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SOIL – SITE SUITABILITY EVALUATION FOR COMMONLY GROWING CROPS OF NALGONDA DISTRICT, ANDHRA PRADESH

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ABSTRACT

In the present study, twelve typical pedons of Nalgonda district, Andhra Pradesh were evaluated for their soil-site suitability to paddy, groundnut, sorghum, red gram, soyabean and cotton. Soil-site suitability evaluation for crops forms an essential part of land use planning programme. Several soil and site characteristics are used as parameters for assessing the suitability of land for crops in land evaluation exercise. As per the developed criteria Thummadam pedon was marginally suitable, Nandipadu, Kukadam and J. P. Gudam pedons were moderate to marginally suitable, Dugapalli, Regulagada and T. R. Gudam pedons were highly suitable to moderately suitable, Topcherla and Devulapalli pedons were highly suitable to marginally suitable and Vemulapalli, Molkacherla and Wadapalli were moderately to unsuitable for above said six crops.

Keyword: Soil site suitability, evaluation, crops, Andhra Pradesh

INTRODUCTION

Indiscriminate uses of land resources, in general, lead to their degradation and in-turn decline in productivity. They need to be used according to their capacity to satisfy the needs of its inhabitants. This can be achieved through proper investigations of land resources and their scientific evaluation. Land suitability evaluation is the process of estimating the potential of land for land use planning (Sys *et al*. 1991). The information on soil-site suitability to crops is believed to improve the usefulness of the soil survey reports which otherwise reportedly lack wider acceptability. Most of the evaluation exercises, particularly soil-site suitability evaluation were inspired by FAO initiatives (FAO 1983). The land is given a suitability rating depending on how well its properties meet the requirement of the crop. If all the properties match well with the crop requirements the land is considered highly suitable, otherwise, less suitable (moderate, marginal) and even not suitable depending upon the deviation of the land properties from the optimal growth requirement of the crops. Hence the present study covers the objective of providing the suitability evalution of the soils of Nalgonda district for growing some important crops that increases the crop productivity. This evaluation exercise may help the farmers in placing land under suitable crops.

MATERIALS AND METHODS

Andhra Pradesh state is endowed with varied types of soils under varied climatic situations. Nalgonda, a district in Andhra Pradesh is situated in the southern part of Telangana region and is located between 16-25' and 17-50' of the Northern Latitude and 78-40' and 80-05' of Eastern longitude and has great variations in land and soil characteristics. Land cover ranges from steep slopes to plain lands, supporting different types of vegetation comprises *Tridax procumbens, Parthenium hysterophorus, Prosopis juliflora, Calotropis gigantean, Acacia auriculiformis, Commalina bengalensis, Cynodon dactylon, Cyprus rotundus, Pongamia pinnata* and *Azadirachta indica,* etc.. In this area, relief played a pivotal role in the soil development.

After traversing, twelve pedons were studied on three landforms (lowland, midland and upland) for their morphological characteristics following the procedure outlined in Soil Survey Staff (1951). Horizon-wise soil samples collected from the typifying pedons were analysed for their physical, physico-chemical and chemical properties following the standard procedures and classified according to Soil Taxonomy (Soil Survey Staff 1999). These pedons were evaluated for their suitability using limitation method regarding number and intensity of limitations (Sys *et al*. 1991). The landscape and soil requirements for these crops were matched with generated data at different limitation levels: no (0), slight (1), moderate (2), severe (3), very severe (4). The number and degrees of limitations suggested the suitability class of pedon for a particular crop (Sys *et al*. 1991).

RESULTS AND DISCUSSION

The means of relevant soil characteristics are given in Table 1. The kind and degree of limitations of the soils for the six crops are presented in Table 2.

The soils with no or slight limitations were grouped under highly suitable class (S1); the soils with moderate limitations under moderately suitability class (S2); the soils with severe limitations under marginally suitable class (S3); the soils with very severe limitations under unsuitable class (N). This method also identifies the dominant limitations that restrict the crop growth in the sub-class symbol such as 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 (Table 2). Thummadam pedon is loamy sand in texture. pH is of slightly acidic EC, organic carbon, CEC and $CaCO_3$ is also low(Table 1). Pedon is marginally suitable for all the six crops (Table 2). The major limitations are Wetness (drainage), soil physical characteristics (texture and depth) and soil fertility characteristics (cec and organic carbon). Wetness (drainage) is the major limiting factor for paddy cultivation because it does not allow maintaining standing water and requires irrigation at frequent intervals. For all the six crops, organic carbon and cec is a major limiting factor and so, the organic carbon status in soils can be improved by the application of farmyard manure, green manuring, biochar and inclusion of legumes in rotation. Leelavathi *et al.* (2010) also reported that soils of Isukatagal, Merlapak mandals of chittoor district of Andhra Pradesh are also marginally suitable for paddy.

