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Soil Fertility Assessment in Groundnut, Redgram, Blackgram, Sesamum Growing Areas of Krishna District in Andhra Pradesh

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ABSTRACT

A survey was conducted to assess the fertility status of groundnut, redgram, blackgram and sesamum growing soils of Krishna district in Andhra Pradesh during 2017-18. Soil samples were collected from groundnut (50), redgram (38), blackgram (51) and sesamum (53) growing areas and were analyzed for pH , EC, texture and available macronutrients (N, P,K and S) and DTPA extractable micronutrients (Fe , Zn, Cu and Mn) .The soils were sandy loam to sandy clay loam in texture , neutral to slightly alkaline in reaction and nonsaline. Soils were low to medium in organic carbon, low in available nitrogen, medium to high in available P_2O_5 and K_2O and sufficient in available sulphur. The DTPA extractable zinc was deficient in groundnut and blackgram growing soils whereas hot water extractable boron was sufficient in all the soils. Soil organic carbon was positively and significantly correlated with available nitrogen, sulphur and micronutrients whereas the pH was negatively correlated with micronutrients . Electrical conductivity of the soils was significantly and positively correlated with available S .

Key words : *Blackgram, Redgram, Groundnut, Sesamum, Soil Properties and Soil Fertility.*

Soil nutrient status of any cultivable soil is the primary indicator of productivity, mineral nutrition has been recognized as an important constraint in crop production. Systematic and periodic identification of current nutrient deficiencies and sufficiency is a prerequisite for sustaining the productivity and fertility of soils. Soil test based fertilizer application is still a rare practice in this area. Hence, there is a wide variation in fertilizer application by farmers (Satish *et al.,* 2011). Further, In Krishna district, groundnut is grown in about 10,000 ha, redgram in 5000 ha, blackgram in more than one lakh hectares and sesamum in 2000 hectares.

Soil fertility assessment of an area or region cultivated with different crops is an important aspect in the context of sustainable agricultural production. Information on the available nutrient status of soils is a pre requisite for advising individual farmers on fertilizer scheduling and to monitor changes in soil fertility over a period of time. The available soil nutrients *viz.,* nitrogen, phosphorus, potassium, sulphur, iron, manganese, zinc, copper and boron controls fertility and productivity of soils (Singh and Mishra, 2012). Hence, The present study was carried to assess the fertility status of the soil to know best possibilities in improving the nutrient management practices for attaining profitable yields of the crops.

MATERIAL AND METHODS

The study area was (East coast of India lies in between $15^0$43'N & 17^0 10' N latitudes and $80^0$00' E & $81^0$33' E longitudes) located in Krishna district of Andhra Pradesh is known for its varied types of soils with different production potentials and intensively grown for of various agricultural crops. The climate of the area was tropical with extreme hot summer and cold winter. The Monsoon usually enters in the middle of June and brings good rains up to the middle of October. The normal annual rainfall of the district was 1029 mm, which is received through the south-west monsoon. There are four types of soils in this district *viz.,* black cotton (Clayey) soils (57.60%), sandy clay loams (22.30%), sandy loam soils (19.40%) and sandy soils (0.70%).

Surface soil samples (0-15cm) from 50 locations in groundnut growing areas, 38 locations in redgram growing areas, 51 locations in blackgram growing areas and 53 locations in sesamum growing areas were collected. The samples were air dried under shade in room temperature. Roots and other debris present in soil samples were removed before grinding the soil samples using wooden pestle and mortar to pass through 2 mm sieve. Processed soil samples were analysed for soil pH and electrical conductivity (Jackson, 1973), organic carbon (Walkley and Black, 1934), available N (Subbaiah and Asija, 1956), available P (Olsen *et al*., 1954), available K (Jackson, 1973), available sulphur (Chesnin and Yien, 1951), DTPA extractable micronutrients (Lindsay and Norvell, 1978) and available boron (Berger and Troug, 1939). The rating limits for soil test values *viz.,* soil organic carbon available nitrogen, P_2O_5, K_2O, S, Zn,

