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## Soil-site suitability evaluation of groundnut-growing soils of Srikalahasti division in Chittoor district of Andhra Pradesh

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### Abstract

Groundnut-growing soils of Srikalahasti division in Chittoor district of Andhra Pradesh were evaluated for their suitability to groundnut crop. These soils belong to Entisols, Inceptisols and Alfisols. The soil-site suitability evaluation of the study area revealed that P2, P3, P4 P5, P7, P10, P13, P14, P16 and P17 were suitable (S1) for growing groundnut crop with slight limitations of pH, wetness and organic carbon. P1, P6, P8, P12, P15, P18 and P20 were moderately suitable (S2) with moderate limitations of wetness, soil depth and slight limitations of sum of basic cations, organic carbon, pH and alkalinity. P9, P11 and P19 were marginally suitable (S3) with moderately limitations of pH, soil depth and organic carbon for growing groundnut crop. Crop suitability evaluation revealed various limitations for growing groundnut crop in the study area. By correcting these limitations by following suggested said management practices, sustainable yields can be achieved in groundnut crop besides sustaining the soil fertility.

**Keywords:** Land evaluation, groundnut crop, crop suitability, limitations and potentials

### 1. Introduction

Suitability evaluation criteria provides scientific database dealing the soil and climatic requirements of major crops grown in the country. Land suitability assessment is primarily based on land qualities, which can be derived from the available land characteristics. Degree of limitations are conceptually same as factor ratings, however they differ in their name and sometimes in the number of classes (Gabhane *et al.*, 2006) [1]. Every crop has specific requirement of soil for economic production. Information on soil constraints for crop growth and soil-site suitability for groundnut crop in groundnut-growing soils of Srikalahasti division in Chittoor district in particular and Andhra Pradesh in general is very much lacking. Hence, an attempt has been made to evaluate the soil-site suitability for groundnut crop grown on Entisols, Inceptisols and Alfisols of Srikalahasti division of Chittoor district in Andhra Pradesh.

### 2. Material and Methods

#### 2.1. Study area

The study area lies in between 13<sup>0</sup>25' and 14<sup>0</sup>05' N latitude and 79<sup>0</sup>.12' and 80<sup>0</sup>.08' longitude. It represents semi-arid monsoonic climate with distinct summer, winter and rainy seasons. The annual precipitation was 888.44 mm of which 94.21 percent was received during May to December. The mean annual soil temperature was 27.66<sup>0</sup>C with mean summer and winter temperatures of 31.79 and 27.06<sup>0</sup>C, respectively. The area qualifies for iso-hyperthermic temperature regime. The soil moisture control section remains dry for more than 90 cumulative days or 45 consecutive days in four months following summer solstice and this qualifies for ustic soil moisture regime. The natural vegetation of the study area was *Parthenium hysterophorus*, *Calotropis gigantia*, *Tridax procumbens*, *Pongamia pinnata*, *Azardirachta indica*, *Lantana camera*, *Cyperus rotundus* and *Cynodon dactylon*. The soils were developed from granite-gneiss and alluvium parent materials.

#### 2.2. Methodology

After traversing the groundnut-growing soils of Srikalahasti division in Chittoor district, twenty typical pedons were studied on defined land forms (plains and uplands) for their morphological characteristics following the procedure given by Soil Survey Staff (1951) [6].

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Horizon-wise soil samples were collected from the typifying pedons analysed for their physical, physico-chemical and chemical properties following the standard procedures. The soils were classified according to Soil Taxonomy (Soil Survey Staff, 2014) [7]. These pedons were selected for evaluation and their suitability assessed using limitation method regarding number and intensity of limitations (Sys *et al.*, 1991) [8].

The landscape and soil requirements for these crops (Sys *et al.*, 1993) [9] were matched with generated data at different limitation levels: no (0), slight (1), moderate (2), severe (3), very severe (4). The number and degree of limitations suggested the suitability class of pedons for a particular crop (Sys *et al.*, 1991) [8]. The potential land suitability (Table 3) sub-classes were determined after considering the improvement measures to correct these limitations (Sys *et al.*, 1991) [8].