Table 1: Site and soil characteristics of pedons

Pedon	Drainage	Soil depth (cm)	Texture	$CaCO_3$ (g kg^{-1})	CEC (cmol (p^+) kg^{-1})	BS (%)	pH (1:2.5)	OC (g kg^{-1})	EC dS m^{-1}	ESP
Thummadam	Well drained	45+	LS	1.00	8.30	90.30	6.51	3.70	0.15	1.91
Nandipadu	Well drained	55+	C	248.0	50.06	93.10	7.68	5.70	0.18	9.60
Dugapalli	Well drained	75+	SCL	63.0	22.50	71.20	7.64	5.60	0.64	6.10
Kukadam	Well drained	90+	SL	2.00	15.21	86.70	7.13	2.40	0.19	2.22
Topcherla	Well drained	120	SL	1.20	18.83	72.10	6.78	5.20	0.04	4.80
Regulagada	Mod. Well drained	90+	C	138.0	46.60	100	7.52	7.20	0.33	6.89
J P Gudam	Mod. Well drained	28+	C	241.0	41.30	96.10	7.99	7.80	0.14	7.90
Vemulapalli	Poorly drained	120	SC	39.0	27.30	75.10	7.47	7.90	0.39	7.10
T R Gudam	Mod. Well drained	100+	SCL	81.0	24.00	74.00	7.39	6.20	0.53	3.21
Molkacherla	Poorly drained	85+	C	7.40	35.10	82.10	7.31	9.30	0.10	14.20
Wadapalli	Poorly drained	120	C	32.00	39.30	70.10	7.97	9.10	1.00	8.20
Devulapalli	Imferfectly drained	140	C	125.0	44.30	65.20	7.94	8.80	0.51	6.12

Weighted means of all parameters are taken

Nandipadu pedon is clayey in texture. pH is of slightly alkaline, EC is low, organic carbon was medium, CEC and $CaCO_3$ is high (Table 1). Pedon is moderately suitable for sorghum and soybean and marginally suitable for paddy, redgram, groundnut and cotton (Table 2). These soils showed limitations of wetness (drainage), soil physical characteristics (depth), soil fertility characteristics (calcium carbonate, soil reaction and organic carbon). Shweta *et al.* (2010) also reported that depth was the limitation for the cultivation of cotton, sorghum and soybean in soils of Khapri village of Nagpur district of Maharashtra. In addition to above parameters esp and texture are limitations for redgram, groundnut and soybean. Dugapalli pedon is sandy clay loamy in texture. pH is of slightly alkaline, EC is low, cec and organic carbon is medium and $CaCO_3$ is high (Table 1). Pedon is highly suitable for sorghum and groundnut and moderately suitable for paddy, redgram, soybean and cotton (Table 2). The soils are moderately suitable because of drainage and soil reaction. Similar results were noticed by Vadivelu *et al.* (2004) in paddy that soil reaction was the limiting factor for its cultivation.

Kukadam pedon is sandy loam in texture. pH is of slightly alkaline, EC, $CaCO_3$, and organic carbon is low, CEC is medium (Table 1). Pedon is moderately suitable for sorghum, redgram and groundnut and marginally suitable for paddy, soybean and cotton (Table 2). The common limitations for all crops were texture and organic carbon. Similarly Satyavathi and Suryanarayan Reddy (2004) reported that the some soils of Telangana region of Andhra Pradesh were moderately suitable for growing groundnut crop as they exhibited similar limitations in soil fertility and physical soil characteristics. Topcherla pedon is sandy loam in texture. pH is of slightly acidic, EC and $CaCO_3$ is low, organic carbon and CEC is medium (Table 1).Topcherla pedon is highly suitable for redgram, soybean and groundnut and moderately suitable for paddy and sorghum and marginally suitable for cotton (Table 2). Cotton is

marginally suitable because of the texture and cec. Major limitations were the texture and organic carbon for all the crops. For all crops organic carbon is a major limitation factor. So the organic carbon status in these soils can be improved by the application of farm yard manure, green manuring and inclusion of legumes in rotation.