Table 1. Rating limits for soil test values

Nutrient	Low	Medium	High
Organic carbon	<0.5%	0.5 - 0.75%	>0.75%
Available N-$KMnO_4$ kg ha^{-1}	<280	280 - 560	>560
Available P_2O_5 kg ha^{-1}	<22.9	22.9 - 56.34	>56.34
Available K_2O kg ha^{-1}	<129.6	129.6 - 336	>336
Secondary & micronutrients (mg kg^{-1})	Deficiency		Sufficiency
Available S	<10		>10
Available Zn	<0.6		>0.6
Available Fe	<4.5		>4.5
Available Mn	<2.0		>2.0
Available Cu	<0.2		>0.2
Available B	<0.5		>0.5

B, Fe, Mn and Cu given by Tandon (2005) presented in Table 1 was used for the assessment of the soil fertility status of groundnut, redgram, blackgram and sesamum growing soils. The statistical parameters like minimum, maximum, mean, standard deviation (SD), Standard error and correlation coefficient of soil properties were determined by adopting standard methods as described by Gomez and Gomez (1984).

In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for each nutrient. Nutrient index (N.I) value is a measure of nutrient supplying capacity of soil to plants (Singh *et al.,* 2016). The nutrient index approach introduced by Parker *et al.*(1951). This index is used to evaluate the fertility status of soils based on the samples in each of the three classes, *i.e.,* low, medium and high. Crop wise nutrient index were calculated for the soil samples analyzed using the following formula:

Nutrient Index (N.I.)

$$= (NL \times 1 + NM \times 2 + NH \times 3) / NT$$

where,

NL : Indicates number of samples falling in low class of nutrient status

NM : Indicates number of samples falling in medium class of nutrient status

NH : Indicates number of samples falling in high class of nutrient status

NT : Indicates total number of samples analysed for a given area.

Table 2. Nutrient index values and their interpretation

S.No.	Nutrient Index	Value	Interpretation
1	Low	<1.67	Low fertility status of the area
2	Medium	1.67-2.33	medium fertility status of the area
3	High	>2.33	High fertility status of the area

RESULTS AND DISCUSSION

Fertility status of groundnut growing soils:

Fertility status of groundnut growing soils of Vatsavai and Gannavaram mandals of Krishna district was presented in tables 3, 11 and 12. Groundnut cultivation in Vatsavai mandal was confined to sandy loam soils. The pH of the soil ranged from 6.5 to 7.2 with a mean value of 6.81 indicating neutral in reaction. The electrical conductivity (EC) of soil varied from 0.06 to 0.9 dSm^{-1} with a mean value of 0.15 dSm^{-1} revealing non saline nature. Organic carbon content of the soil showed greater variation and ranged from 0.02 % to 0.67 % with a mean organic carbon content of 0.21%. The parker nutrient index value for organic carbon is 1.07 which indicates low in organic carbon status of soil. Available nitrogen of the groundnut growing soils ranged from 124 kg ha^{-1} to 285 kg ha^{-1} with a mean value of 169.07 kg ha^{-1}. The parker nutrient index value is 1.04 indicating low N status . Available P_2O_5 ranged from 9.8 kg ha^{-1} to 75 kg ha^{-1} with a mean value of 32.93 kg $ha^{-1}$with parker nutrient index of 1.75 indicating medium P_2O_5 status. Available K_2O ranged from 12 to 128 kg ha^{-1} with a mean of 81.04 kg ha^{-1} nutrient index of 1.0 indicating low K status. Available sulphur ranged from 1 to 50 mg kg^{-1} with a mean of 14.61 mg $kg^{-1}$and was found sufficient in majority soils (64.28%). DTPA extractable micronutrients *viz.,* Zn (0.18-0.8 mg kg^{-1}), Fe (1.9-17 mg kg^{-1}), Mn (4-23 mg kg^{-1}), Cu (0.2-5 mg kg^{-1}) and hot water extractable boron (0.01-2.02 mg kg^{-1}) were found to be deficient to sufficient. However, zinc was