### 3. Results and Discussion

Relevant soil characteristics are given in table 1 while the site and weighted means of soil characteristics are given in table 2. These soils were developed from granite-gneiss, and

alluvium parent material. The kind and degree of limitations for the groundnut crop is presented in table 3. The soils with no or only four slight limitations were grouped under suitability class (S1) (very suitable); the soils with more than four slight limitations, and/or with more than three moderate limitations under moderately suitability class (S2); the soil with more than three moderate limitations, and/or one or more severe limitations (s) under marginally suitable (S3) class; the soils with very severe limitations which can be corrected under N1 (currently not suitable); the soils with very severe limitations which cannot be corrected grouped under unsuitable class N2 (Sys *et al.*, 1991) [8]. This method also identifies the dominant limitations that restrict the crop growth in the sub-class symbol such as climatic (c), topographic (t), wetness (w), physical soil characteristics (s), soil fertility (f) and soil salinity/alkalinity (n). The suitability classes and sub-classes were decided by the most limiting soil characteristics. The studied soils vary in their suitability for different crops according to the criteria for the determination of the land suitability classes (table 3).

**Table 1:** Relevant soil characteristics of the pedons

Depth (m)	Physical characteristics (s)				CaCO <sub>3</sub> (%)	Fertility characteristics (f)					Salinity and alkalinity (n)	
	Texture			CEC [cmol (p+) kg <sup>-1</sup> soil]		BS (%)	Sum of basic cations [cmol (p+) kg <sup>-1</sup> soil]	pH (1:2.5 H <sub>2</sub> O)	OC (%)	EC (dS m <sup>-1</sup> )	ESP	
	Sand (2-0.05%)	Silt (0.05-0.002)	Clay (<0.002)									
% of <2 mm soil												
<b>P1 Suryanarayanapuram: Fine-loamy, smectitic, isohyperthermic, Typic Haplustep</b>												
Ap	0.00-0.20	74.79	15.41	09.80	2.50	18.26	65.39	11.94	7.51	0.58	0.02	3.29
A1	0.20-0.40	78.42	06.47	15.11	2.98	18.80	67.61	12.71	7.36	0.38	0.02	3.40
Bw1	0.40-0.69	69.15	05.71	25.14	2.90	24.04	72.50	17.43	7.14	0.28	0.02	4.83
Bw2	0.69-0.90	68.51	05.62	25.87	3.05	24.39	68.72	16.76	7.35	0.32	0.02	3.77
Bw3	0.90-1.10	62.21	10.00	27.79	2.90	24.48	72.55	17.76	7.66	0.24	0.01	4.45
<b>P2 M.D. Puttur: Coarse-loamy, kaolinitic, isohyperthermic, Typic Haplustalf</b>												
Ap	0.00-0.30	76.39	06.28	17.33	3.00	18.62	55.91	10.41	7.44	0.68	0.03	2.58
E	0.30-0.60	76.35	13.91	09.74	3.00	14.78	85.18	12.59	7.18	0.41	0.02	2.77
Bt1	0.60-0.90	77.47	02.94	19.59	2.90	23.66	64.07	15.16	7.34	0.37	0.02	2.58
Bt2	0.90-1.10	54.64	11.34	34.02	2.98	25.37	80.02	20.30	7.84	0.34	0.02	3.55
Bt3	1.10-1.50	67.95	02.67	29.38	2.98	26.79	67.38	18.05	7.96	0.32	0.03	5.52
Bt4	1.50-1.80 +	60.50	14.67	24.83	3.03	32.31	59.67	19.28	8.16	0.21	0.02	4.70
<b>P3 Musalipedu: Coarse-loamy, smectitic, isohyperthermic, Typic Haplustep</b>												
Ap	0.00-0.20	81.62	05.41	12.97	3.03	19.14	67.76	12.97	7.25	0.43	0.02	6.22
Bw1	0.20-0.54	71.54	14.14	14.32	2.95	16.57	73.33	12.15	7.53	0.39	0.01	5.43
Bw2	0.54-0.84	77.82	08.32	13.86	2.98	21.54	75.67	16.30	7.55	0.43	0.01	5.80
Bw3	0.84-1.12	81.94	06.02	12.04	2.78	20.67	64.68	13.37	7.80	0.29	0.01	5.27
Bw4	1.12-1.50	78.30	02.28	19.42	2.78	24.05	69.27	16.66	7.82	0.23	0.02	4.16
Bw5	1.50-1.80 +	79.13	05.49	15.38	2.78	22.28	70.20	15.64	7.91	0.24	0.02	5.34
<b>P4 Bonupalle: Sandy, siliceous, isohyperthermic, Typic Ustifluent</b>												
Ap	0.00-0.23	62.67	12.11	25.22	2.83	23.77	76.74	18.24	7.37	0.45	0.01	7.57
2A1	0.23-0.55	79.46	11.30	09.24	2.58	08.02	73.07	5.86	7.30	0.45	0.01	6.86
3A2	0.55-0.90	75.84	06.67	17.49	2.95	19.20	78.28	15.03	7.05	0.39	0.01	4.01
3A3	0.90-1.20	78.24	04.58	17.18	2.55	22.11	84.67	18.72	6.98	0.30	0.01	6.11
4A4	1.20-1.60	66.85	06.86	26.29	2.93	30.03	79.32	23.82	7.03	0.21	0.01	6.46
5A5	1.60-2.00 +	73.12	07.53	19.35	2.80	21.82	76.44	16.68	7.07	0.15	0.01	5.73

