{-1}
Drought Prone zone	Vaijapur P1	Ap	0-15	7.8	0.739	0.526	1.462	7.8	56.1
		A	15-28	7.8	0.780	0.628	1.906	13.5	53.2
	Beed P2	Ap	0-15	8.0	0.270	0.624	1.116	4.1	59.2
		A	15-27	7.8	0.286	0.585	1.005	3.5	62.1
		Bw	27-60	8.1	0.231	0.562	1.594	8.6	62
		Bssk	60-100	7.9	0.261	0.331	1.675	11.2	59.1
	Govindpur P3	Ap	0-15	8.1	0.254	0.994	1.570	4.8	45.4
		A	15-30	8.5	0.288	0.624	1.536	7.6	47.1
		Bw	30-60	8.3	0.346	0.524	1.604	9.0	51.6
		Bssk	60-105	8.4	0.560	0.292	1.612	11.0	41.3
	Wadgaon P4	Ap	0-15	8.0	0.233	0.975	2.115	9.5	48.9
		A	15-33	7.9	0.269	0.721	2.041	11.0	51.5
		Bss1	33-65	7.9	0.204	0.546	2.442	15.8	56.3
		Bssk	65-100	8.1	0.290	0.409	2.689	19.0	40.3
Assured Rainfall zone	Latur P5	Ap	0-25	8.1	0.290	0.682	1.018	2.8	55.8
		Bw1	25-60	8.1	0.291	0.624	1.08	3.8	52.1
		Bw2	60-90	8.0	0.287	0.429	0.789	3.0	62.5
		Bssk	90-120	8.3	0.337	0.351	0.951	5.0	40.5
	Bharaswada P6	Ap	0-15	8.1	0.255	0.741	1.437	5.8	51.2
		A	15-35	8.0	0.230	0.641	1.301	5.5	54.7
		Bw	35-65	8.1	0.237	0.292	1.672	11.5	61.1
		Bssk	65-102	8.2	0.227	0.195	2.211	16.8	41.5

attributed to textural variation. In general the low hydraulic conductivity was decreased with depth (Kadu *et al.*, 2003).

Chemical properties of soil

The pH of the soil is slightly alkaline to moderately alkaline with pH ranging from 7.8 to 8.7. The electrical conductivity varied from 0.204 to 0.780 dSm^{-1}. Which well below the medium to high permissible limits in table 4.

The Soil organic carbon and total carbon content ranged from 0.195 to 0.994 and 1.005 to 2.689 (%) in different horizons of pedons and in general, decreased with depth. but, in total carbon content had increased with depth of all profile. It may be effect of pedogenic and non pedogenic present of calcium carbonate it may inorganic form of carbon. This might be due to sieving effect and adsorption of fine organic particles and water soluble organic matter respectively by soil particles. The calcium carbonate content varied from 2.8 to 19.0%. The high calcium carbonate in soil affect the water holding capacity of soil which has great bearing on crop production under rain fed condition. Calcium carbonate affects the physical and chemical characteristics of soil and may prevent root penetration (Sys, 1985). The high cation exchange capacity is attributed to the high amount of clay. The CEC ranged from 40.3 to 62.5cmol$^{(P+)}$$kg^{-1}$. The cation exchange capacity of these black soils is attributed to its smectite clay mineralogy (Pal and Deshpande, 1987). Since soils under study had low to moderate organic carbon status, clay fraction appeared to influence largely the CEC value (Pal *et al.*, 2000).

Nutrient status of soils

The available N, P and K ranged from 51.2 to 334.8, 1.00 to 27.10 and 272.6 to 583.8 Kg ha^{-1}, respectively in different pedons and in general, their content decreased with the depth table 5. The variation in available N content in soil could be attributed to the differences in their physiographic, differential cultivation and management practices of this soil but also removed of N by the crop, losses through leaching, denitrification, fixation and volatization take place. Some nitrogen is immobilized by soil microbes. These results were in confirmatory with result resporated by Malewar *et al.*, (1998). The availed N was optimum in A horizons of P4 and low in P6 were as deficient in profile. Available P was optimum in surface horizon of P4 and low to defiance in other pedons and K was above optimum at P4 and low in P1.

The DTPA-Fe ranged from 3.00 to 7.11 mg kg^{-1} table 5 and found to be medium to higher than the critical level of 4.5 mg kg^{-1} (Lindsey and Norvell, 1978) in all the soils. DTPA-Mn varied from 2.36 to 21.89 mg kg^{-1} and found to much higher than critical level of 3.0 mg kg^{-1} (Takkar

Table 5: Nutrient status of varied Agro-ecological zone of Marathwada region.