Table 3. Fertility status of Groundnut growing soils

Name of the mandal	Soil type	Soil Fertility Status											
		Physico chemical properties			Available nutrients								
					kg ha^{-1}			mg kg^{-1}					
		pH	Ec(dSm^{-}	OC (%)	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
Vatsavai	Sandy loam	6.81	0.15	0.21	169.07	32.93	81.04	14.61	0.47	0.48	9.19	9.04	1.35
Range(minimum-maximum)		6.5-7.2	0.06-0.9	0.02-0.67	124-285	9.8-75	12-128	Jan-50	0.18-0.8	0.01-2.02	1.9-17	23-Apr	0.2-5.0
Nutrient Index				1.07	1.04	1.75	1						
Fertility Status				low	low	medium	low						
Gannavaram	Sandy clay loam	7.23	0.41	0.45	207.95	37.4	169.09	22.18	0.47	1.4	5.77	6.16	2.53
Range(minimum-maximum)		6.5-7.5	0.11-0.83	0.15-0.84	156-283	20.55-62.56	91-242	7.0-37.0	0.18-1.01	0.55-3.22	2.24-9.85	4.6-7.40	0.22-4.58
Nutrient Index				1.41	1.14	2.09	1.77						
Fertility Status				Low	Low	Medium	Medium						

Table 4. Correlation between soil properties and soil available nutrients in groundnut growing soils

Soil Properties	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
pH	0.358**	-0.008	0.626**	0.307*	-0.125	0.450**	-0.527**	-0.139	0.367**
EC	0.317*	0.039	0.470**	0.501**	-0.232	0.436**	-0.159	-0.17	0.374**
Organic carbon	0.810**	0.033	0.508**	0.293*	-0.162	0.194	-0.067	-0.116	0.420**

*Significant at the 5% level; ** Significant at the 1% level

Table 5. Fertility status of Redgram growing soils

Name of the Mandal	Soil type	Soil Fertility status											
		Physico chemical properties			Available nutrients								
					Kg ha^{-1}			mg kg^{-1}					
		pH	EC(dSm^{-1})	OC (%)	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
Jaggaiahpeta	Sandy loam	7.51	0.21	0.44	198	46.97	153	21.84	2.03	3.11	7.78	5.23	2.61
Range (minimum-maximum)		6.6-8.3	0.04-0.78	0.1-0.82	66.3-295	9-106	33-342	3.0-89	0.18-8.69	0.18-19	1.22-20.4	1.8-13.5	0.25-5.2
Nutrient Index				1.39	1.03	1.76	1.63						
Fertility status				Low	Low	Medium	Medium						

deficient in 75% of soils whereas boron was deficient in 67.85% soils. In Gannavaram mandal groundnut is cultivated in sandy caly loam soils having pH varied from 6.5-7.5 with a mean pH value of 7.23 indicating neutral in reaction. Electrical conductivity (EC) ranged from 0.11-0.83 with a mean of 0.41 dSm^{-1}inidcating non saline. The organic carbon content of soil ranged from 0.15-0.84 % with a mean of 0.45 % having nutrient index of 1.41 indicating low in organic carbon (Table 3.). Low available nitrogen (Nutrient index 1.14) and medium in available phosphorus (nutrient index 2.09) and potassium (nutrient index 1.77) were observed in these soils. Available S varied from 7.0-37.0 with a mean value of 22.18 mg kg^{-1} and was found to be sufficient in most of the soils (95.45%) Available zinc ranged from 0.18-1.01 mg kg^{-1} with a mean value of 0.47, available Boron ranges from 0.55-3.22 mg kg^{-1} with a mean value of 1.40 mg kg^{-1}, available iron ranged from 2.24-9.85 mg kg^{-1} with a mean of 5.77 mg kg^{-1}, available manganese varied from 4.6 to 9.85 (6.16 mg kg^{-1}) and available boron ranged from 0.22 to 4.58 (2.53) mg kg^{-1}.

Groundnut in Andhra Pradesh is mostly cultivated in high to low rainfall zones in varied textured soils, variation in soil texture might be due to variation in topographic position, nature of parent material *in situ* weathering of clay and age of soils and climate conditions (Satish *et al.* 2011). The organic carbon content and available soil nitrogen are low in groundnut growing soils. This might be due rapid oxidation of organic matter due to semiarid conditions of the area and less accumulation of NO_3^--N and intensive leaching (Finck and Venkatewarlu, 1982). The medium to high available P_2O_5 might be due to the continuous use of phosphatic fertilizers like single super phosphate by farmers in these areas (Satish *et al.* 2011). Available S was sufficient due to continuous application of sulphur containing fertilizers like SSP (Satish *et al.* 2011).