**Table 1:** (Cont.)...

Horizon	Depth (m)	Physical characteristics (s)			CaCO <sub>3</sub> (%)	Fertility characteristics (f)					Salinity and alkalinity (n)	
		Texture				CEC [cmol (p+) kg <sup>-1</sup> soil]	BS (%)	Sum of Basic cations [cmol (p+) kg <sup>-1</sup> soil]	pH (1:2.5 H <sub>2</sub> O)	OC (%)	EC (dS m <sup>-1</sup> )	ESP
		Sand (2-0.05%)	Silt (0.05-0.002)	Clay (<0.002)								
% of <2 mm soil												
<b>P5 Poyya: Fine-loamy, kaolinitic, isohyperthermic, Typic Haplustalf</b>												
Ap	0.00-0.30	67.22	18.87	13.91	2.68	17.26	76.77	13.25	7.27	0.74	0.04	8.52

Bt1	0.30-0.58	65.90	11.00	23.10	2.78	32.08	72.82	23.36	7.10	0.42	0.04	8.73
Bt2	0.58-0.90	59.89	9.44	30.67	3.05	33.93	68.17	23.13	7.17	0.36	0.06	7.22
Bt3	0.90-1.22	60.67	10.41	28.92	3.00	38.09	74.59	28.41	7.68	0.24	0.05	7.88
Bt4	1.22-1.80 +	64.47	8.29	27.24	2.90	35.36	69.82	24.69	7.46	0.39	0.07	6.93
<b>P6 Kommanagradu: Sandy, siliceous, isohyperthermic, Typic Ustipsamment</b>												
Ap	0.00-0.25	80.74	6.42	12.84	2.80	21.20	78.82	16.71	7.58	0.48	0.05	5.28
C1	0.25-0.58	93.34	2.22	04.44	3.05	14.20	68.87	09.78	7.32	0.36	0.04	9.51
C2	0.58-0.99	90.76	2.05	07.19	3.00	16.07	64.53	10.37	7.28	0.18	0.04	6.53
C3	0.99-1.33	92.97	2.01	05.02	2.93	15.02	61.85	09.29	7.46	0.18	0.05	6.32
C4	1.33-1.60	94.03	1.99	03.98	2.98	12.33	64.40	07.94	7.69	0.15	0.05	4.70
<b>P7 Durgiperi: Fine-loamy, smectitic, isohyperthermic, Vertic Haplustept</b>												
Ap	0.00-0.15	80.36	3.21	16.43	2.73	11.55	82.68	09.55	7.04	0.65	0.03	5.45
Bw1	0.15-0.46	63.61	3.41	32.98	2.98	34.76	79.05	27.48	7.14	0.45	0.02	5.67
Bw2	0.46-0.86	67.82	5.75	26.43	2.90	26.51	71.56	18.97	7.22	0.09	0.02	4.68
Bw3	0.86-1.00	47.47	6.85	45.68	2.85	37.30	85.79	32.00	7.70	0.15	0.02	5.52
Cr	1.00	Weathered gneiss mixed with soil										
<b>P8 Sarswathi Kandriga: Fine-loamy, smectitic, isohyperthermic, Typic Haplustept</b>												
Ap	0.00-0.29	79.68	7.17	13.15	2.88	18.59	65.52	12.18	7.53	0.56	0.08	7.64
A1	0.29-0.43	63.55	21.87	14.58	2.95	20.43	66.47	13.58	7.52	0.42	0.09	12.63
A2	0.43-0.71	78.34	7.98	13.68	2.95	17.69	70.10	12.40	7.60	0.31	0.08	12.95
A3	0.71-1.10	56.38	23.99	19.63	2.95	20.79	61.81	12.85	7.36	0.27	0.06	12.41
Bw1	1.10-1.40	59.14	14.01	26.85	2.85	31.78	70.74	22.48	7.24	0.12	0.04	10.70
Bw2	1.40-1.80 +	60.13	13.67	26.20	2.90	33.38	72.74	24.28	7.14	0.06	0.02	8.99
<b>P9 Vedam: Fine-loamy, smectitic, isohyperthermic, Typic Haplustept</b>												
Ap	0.00-0.15	63.61	8.49	27.90	2.80	34.63	83.51	28.92	5.91	0.45	0.01	4.94
Bw1	0.15-0.33	52.64	26.81	20.55	2.95	31.60	76.71	24.24	6.07	0.33	0.01	3.20
Bw2	0.33-0.64	55.68	23.45	20.87	3.00	32.23	74.40	23.98	5.54	0.30	0.01	3.48
Bw3	0.64-0.86	62.67	12.11	25.22	3.13	33.63	71.36	24.00	5.89	0.24	0.01	18.23
Bw4	0.86-1.10	70.09	6.54	23.37	2.90	29.96	70.49	21.12	6.41	0.15	0.02	3.44
Bw5	1.10-1.50	65.43	15.37	19.20	2.73	22.23	60.19	13.38	6.45	0.12	0.02	4.00
Cr	1.50	Weathered gneiss mixed with soil										
<b>P10 Kallivettu: Fine-loamy, smectitic, isohyperthermic, Typic Haplustept</b>												
Ap	0.00-0.18	76.38	8.22	15.40	2.98	21.22	57.02	12.10	7.00	0.42	0.03	4.15
Bw1	0.18-0.55	73.20	3.66	23.14	2.93	33.39	76.85	25.66	7.05	0.30	0.02	6.89
Bw2	0.55-0.84	58.04	24.40	17.56	2.90	24.47	72.46	17.73	6.91	0.30	0.02	4.00
Bw3	0.84-1.02	48.21	14.67	37.12	3.00	39.89	69.27	27.63	6.74	0.24	0.02	3.96
Cr	1.02	Weathered gneiss mixed with lime										
<b>P11 Gajulapellore: Coarse-loamy, siliceous, isohyperthermic, Lithic Ustorthent</b>												
Ap	0.00-0.22	60.86	19.07	20.07	2.40	30.31	59.32	17.98	6.61	0.42	0.02	4.82
A1	0.22-0.33	82.73	3.22	14.05	3.00	21.64	65.71	14.22	7.02	0.30	0.02	5.55
R	0.33	Hard Rock										

