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Subsoiling, land configuration and sulphur fertilization effects on soil physico-chemical properties, growth and yield of groundnut

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ABSTRACT
A field study was conducted during the rainy (*kharif*) seasons of 2002 and 2003 at Junagadh (Gujarat, India) to evaluate subsoiling, land configuration and sulphur fertilization effects on physico-chemical properties of clayey soils and yield of groundnut. The results expound that subsoiling significantly reduced bulk density and increased porosity. Between-row subsoiling and broad bed and furrow significantly increased moisture content of soil at 60 DAS, root volume, plant height, dry matter and yields of groundnut over flat bed control. The residual availability of N, P, K and S remained almost equal under subsoiling, broad bed and furrow and flat bed. Application of sulphur did not influence bulk density, porosity, moisture content and residual status of available N, P and K, however significantly increased the residual availability of sulphur. Sulphur fertilization @ 50 and 25 kg ha^{-1} were found equally effective and increased root volume and dry matter in 2003 as well as plant height and pod yield during both the years. Sulphur nutrition significantly increased haulm yield over control in pooled results but it did not reach at the level of significance in individual years.

Key words : Subsoiling, Land configuration, Sulphur, Soil, Groundnut.

INTRODUCTION

A dense and compact layer in subsoil is characterized by high mechanical impedance for root growth and low water transmission in the soil matrix. Subsoiling breaks the hard pan and helps in sinking down of the rainwater in the lower layer of soil from where it is not easily lost by evaporation and aids to deeper rooting, which helps in better exploitation of stored soil moisture and applied nutrients from the profile. Land configuration like broad bed and furrow (BBF) can increase infiltration of rainwater and thus helps to improve moisture storage in soil profile. Sulphur as a plant nutrient is becoming increasingly important in dryland agriculture as it is the master nutrient of all oilseed crops and pulses and is rightly being called the "Fourth Major Nutrient". With these points in view, the present experiment was undertaken to evaluate subsoiling, BBF and sulphur effects on physico-chemical properties of soil and yield of groundnut (*Arachis hypogaea* L.).

MATERIALS AND METHODS

A field investigation was carried out during rainy (*kharif*) seasons of 2002 and 2003 at Department of Agronomy, Junagadh Agricultural University, Junagadh. The soil was clayey in texture and slightly alkaline in reaction (pH 8.0 and EC 0.28 dS m^{-1}) with available N 258 kg ha^{-1}, available P_2O_5 27.5 kg ha^{-1}, available K_2O 236 kg ha^{-1} and available S 19.5 kg ha^{-1}. Field capacity and permanent wilting point were 28.4 and 12.8%, respectively, whereas bulk density was 1.42 Mg m^{-3} with 45.3% porosity. There were 5 main plots assigned to moisture conservation practices viz., M_1- flat bed (FB), M_2- alternate between-row subsoiling (ABRS), M_3- between-row subsoiling (BRS), M_4- in-row subsoiling (IRS) and M_5- broad bed and furrow (BBF) and 3 sub-plots allocated to sulphur levels viz., 0, 25 and 50 kg ha^{-1}. The experiment was laid out in split plot design with 4 replications. Subsoiling to a depth of 30 cm was carried out by subsoiler, while a bed of 150 cm width with furrow of 30 cm width and 15 cm depth was formed by BBF former after preparatory tillage and before sowing. The crop was fertilized with 12.5 kg N and 25 kg P_2O_5 ha^{-1}. Sulphur in the form of gypsum was applied at sowing in furrows as per treatments. The groundnut variety 'GG 20' was sown at a row spacing of 60 cm on 1st July, 2002 and 20th June, 2003 and harvested on 22nd October, 2002 and 15th October, 2003. The total seasonal rainfall of 540 and 1275 mm was received in 22 and 42 rainy days during 2002 and 2003, respectively. Moisture content was estimated gravimetrically at 60 DAS. The residual availability of N, P_2O_5, K_2O and S was determined by alkaline $KMnO_4$ method, Olsen's method, flame photometric method and turbidimetric method, respectively. The bulk density, total porosity, available nutrient status in soil, root and shoot growth and yields were recorded at harvest.