The data on simple correlations carried between available major nutrients, micronutrients and soil properties of groundnut growing soil is presented in table 4. The pH of the soil was significantly and positively correlated with available nitrogen (r = 0.358**), potassium (r = 0.626**), boron (r = 0.450**) and copper (r = 0.367**). Significant and positive correlation was also observed with available sulphur (r = 0.307*). Furthermore, there was a significant and negative correlation between pH and available iron (r = - 0.527**) .Similar negative correlation of available P_2O_5 (r = - 0.008) with pH was also noticed by Shirigire *et al.,* (2018). Electrical conductivity of the soil had significant and positive correlation with available nitrogen (r = 0.317*), P_2O_5 (r = 0.039), potassium(r = 0.470**), sulphur (r = 0.501**), boron (r = 0.436**) and copper (r = 0.374**) and negative correlation with available zinc (r = - 0.232), iron(r = - 0.159) and manganese (r = -0.170). Significant and positive correlation was recorded between organic carbon of the soil and available nitrogen (r = 0.810**), potassium (0.508**), sulphur (0.293*) and copper (0.420**) , indicating the importance of organic matter in promoting the availability of these micronutrients in the soils. The availability of these nutrients increases with increase in organic matter due to its decomposition and chelation activity (Shah *et al*. 2018).

Fertility Status of Redgram growing soils

The data pertaining to soil fertility status of redgram growing soils is presented in Tables 5, 11 and 12.The results indicated that soil texture confined to sandy loam with pH varied from 6.6 to 8.3 with a mean value of 7.51 indicating neutral to slightly alkaline in reaction. The Electrical conductivity ranged from 0.04-0.78 dSm^{-1} with a mean value of 0.21 dSm^{-1} indicating non saline. Organic carbon of the soil ranged from 0.10% to 0.82% with a nutrient index value of 1.39 indicating low organic carbon status in redgram growing soils. Available nitrogen ranging from 66.3 to 295 kg ha^{-1} with a nutrient index value of 1.03 indicating low N status (97.36%). The nutrient index value of 1.76 and 1.63 for available P_2O_5 and K_2O, respectively indicating medium status The redgram growing soils are sufficient in available sulphur (78.94%) and DTPA extractable micronutrients *viz.,* zinc (76.31%), iron (68.42%), manganese (97.36%), copper (100.00%) and hot water soluble boron (92.1%). The low organic carbon and available nitrogen might be due to poor fertility management of redgram growing soils. The medium status of available P_2O_5 and K_2O is due to the application of P and K fertilizers and weathering of minerals. The available sulphur and DTPA extractable micronutrients were sufficient, this might be due to less intensive cultivation of soils, application of fertilizers and weathering of minerals this was also reported by Satish *et al*., (2011) in Cotton crop.

Correlation data pertaining to available nutrients and soil properties in redgram growing soils is presented in table 6. The available of micronutrients zinc (r = - 0.345*), boron (r = -0.342**), iron (r = - 0.137), manganese (r = - 0.005) and copper (r = - 0.169) were negatively correlated with pH of the soil, the negative effect of pH on available soil micronutrients was also reported by Shah *et al*.(2018). Available S (r = 0.860**) showed significant and positive correlation with electrical conducitivty (EC) of the soil and negative correlation with available nitrogen, zinc, boron and manganese . The organic carbon had positive correlation with available nitrogen

Table 6. Correlation between soil properties and soil available nutrients in redgram growing soils.