Table 1: (Cont.)...

Hori zon	Depth (m)	Physical characteristics (s)			CaCO <sub>3</sub> (%)	Fertility characteristics (f)					Salinity and alkalinity (n)	
		Texture				CEC [cmol (p+) kg <sup>-1</sup> soil]	BS (%)	Sum of basic cations [cmol (p + ) kg <sup>-1</sup> soil]	pH (1:2.5 H <sub>2</sub> O)	OC (%)	EC (dS m <sup>-1</sup> )	ESP
		Sand (2- 0.05%)	Silt (0.05 - 0.002)	Clay (<0.002)								
<b>P12 Kanamanambedu: Fine-loamy, kaolinitic, isohyperthermic, Typic Haplustalf</b>												
Ap	0.00-0.15	73.43	05.08	21.49	3.23	34.58	79.51	27.50	7.96	0.42	0.01	2.89
Bt1	0.15-0.34	68.37	04.69	26.94	2.93	41.39	88.74	36.73	7.99	0.36	0.03	3.91
Bt2	0.34-0.80	56.63	08.24	35.13	3.05	46.26	90.14	41.70	8.14	0.12	0.02	3.42
Cr	0.80	Weathered gneiss mixed with soil										
<b>P13 Kalathuru: Fine-loamy, siliceous, isohyperthermic, Typic Ustorthent</b>												
Ap	0.00-0.23	82.78	02.22	15.00	2.90	12.15	65.02	07.90	7.14	0.57	0.04	4.03
A1	0.23-0.44	76.90	04.20	18.90	3.05	18.82	70.35	13.24	7.05	0.48	0.02	3.83
A2	0.44-0.69	71.39	04.24	24.37	2.93	33.23	78.78	26.18	7.22	0.27	0.02	4.48
A3	0.69-0.92	53.49	28.25	18.26	3.00	22.61	58.51	13.23	7.15	0.24	0.01	3.23
A4	0.92-1.30 +	67.03	10.99	21.98	2.93	36.24	80.13	29.04	7.44	0.18	0.01	3.95
<b>P14 Chukkalanidigallu: Fine-loamy, smectitic, isohyperthermic, Fulventic Haplustept</b>												
Ap	0.00-0.17	72.12	13.21	14.67	2.88	25.40	71.02	18.04	6.66	0.51	0.02	6.38
A1	0.17-0.41	66.87	20.21	12.92	2.98	25.88	74.69	19.33	7.11	0.42	0.03	5.83
A2	0.41-0.77	62.69	20.62	16.69	2.65	26.17	78.14	20.45	7.40	0.35	0.03	8.94
Bw1	0.77-1.19	71.76	03.38	24.86	2.63	25.72	85.93	22.10	7.64	0.18	0.01	9.25
Bw2	1.19-1.43	59.17	15.69	25.14	2.63	28.10	79.25	22.27	7.67	0.21	0.02	8.83
BC	1.43-1.80 +	68.69	13.03	18.28	2.90	23.83	77.76	18.53	7.65	0.15	0.02	6.25