Regulagada pedon is clayey in texture. pH is of slightly alkaline, EC is low, organic carbon was medium, cec and $CaCO_3$ is high (Table 1).Regulagada pedon is highly suitable for paddy, sorghum and soybean, moderately suitable for redgram and cotton and marginally suitable for groundnut (Table 2). Marginally suitable for groundnut because of the presence of clay texture. J P gugam pedon is clayey in texture. pH is of slightly alkaline, EC is low, organic carbon, CEC and $CaCO_3$ is high (Table 1). Pedon is moderately suitable for sorghum and marginally suitable for remaining five crop i.e. paddy, redgram, groundnut, soybean and cotton (Table 2). Depth was the limitation for the cotton, redgram, soybean and texture was the limitation for the paddy and groundnut. Kashiwar *et al.* (2009) reported that soil depth was the limitation for the cotton in Kh-2 series in Nagpur district of Maharashtra. Vemulapalli pedon is sandy clay in texture. pH is of slightly alkaline, EC and $CaCO_3$, and organic carbon and CEC is high (Table 1). Vemulapalli pedon is moderately suitable for paddy and soybean, marginally suitable for sorghum, redgram and cotton and not suitable for groundnut (Table 2). Wetness (drainage) is the main limitation for the groundnut, cotton, sorghum and redgram. Jagdish Prasad *et al.* (2009) reported that drainage is the one of the limitation for groundnut, cotton, sorghum in soils of Selsura research farm in Wardha district of Maharashtra. T R gudam pedon is sandy clay loamy in texture. pH is of slightly alkaline, EC is low and $CaCO_3$ and CEC is high and organic carbon is medium (Table 1). TR Gudam pedon is suitable for paddy, sorghum, redgram, soybean and moderately suitable for groundnut and cotton (Table 2).

Table 2: Soil–site suitability evaluation for commonly growing crops

Pedon	Paddy	Sorghum	Redgram	Groundnut	Soyabean	Cotton
Thummadam	S3wsf	S3sf	S3sf	S3sf	S3sf	S3sf
Nandipadu	S3wsf	S2sfn	S3sfn	S3sfn	S2sfn	S3sfn
Dugapalli	S2wsf	S1sfn	S2sfn	S1sfn	S2sfn	S2sfn
Kukadam	S3wsf	S2sf	S2sf	S2sf	S3sf	S3sf
Topcherla	S2wsf	S2sf	S1sfn	S1sf	S1sfn	S3sf
Regulagada	S1wf	S1wsfn	S2wsfn	S3wfn	S1sfn	S2wsfn
J P Gudam	S3wsf	S2wsfn	S3wsn	S3wsfn	S3sfn	S3wfn
Vemulapalli	S2wsf	S3wsfn	S3wsfn	Nwsfn	S2fs	S3wfn
T R Gudam	S1wf	S1wsf	S1wsfn	S2wsf	S1fs	S2wf
Molkacherla	S2wf	S3wsfn	S3wsn	Nsnf	S2sfn	S3wsfn
Wadapalli	S2wf	S3wfn	S3wsfn	Nwsfn	S2sfn	S3wfn
Devulapalli	S2f	S2wf	S2wsfn	S3wsfn	S1sfn	S2wfn

Limitations: 1 – Slight; 2 – moderate; 3 – severe; N – Very severe

Molkacherla and Wadapalli pedons is clayey in texture. pH is of slightly alkaline, EC and $CaCO_3$ is low, organic carbon and CEC is high (Table 1). Molkacherla and Wadapalli pedons is moderately suitable for paddy, soybean, marginally suitable for sorghum, redgram, cotton and not suitable for grountnut (Table 2). Wetness (drainage) is the main limitation for the groundnut, cotton, sorghum and redgram in this pedons. Kannan *et al.* (2011) reported that the soils of Amarpagam series of Tiruvarur district of tamil Nadu is moderately suitable for paddy and marginally suitable for cotton. Devulapalli pedon is clayey in texture. pH is of slightly alkaline, EC is low, organic carbon, CEC and $CaCO_3$ is high (Table 1). Devulapalli pedon is suitable for soybean, moderately suitable for paddy, sorghum, redgram, cotton and marginally suitable for groundnut. Drainage is the main limitation for groundnut, sorghum, redgram and cotton. The pedons of Kukadam and Molkacherla are moderately suitable for groundnut and Thummadam, Nandipadu, Regulagada, J P Gudam and Devulapalli pedons are marginally suitable for groundnut. Satyavathi and Suryanarayan Reddy (2005) and Leelavathi *et al.* (2010) also reported that the some soils of Andhra Pradesh are marginally to moderately suitable for growing groundnut crop. Texture is the major limitation for the paddy in Thummadam and Kukadam and pH is the major limitation for paddy in Dugapalli, Nandipadu, Wadapalli, Devulapalli similarly Vadivelu *et al.* (2004) was found the texture and pH was major limitation.

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