Soil properties	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
pH	0.096	-0.133	0.0035	0.171	-0.345*	-0.342*	-0.1372	-0.005	-0.169
EC	-0.096	0.244	0.223	0.860**	-0.303*	-0.125	0.017	-0.145	0.235
Organic carbon	0.680**	-0.146	0.138	0.05	0.029	-0.229	0.179	-0.146	-0.144

*Significant at the 5% level; ** Significant at the 1% level

Table 7. Fertility Status of Balckgram growing soils

Name of the Mandal	Soil type	Soil fertility status											
		Physic chemical properties			Available major nutrients								
					kg ha^{-1}			mg kg^{-1}					
		pH	EC (dSm^{-1})	OC(%)	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
Nandigama	Sandy clay laom	7.86	0.47	0.62	207.52	39.55	382.8	53.64	0.3	4.08	4.07	4.06	1.54
Range (minimum-maximum)		7.2-8.3	0.18-1.4	0.25-1.12	156-277	3.57-171.6	66-741	5.0-213	0.18-1.12	0.64-19.2	0.11-21.3	0.45-13.0	0.21-10.9
Nutrient Index				1.76	1	1.5	2.5						
Fertility status				medium	low	low	High						
Jaggaiahpeta	Sandy laom	7.65	0.315	0.62	223.55	48.705	313.5	42	0.46	1.935	6.04	4.725	1.07
Range (minimum-maximum)		7.2-8.1	0.17-0.46	0.44-0.8	214-233.1	5.58-51.8	247-380	16-68.0	0.37-0.55	0.92-2.95	6.6-5.48	2.25-7.2	0.65-1.49
Nutrient Index				2	1	2	2						
Fertility status				medium	low	medium	medium						

(r = 0.680**), K_2O (r = 0.138), S(r = 0.050), Zn (r = 0.029) and Fe (r = 0.179).

Fertility status of blackgram growing Soils

Soil fertility status of blackgram growing areas in Nandigama and Jaggaiahpeta mandals was presented in tables 7, 11and 12 . Blackgram crop in Nandigama was grown in sandy clay loam soils. The pH of black gram growing soils was neutral to slightly alkaline (7.2 - 8.3) and non saline (mean EC 0.47 dSm^{-1}). The organic carbon content of the soil ranged from 0.25 to 1.12% with a mean of 0.62% with a nutrient index value of 1.76 indicating medium status in organic carbon . All the soils were deficient in available nitrogen(nutrient index value 1.0) with a mean available N of 208 kg ha^{-1}, available P_2O_5 was low (nutrient index value 1.5) and ranged from 3.5 to 171.6 kg ha^{-1} and available K_2O was high (nutrient index value 2.5) and ranged between 66 and 741 kg ha^{-1} with a mean available K of 380 kg ha^{-1}. The available sulphur ranged from 5.0-213 mg kg^{-1} with a mean available sulphur of 53.64 mg kg^{-1}. Most (98.0%) of the soils were sufficient in available sulphur. Available zinc varied from 0.18 to 1.12 mg kg^{-1} with a mean available zinc of 0.30 mg kg^{-1} and majority (92.0%) of the soils showed deficiency in zinc . The available boron was sufficient in all the soils (100%) with a mean of 4.08 mg kg^{-1}. Available Fe was ranged from 0.11 to 21.3 mg kg^{-1} and more than two third of the soils (74.0%) showed the deficiency of available iron. Available Mn ranged from 0.45 [1] to 13.0 mg kg^{-1} and majority of samples (64%) s were sufficient in available Mn . The available Cu was sufficient in all the soils and it varied from 0.21 to 10.9 mg kg^{-1} with a mean available Cu of 1.52 mg kg^{-1}.

The blackgram growing soils of Jaggaiahpeta mandals are sandy loam in texture having pH ranged from 7.2-8.1 and EC varied between 0.44 dSm^{-1} and 0.8 dSm^{-1}. Parker nutrient index values for organic carbon, available phosphorus and potassium are 2.0, 2.0 and 2.0 respectively, indicating medium status of organic carbon, available phosphorus and potassium. However, these soils were sufficient in available sulphur, boron, iron and copper.

The variation in nutrient status of black gram grown in sandy clay loam and sandy laom soils , might be due to variation in texture of the soils (Satish *et al*., 2011).