<b>P15 Thimmasamudram: Coarse-loamy, smectitic, isohyperthermic, Typic Haplustept</b>												
Ap	0.00-0.20	77.57	12.99	9.44	2.70	22.44	68.76	15.43	7.15	0.39	0.01	5.53
A1	0.20-0.54	73.58	13.96	12.46	2.65	23.12	63.11	14.59	7.31	0.30	0.02	5.06
Bw1	0.54-0.84	65.54	13.14	21.32	3.10	25.44	80.70	20.53	7.09	0.18	0.02	3.11
Bw2	0.84-1.07	72.19	10.20	17.61	2.65	25.13	75.13	18.88	6.71	0.12	0.03	3.62
Bw3	1.07-1.50 +	56.13	12.48	31.39	2.60	30.67	85.39	26.19	7.15	0.09	0.01	3.98
<b>P16 Ramapuram: Fine-loamy, smectitic, isohyperthermic, Fulventic Haplustept</b>												
Ap	0.00-0.20	72.31	16.23	11.46	2.75	21.39	58.44	12.50	7.20	0.45	0.01	2.01
A1	0.20-0.40	82.30	08.33	09.37	2.55	10.84	61.35	06.65	7.59	0.30	0.01	4.43
Bw1	0.40-0.80	72.12	05.58	22.30	2.75	23.85	65.07	15.52	7.27	0.18	0.02	6.37
Bw2	0.80-1.20	63.19	07.64	29.17	2.68	24.20	74.26	17.97	7.29	0.15	0.02	4.42
Bw3	1.20-1.50 +	51.21	07.41	41.38	2.75	34.54	84.51	29.19	7.56	0.10	0.02	4.11
<b>P17 Chinamitti kandriga: Coarse-loamy, siliceous, isohyperthermic, Typic Ustrorthent</b>												
Ap	0.00-0.16	78.37	05.74	15.89	2.78	11.28	78.99	08.91	7.45	0.59	0.02	6.21
A1	0.16-0.50	72.14	12.43	15.43	2.53	19.03	61.80	11.76	7.36	0.38	0.01	5.73
A2	0.50-0.85	68.72	12.96	18.32	2.55	21.54	72.79	15.68	7.28	0.30	0.02	4.83
A3	0.85-1.28	69.34	13.33	17.33	2.70	17.87	74.31	13.28	7.03	0.18	0.02	4.81
A4	1.28-1.60 +	66.79	16.25	16.96	2.75	17.68	64.54	11.41	7.10	0.15	0.02	7.41
<b>P18 Chittathur: Coarse-loamy, siliceous, isohyperthermic, Typic Ustrorthent</b>												
Ap	0.00-0.22	72.78	07.78	19.44	2.78	18.13	78.65	14.26	7.71	0.48	0.01	12.24
A1	0.22-0.46	74.07	07.38	18.55	2.90	18.82	80.71	15.19	7.04	0.31	0.02	6.96
A2	0.46-0.81	81.14	02.02	16.84	2.73	13.07	55.93	07.31	6.97	0.20	0.02	4.59
Cr	0.81	Weathered gneiss mixed with soil										
<b>P19 Kirlapudu: Sandy, siliceous, isohyperthermic, Lithic Ustrorthent</b>												
Ap	0.00-0.15	76.85	10.52	12.63	2.90	10.77	69.64	7.50	6.85	0.51	0.04	8.45
A1	0.15-0.29	80.55	03.21	16.24	2.73	12.07	56.84	6.86	6.74	0.27	0.04	8.20
A2	0.29-0.49	78.81	8.93	12.26	2.48	12.96	62.96	8.16	6.74	0.15	0.04	9.88
R	0.49	Weathered Rock										
<b>P20 Brahmanapalle: Coarse-loamy, siliceous, isohyperthermic, Typic Ustrorthent</b>												
Ap	0.00-0.16	65.54	13.14	21.32	3.00	19.33	67.20	12.99	6.70	0.46	0.01	9.05
A1	0.16-0.34	63.55	21.87	14.58	2.75	08.91	64.31	05.73	7.24	0.32	0.01	14.14
A2	0.34-0.58	60.86	19.07	20.07	2.65	18.92	69.56	13.16	7.73	0.18	0.01	7.72
Cr	0.58	Weathered gneiss mixed with soil										