Agro-ecological Zone	Pedon	Horizon	Depth (cm)	Available macro nutrient (kg ha^{-1})			Available micronutrient (mg kg^{-1})			
				N	P	K	Fe	Mn	Zn	Cu
Drought Prone zone	Vaijapur P1	Ap	0-15	128.6	7.20	299.7	5.11	8.90	0.91	2.43
		A	15-28	82.3	2.60	293.2	3.13	10.21	0.61	1.91
	Beed P2	Ap	0-15	259.9	18.20	318.2	6.13	21.89	1.23	2.61
		A	15-27	125.4	2.80	404.7	4.20	14.39	0.92	3.11
		Bw	27-60	94.9	1.20	350.3	3.17	12.94	0.92	2.16
		Bssk	60-100	74.4	1.00	272.6	3.00	8.39	0.49	1.67
	Govindpur P3	Ap	0-15	128.5	16.30	403.8	5.91	12.81	0.93	4.13
		A	15-30	134.8	8.90	427.1	4.76	13.80	1.11	4.12
		Bw	30-60	97.2	3.10	348.2	3.93	2.36	0.81	4.23
		Bssk	60-105	87.8	2.00	382.5	3.51	3.09	0.61	2.22
	Wadgaon P4	Ap	0-15	206.9	27.10	583.8	6.20	15.42	1.39	3.90
		A	15-33	334.8	11.20	472.1	5.53	12.83	0.91	4.10
		Bss1	33-65	128.5	1.60	461.2	4.18	6.40	0.61	2.56
		Bssk	65-100	63.9	1.40	382.3	3.81	7.51	0.51	1.75
Assured Rainfall zone	Latur P5	Ap	0-25	213.2	21.20	465.8	5.52	15.66	0.91	2.83
		Bw1	25-60	194.3	6.50	438.9	5.10	12.13	0.68	3.10
		Bw2	60-90	140.1	2.80	382.7	4.37	8.17	0.49	2.01
		Bssk	90-120	90.7	1.80	337.5	3.18	6.42	0.46	0.59
	Bharaswada P6	Ap	0-15	219.1	10.20	523.4	7.11	16.80	1.32	4.51
		A	15-35	75.4	3.40	469.5	6.27	16.15	1.13	3.98
		Bw	35-65	69.0	1.80	373.2	4.14	13.04	0.82	1.77
		Bssk	65-102	51.2	1.20	291.4	4.01	10.48	0.41	1.98

et al., 1989) in all the soils. DTPA-Zn of all soils pedon varied from 0.41 to 1.39 mg kg^{-1} the deficient in Zn as per critical level of 0.6 mg kg^{-1}which, was also reported by (Sharma *et al.*, 1996; Patil, 2013 and Malode and Patil, 2014). DTPA-Cu of the soil ranged from 0.59 to 4.51 mg kg^{-1} and decreased with depth but higher than the critical value of 0.2 mg kg^{-1} in all the soils (Katyal and Randhawa, 1983).

Soil pH is the most important factor regulating Zn supply in calcareous soils. At alkaline pH, very low levels of soluble Zn are found and only a negligible amount can be in there from of exchangeable Zn^{++}, which is available to plant and need to be supplemented (Patricia, 2000).

Soil classification and Soil site suitability for Soybean crops

The pedon located on elevated topography P1 does not have any diagnostic horizon and thus, these soils are qualified as order Entisols and due to the presence of Ustic moisture regime soils were grouped in to *Ustorthents*. Further in a view of *Litic* contact within < 50 cm of depth, these soils belonging to the subgroup Lithic Ustorthants. The pedons located on lower topographic position (P3, P4, P5 and P6) were deep to very deep black and dark grey in colour, clayey (>50%) and characterized by deep, wide cracks and well developed slicken side and pressure faces, these soils

Table 6: Soil site suitability classes and yield of soybean crops invaried Agro-ecological zone Marathawada region.

Pedon	Sys *et al.*, (1991) and NBSS & LUP, (1994) Soybean	Soil site suitability class with limitation (FAO, 1983)		
		Yield q/ha^{-1}	% Yield optimum yield (25 q ha^{-1})	Suitability Class
Vaijapur- P1	S3 (dt,k)	7.28	29.12	S3
Beed- P2	S2 (h,o)	13.2	52.8	S2
Govindpur- P3	S3 (o)	18.6	74.4	S2
Wadgeon- P4	S2 (k,o)	—	—	S2
Latur- P5	S2 (o)	17.21	68.84	S2
Bharaswada-P6	S3	21.2	84.8	S1

** Latter in parentheses show limitation as, dt-soil depth, s- slope, o-organic carbon, k-CaCO3, h-hydrolic conductivity and p- pH.*
** Suitability class – S1- Highly suitable, S2- Moderately suitable, S3- Marginally suitable, N1- Currently not suitable & N2- Un suitable; *The yield was notated in mean of 5 years (*— Not regular sowing).*

were classified under the order Vertisols and due to presence of Ustic moisture regime, these soils were grouped in to Haplusters and subgroup Typic Haplusterts.

The data regarding soil site suitability evaluation are presented in table 6 and it was carried out by using criteria suggested by Sys, *et al*., (1991) and modified by NBSS and LUP (Anonymous, 1994a) the soils of Lithic Ustorthents P1 were unsuitable (S2) for soybean crop. Whereas, Typic Haplusterts P2, P3, P4 and P5 were moderately suitable (S2) and Pedon P6 was highly suitable (S1) for soybean crop. This suggested that Lithic Ustorthents soils were suitable for shallow rooted crop like soybean were as Typic Haplusterts soils were suitable for both shallow and deep rooted crop soybean and other viz., (pigeon pea) for sustaining the productivity of soils in the study area.

The land soil suitability study (simple limitation method) based on productivity index, the soils were found to be extremely poor P1 and P9 good. As per soil site criteria for soybean crop, pedons P2 and P5 moderate limitation of soil texture, depth and soil organic carbon. Hence are moderately suitable (S2) whereas, the pedon P2 and P7 are marginally suitable (S3) as there soils having marginal limitations of soil depth and texture. The pedon P1 are not suitable (N2) for growing soybean due to very severe limitations of soil depth, organic carbon, texture and calcium carbonate.

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