The data presented in table 8 indicated that, pH of blackgram growing soil showed significant and negative correlation with available zinc (r = - 0.295*). Significant and positive correlation was observed between available sulphur and electrical conductivity of the soil. The organic carbon significantly and positively correlated with available nitrogen (r = 0.984**), K_2O (r = 0.274*) , zinc (r = 0.144), and copper (r = 0.245) of the soil. This was due to the mineralization of organic form of nitrogen and chelation activity of organic compounds which might have increased the availability of micronutrients.

Soil fertility status of sesamum growing soils

The data on soil fertility status of sesamum growing soils was presented in tables 9, 11 and 12. Sesamum is growing in sandy loam and sandy clay loam soils with pH ranged from 7.5 to 8.5 (mean 7.96) indicating slightly alkaline in reaction and non saline (EC ranges 0.16-0.88 dSm^{-1}) with a mean electrical conductivity of 0.49 dSm^{-1}. The organic carbon of the soil ranged from 0.13 to 1.12% with a mean value of 0.62% and nutrient index value of 2.1 indicating medium in organic carbon status. The available nitrogen varied between 137 and 277 kg ha^{-1} and is deficient (Nutrient index value 1.0) in available N. The available P_2O_5 ranged from 17 to 162 kg ha^{-1} with a mean available P_2O_5 of 57.4 kg ha^{-1} and nutrient index value of 2.4 indicating the sesamum growing soils were high in availble P_2O_5 . Available K_2O ranged from 75 to 643 kg ha^{-1} and had nutrient index value of 2.0 indicating medium in available K. The available Sulphur ranged from 6 to 185 mg kg^{-1} and was high in most (94.33%) of the soils. The DTPA extractable Zn ranged from 0.18 to 2.5 mg kg^{-1} with a mean value of 0.99 mg kg^{-1}, iron ranged from 2.68 to 29 mg kg^{-1} with a mean value 11 mg kg^{-1}, manganese from 0.9 to 6.3 mg kg^{-1} with a mean of 2.88 mg kg^{-1}, copper ranged from 0.52[1] to 9.7 mg kg^{-1} and hot water extractable boron ranged from 1.1 to 12 mg kg^{-1} with a mean of2.7 mg kg^{-1}. The soils were sufficient in available zinc (58.49%), iron (77.35%), copper (100.00%), boron (100.00%) and manganese (75.47 %). Finally, sesamum growing soils were sufficient in available P_2O_5, K_2O, S, Fe, Mn, Zn, Cu and B. Further, the sufficiency of these nutrients in sessamum growing soils was might be due to the residual fertility of the previous sown crops and application of respective nutrient containing fertilizers to the crop. Similar findings were also reported in rice by Somasekhar Babu *et al*., (2011).

Data presented in table 10 revealed that there was a negative correlation between pH of the soil and available sulphur (r = 0.170), boron (r = - 0.385**), iron (r = - 0.189) and copper (r = -0.072). Significant and positive correlation was observed between electrical conductivity of the soil and available nitrogen (r = 0.251), P_2O_5 (r = 0.298*), S (r = 0.494**), iron (r = 0.351*) and copper (r =0.533**) whereas significant and negative correlation was observed with K_2O (r = - 0.295*). The organic carbon was negatively correlated with available manganese (r = - 0.303 *)

Table 8. Correlation between Soil properties and Soil available nutrients in Blackgram growing soils

Soil properties	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
pH	-0.054	0.245	-0.053	0.283*	-0.295*	0.102	0.301*	0.082	0.143
EC	-0.055	0.458**	-0.081	0.584**	-0.059	-0.037	0.166	0.129	0.1939
Organic carbon	0.984**	-0.07	0.274*	-0.015	0.144	-0.222	-0.042	-0.034	0.245

*Significant at the 5% level; ** Significant at the 1% level

Table 9. Fertiltiy Status of Sesamum growing soils

Name of the Mandal	Soil Type	Soil Fertility status											
		Physico chemical properties			Available nutrients								
					kg ha^{-1}			mg kg^{-1}					
		pH	EC(dSm^{-1})	OC(%)	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
Nandigama	Sandy clay loam	7.96	0.49	0.62	209	57.4	237	69	0.99	2.7	11	2.88	3.56
Range		7.5-8.5	0.16-0.88	0.13-1.12	137-277	17-162	75-643	6-185	0.18-2.5	1.1-12	2.68-29	0.9-6.3	0.52-9.7
Nutrient Index				2.1	1	2.4	2						
Fertility status				medium	low	High	medium						