**Table 2:** Site and soil characteristics of Pedons (weighted mean)

Pedon no.	Land form	Wetness (W) drainage	Physical soil characteristics (s)				Soil fertility characteristics (f)					Salinity and alkalinity (n)	
			Texture	Coarse fragments Volume (%)	Soil depth (m)	CaCO <sub>3</sub> (%)	Apparent CEC [c mol (p+) kg <sup>-1</sup> soil]	Sum of basic cations [c mol (p+) kg <sup>-1</sup> soil]	BS	pH 1:2.5	OC	EC (dS m <sup>-1</sup> )	ESP
1	Plain	Moderately well drained	sl	Nil	1.10	2.87	27.15	11.49	69.61	7.48	0.54	0.02	3.98
2	Plain	Moderately well drained	sl	Nil	1.80	2.97	17.08	10.41	68.00	7.44	0.68	0.02	2.73
3	Upland	Well drained	sl	Nil	1.80	2.95	18.92	11.67	70.26	7.31	0.42	0.01	5.67
4	Plain	Well drained	scl	Nil	2.00	2.76	15.27	15.55	78.06	7.36	0.45	0.01	5.95
5	Plain	Moderately well drained	sl	Nil	1.80	2.86	23.19	11.78	72.00	7.27	0.74	0.05	8.10
6	Plain	Well drained	sl	Nil	1.60	2.20	17.70	15.59	67.07	7.58	0.48	0.03	4.76
7	Upland	Moderately well drained	sl	Nil	1.00	2.89	27.14	15.56	77.55	7.08	0.57	0.02	5.22
8	Plain	Moderately well drained	sl	Nil	1.80	2.93	18.98	10.76	67.98	7.53	0.56	0.08	11.21
9	Upland	Moderately well drained	scl	Nil	1.50	2.98	32.72	25.62	65.61	5.97	0.40	0.01	6.89
10	Upland	Moderately Well drained	sl	Nil	1.02	2.94	29.01	14.62	70.76	7.01	0.39	0.02	5.09

**Table 2:** (Cont.)...

Pedon no.	Land form	Wetness (W) drainage	Physical soil characteristics (s)				Soil fertility characteristics (f)					Salinity and alkalinity (n)	
			Texture	Coarse fragments Volume (%)	Soil depth (m)	CaCO <sub>3</sub> (%)	Apparent CEC [c mol (p+) kg <sup>-1</sup> soil]	Sum of basic cations [c mol (p+) kg <sup>-1</sup> soil]	BS	pH 1:2.5	OC	EC (dS m <sup>-1</sup> )	ESP
11	Upland	Well drained	scl	Nil	0.33	2.60	27.42	16.10	61.45	6.66	0.41	0.03	5.06
12	Upland	Well drained	scl	Nil	0.80	3.06	40.91	29.94	87.81	7.97	0.40	0.02	3.44
13	Upland	Moderately well drained	sl	Nil	1.30	2.96	17.48	7.82	71.79	7.13	0.56	0.02	3.91
14	Upland	Well drained	sl	Nil	1.80	2.76	25.77	16.87	78.90	6.80	0.48	0.02	7.83
15	Upland	Well drained	sl	Nil	1.48	2.81	24.70	14.04	75.61	7.16	0.39	0.01	4.34
16	Upland	Moderately Well drained	sl	Nil	1.50	2.69	17.66	10.89	70.03	7.42	0.40	0.02	4.79



17	Upland	Well drained	sl	Nil	1.60	2.60	16.55	9.10	69.83	7.32	0.51	0.02	5.35
18	Upland	Well drained	sl	Nil	0.81	2.79	18.06	12.26	69.44	7.42	0.46	0.01	7.37
19	Upland	Moderately well drained	sl	Nil	0.49	2.68	12.04	6.07	63.26	7.63	0.41	0.04	8.96
20	Upland	Well drained	scl	Nil	0.58	2.78	15.45	8.80	67.28	6.81	0.41	0.01	10.08

**Table 3:** Limitation levels of the land characteristics and land suitability classes for groundnut crop

Soil	Crop	Wetness (w) drainage	Physical soil characteristics (s)			CaCO <sub>3</sub> (%)	Soil fertility characteristics (f)			Alkalinity (n) ESP	Actual land suitability sub-class	Potential land suitability sub-class
			Texture	Coarse fragments (vol. %)	Soil depth (cm)		Sum of basic cations [cmol (p+) kg <sup>-1</sup> soil]	pH 1:2.5	OC (%)			
Typic Haplustept	Groundnut	1	0	0	0	0	0	2	1	0	S2fw	S1w
Typic Haplustalf	Groundnut	1	0	0	0	0	0	1	1	0	S1fw	S1w
Typic Haplustept	Groundnut	0	0	0	0	0	0	1	1	0	S1f	S1
Typic Ustifluent	Groundnut	0	0	0	0	0	0	1	1	0	S1f	S1
Typic Haplustalf	Groundnut	1	0	0	0	0	0	1	1	1	S1fw	S1w
Typic Ustipsamment	Groundnut	0	0	0	0	0	0	2	1	0	S2f	S1
Vertic Haplustept	Groundnut	1	0	0	1	0	0	1	1	0	S1fw	S1w
Typic Haplustept	Groundnut	1	0	0	0	0	0	2	1	0	S2fw	S1w
Typic Haplustept	Groundnut	1	0	0	0	0	0	2	1	0	S2fw	S1w
Typic Haplustept	Groundnut	1	0	0	0	0	0	0	1	0	S1fw	S1w
Lithic Ustorthent	Groundnut	0	0	0	3	0	0	0	1	0	S3fs	S2s
Typic Haplustalf	Groundnut	0	0	0	1	0	0	2	1	0	S2fs	S1s
Typic Ustorthent	Groundnut	1	0	0	0	0	0	1	1	0	S1fw	S1w
Fulventic Haplustepts	Groundnut	0	0	0	0	0	0	0	1	0	S1f	S1
Typic Haplustepts	Groundnut	0	0	0	0	0	0	1	2	0	S2f	S1
Fulventic Haplustepts	Groundnut	1	0	0	0	0	0	1	1	0	S1fw	S1w
Typic Ustorthent	Groundnut	1	0	0	0	0	0	1	1	0	S1fw	S1w
Typic Ustorthent	Groundnut	0	0	0	1	0	0	2	1	1	S2fsw	S1s
Lithic Ustorthent	Groundnut	0	0	0	3	0	0	0	1	0	S3fs	S2s
Typic Ustorthent	Groundnut	1	0	0	2	0	0	0	1	0	S2fsw	S1s

Limitations: 0- No; 1- Slight; 2- Moderate; 3- Severe; 4- Very severe

Suitability classes: f- soil fertility limitations; s- Physical soil limitations; w- wetness limitations; n- Salinity (and/or alkalinity) limitations

**3.1. Suitability of pedons to groundnut crop**

Pedons 2, 5 and 12 are classified taxonomically under Typic Haplustalf. Although, they are grouped under same classification they differ in their suitability to groundnut *i.e.* suitable (S1) (pedons 2 and 5) and moderately suitable (S2) (pedons 12). These pedons showed limitations *viz.*, soil fertility characteristics (pH, organic carbon and ESP), physical soil characteristics (depth) and wetness for growing groundnut crop. Organic carbon was a slight limitation for all the three pedons. However, pH was a moderate limitation for pedon 12 and not a limitation for pedons 2 and 5. Wetness is a slight limitation for pedons 2 and 5 but not a limitation for pedon 12. Similar limitations of organic carbon and pH were reported in Typic Haplustalf in Vadamalapeta mandal of Chittoor district (Kumar and Naidu, 2012) [12].

Pedons 1, 3, 8, 9, 10 and 15, which are grouped under Typic Haplustept, which are suitable (S1) for growing groundnut crop. Wetness was a slight limitation for pedons 1, 8, 9 and 10 and not a limitation for pedons 3 and 8. Organic carbon was a slight limitation for pedons 1, 3, 8, 9 and 10 but it was a moderate limitation for pedon 15. Soil pH was a moderate limitation for pedons 1, 8 and 9, slight limitation for pedons 1 and 15 and not a limitation for pedon 10. Similar limitations were identified in Typic Haplustept of Yerpedu mandal in Chittoor district in Andhra Pradesh for groundnut growing soils (Leelavathi *et al.*, 2010) [13].

Pedon 7 which was classified under Vertic Haplustept was suitable (S1) for groundnut crop. Wetness, soil depth, pH and organic carbon are the slight limitations for this pedon. Similar types of limitations in Vertic Haplustept were noticed

in Vidarbha region of Maharashtra for growing groundnut crop (Gabhane *et al.*, 2006) [11].