Table 10. Correlation between Soil properties and Soil available nutrients in Sesamum growing soils

Soil properties	N	P_2O_5	K_2O	S	Zn	B	Fe	Mn	Cu
pH	0.106	-0.076	0.177	-0.17	0.263	-0.385**	-0.189	0.167	-0.072
EC	0.251	0.298*	-0.295*	0.494**	-0.271	0.036	0.351*	0.158	0.533**
Organic carbon	0.978**	-0.053	-0.077	0.440**	0.026	0.06	-0.233	-0.303*	-0.06

*Significant at the 5% level; ** Significant at the 1% level

Table 11. Status of major nutrients in Groundnut, Redgram, Blackgram and Sesamum growing areas

Crop	Mandal	Status (%)	OC	N	P_2O_5	K_2O
Groundnut	Vatsvai	Low	92.85	96.40	42.85	100.00
		Medium	7.15	3.60	39.28	0.00
		High	0.00	0.00	17.85	0.00
	Gannavaram	Low	68.18	86.36	4.54	22.72
		Medium	22.72	13.63	81.81	77.27
		High	9.09	0.00	13.63	0.00
Redgram	Jaggaiahpeta	Low	63.15	97.36	23.68	39.40
		Medium	34.21	2.63	44.73	57.89
		High	2.63	0.00	21.05	2.63
Blackgram	Nandigama	Low	26.00	100.00	28.00	4.00
		Medium	54.00	0.00	62.00	42.00
		High	14.00	0.00	6.00	54.00
	Jaggaiahpeta	Low	50.00	100.00	50.00	50.00
		Medium	0.00	0.00	0.00	0.00
		High	50.00	0.00	50.00	50.00
Sesamum	Nandigama	Low	32.00	100.00	5.66	18.86
		Medium	24.50	0.00	49.10	62.26
		High	43.50	0.00	45.28	18.86

Tabel 12. Status of Sulphur & micro nutrients in Groundnut, Redgram, Blackgram and Sesamum growing areas

Crop	Mandal	Status(%)	S	Zn	B	Fe	Mn	Cu
Groundnut	Vatsvai	Defcient	35.71	75.00	67.85	10.71	0.00	0.00
		Sufficient	64.28	25.00	32.15	89.28	100.00	100.00
	Gannavaram	Defcient	4.54	72.72	31.81	0.00	0.00	0.00
		Sufficient	95.45	27.27	68.18	100.00	100.00	100.00
Redgram	Jaggaiahpeta	Defcient	21.05	23.68	7.89	31.57	2.63	0.00
		Sufficient	78.94	76.31	92.10	68.42	97.36	100.00
Blackgram	Nandigama	Defcient	2.00	92.00	0.00	74.00	36.00	0.00
		Sufficient	98.00	8.00	100.00	26.00	64.00	100.00
	Jaggaiahpeta	Defcient	0.00	100.00	0.00	0.00	50.00	0.00
		Sufficient	100.00	0.00	100.00	100.00	50.00	100.00
Sesamum	Nandigama	Defcient	5.66	41.50	0.00	22.64	24.52	0.00
		Sufficient	94.33	58.49	100.00	77.35	75.47	100.00

Fig. 1 Location of Sampling Sites in Krishna District.

and positively correlated with available nitrogen (r = 0.978**) & S (r = 0.440**). The higher available nitrogen and sulphur in these soils was due to the release of these nutrients during decomposition of organic matter in the soil (Shigire *et al*. 2018).

CONCLUSION

The present study concluded that majority of groundnut, redgram, balckgram and sesamum growing soils were neutral to slightly alkaline in reaction, non saline, low in available nitrogen, medium in available phosphorus and potassium and sufficient in available sulphur and micronutrients (Fe, Zn. Cu , Mn and B). The pH of the soil was negatively correlated with available micronutrients whereas the organic carbon was positively and significantly correlated with available nitrogen, sulphur and micronutrient.

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