Though pedons 13, 17, 18 and 20 are classified under Typic Ustorthent they differ in their suitability to groundnut crop. Pedons 13 and 17 are suitable (S1) whereas pedons 18 and 20 were moderately suitable (S2) for growing groundnut crop. Wetness was a slight limitation for pedons 13, 17 and 20 and not a limitation for pedon 18. Organic carbon was a slight limitation for all these pedons. Soil pH was a moderate limitation for pedon 18, slight limitation for pedons 13 and 17 and not a limitation for pedon 20. Soil depth was a moderate limitation for pedon 20, slight limitation for pedon 18 and not a limitation for pedons 13 and 17. Alkalinity was slight limitation for pedon 18 and not a limitation for remaining pedons. Similar kinds of limitations in Typic Ustorthent were noticed for growing groundnut crop in Vadamalapeta mandal of Chittoor district in Andhra Pradesh (Kumar and Naidu, 2012b) [12].

Pedon 4 is grouped under Typic Ustifluent is suitable (S1) for groundnut crop. The slight limitations found for growing groundnut crop were pH and organic carbon. Furthermore, pedon 6 was grouped under Typic Ustipsamment was moderately suitable (S2) for groundnut crop. The slight limitation for crop growth was pH and moderate limitation of soil pH. These results were accordance with finding for Typic Ustipsamment in soils of central and eastern parts in Prakasam district of Andhra Pradesh for groundnut growing soils (Sekhar *et al.* 2014) [15].

Pedons 11 and 19 which are placed under Lithic Ustorthent are marginally suitable (S3) for groundnut crop. Soil depth

was marginal limitation for crop growth. Organic carbon was slight limitation in these pedons. Pedons 14 and 16, were grouped under Fulventic Haplustepts, are suitable (S1) for growing groundnut crop. Wetness was a slight limitation for pedon 16 and not a limitation for pedon 14. Organic carbon was a slight limitation for these pedons while soil pH was slight limitation for pedon 16 and not a limitation for pedon 14. Fluventic Haplustept was moderately suitable (S2) for cultivation of groundnut crop (Savalia *et al.*, 2009) <sup>[4]</sup>.

The soil-site suitability evaluation for groundnut crop revealed that soil depth was a severe limitation in pedons 11 and 19, moderate limitation in pedon 20 and slight limitation in pedons 7, 12 and 18. Soil pH was a moderate limitation in pedons 1, 6, 8, 9, 12 and 18 and a slight limitation in pedons 2, 3, 4, 5, 7, 13, 15, 16 and 17. Organic carbon was a moderate limitation in pedon 15 and slight limitation in all pedons. Alkalinity was a slight limitation in pedons 5 and 18. Wetness was a slight limitation in pedons 1, 2, 5, 7, 8, 9, 10, 13, 16, 17 and 20.

### 3.2. Management practices suggested

All the above said limitations can be managed by adopting management practices such as, altering the soil pH by application of amendments like gypsum or lime or locally available spent wash or pressmud compost. Organic carbon in these soils can be improved by the application of FYM or green manuring with legumes. Wetness/drainage can be improved by improving drainage conditions. Shallow depth changed to good by the adoption of land improvement practices such as deepening of top soil by ridging, deep ploughing or breaking up of soil crust.

The soil-site suitability evaluation of the study area revealed that P2, P3, P4 P5, P7, P10, P13, P14, P16 and P17 were suitable (S1) for growing groundnut crop with slight limitations of pH, wetness and organic carbon. P1, P6, P8, P12, P15, P18 and P20 were moderately suitable (S2) with limitations of wetness, soil depth, and sum of basic cations, organic carbon, pH and alkalinity. P9, P11 and P19 were marginally suitable (S3) with moderately limitations of pH, soil depth, organic carbon for growing groundnut crop. Crop suitability evaluation revealed various limitations for growing groundnut crop in the study area. By correcting these limitations by following above said management practices, sustainable yields can be achieved in groundnut crop.

### 4. Conclusion

Evaluated the Suitability of soils of Srikalahasti division in Chittoor district of Andhra Pradesh for cultivation groundnut crop. These soils belong to Entisols, Inceptisols and Alfisols. The soil-site suitability evaluation of the study area revealed that P2, P3, P4 P5, P7, P10, P13, P14, P16 and P17 were suitable (S1) for growing groundnut crop with slight limitations of pH, wetness and organic carbon. P1, P6, P8, P12, P15, P18 and P20 were moderately suitable (S2) with moderate limitations of wetness, soil depth and slight limitations of sum of basic cations, organic carbon, pH and alkalinity. P9, P11 and P19 were marginally suitable (S3) with moderately limitations of pH, soil depth and organic carbon for growing groundnut crop. Crop suitability evaluation revealed various limitations for growing groundnut crop in the study area. By correcting these limitations by following suggested said management practices, sustainable yields can be achieved in groundnut crop besides sustaining the soil fertility.

### 5. Competing interests

Authors have declared that no competing interests exist.

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