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Table 1 : Subsoiling, land configuration and sulphur fertilization effects on some physico-chemical properties of soil

Treatments	Bulk density ($Mg\ m^{-3}$)		Porosity (%)		Moisture content (%)		Available N ($kg\ ha^{-1}$)		Available P_2O_5 ($kg\ ha^{-1}$)		Available K_2O ($kg\ ha^{-1}$)		Available S ($kg\ ha^{-1}$)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Moisture conservation practices														
M_1- FB	1.47	1.43	40.86	42.57	18.32	20.73	187.1	164.0	28.57	31.63	215.7	199.5	20.07	20.72
M_2- ABRS	1.30	1.31	47.49	47.32	19.18	21.05	185.3	161.5	27.50	31.34	221.4	202.4	20.40	21.79
M_3- BRS	1.26	1.28	49.16	48.46	21.20	22.70	181.2	157.6	26.31	29.57	223.2	208.0	21.45	21.39
M_4- IRS	1.28	1.27	48.53	48.90	19.28	21.35	178.9	155.5	27.99	29.72	236.0	211.6	21.85	22.67
M_5- BBF	1.36	1.33	45.08	46.45	20.18	22.63	175.3	157.1	26.63	30.15	231.7	219.4	21.56	22.80
CD (P=0.05)	0.05	0.04	2.10	1.60	1.06	1.25	NS	NS	NS	NS	NS	NS	NS	NS
Sulphur ($kg\ ha^{-1}$)														
S_1- 0	1.33	1.33	46.63	46.67	19.70	21.75	184.4	161.7	28.00	30.58	222.2	205.6	19.66	20.25
S_2- 25	1.33	1.33	46.45	46.53	19.55	21.72	180.9	157.2	27.84	31.14	224.8	208.3	21.50	22.46
S_3- 50	1.35	1.32	45.60	47.03	19.65	21.61	179.4	158.4	26.36	29.74	229.9	210.7	22.04	22.92
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.75	1.62

RESULTS AND DISCUSSION

Moisture conservation practices

Different practices of moisture conservation could impose their significant influence on bulk density, porosity and moisture content of soil (Table 1). Between-row subsoiling (M_3), in-row subsoiling (M_4) and alternate between-row subsoiling (M_2), being statistically at par, recorded significantly lower bulk density and higher porosity over flat bed (M_1) during the year 2002 and 2003. Significantly higher moisture content in soil at 60 DAS was retained under between row-subsoiling (M_3) and broad bed and furrow (M_5) as compared to flat bed (M_1) during both the years. While the residual availability of nutrients viz., N, P, K and S remained almost equal under various moisture conservation treatments. Between-row subsoiling (M_3) and broad bed and furrow (M_5) also increased root volume, plant height and dry matter/plant and resultantly produced significantly higher pod and haulm yields over flat bed (M_1) in both the years and pooled results (Table 2). On an average, between-row subsoiling (M_3) and broad bed and furrow (M_5) increased pod yield by 22.8 and 20.4% and haulm yield by 21.3 and 19.1% over flat bed (M_1), respectively. Favourable physical condition and better storage of moisture under between-row subsoiling and BBF might have enhanced nutrient availability, which in turn reflected in enhanced root and shoot growth and eventually in yield of the crop. Alike results with BBF were reported by Nitant and Singh (1995) in pigeonpea and with BBF by Velayudham *et al*. (1997) in groundnut.

Sulphur levels

Sulphur levels did not exhibit their significant impact on bulk density, porosity, moisture content and residual status of N, P and K, however sulphur fertilization @ 50 kg ha^{-1} (S_3) and 25 kg ha^{-1} (S_2) being at par significantly resided more sulphur compared to control (S_1) during 2003 and 2004 (Table 1). Root volume and dry matter/plant were not affected by sulphur levels during 2002. While, application of sulphur @ 50 kg ha^{-1} (S_3) and 25 kg ha^{-1} (S_2) both being at par accelerated root volume and dry matter/plant during 2003 as well as plant height during both the years over control (S_1). Sulphur nutrition @ 50 and 25 kg ha^{-1} (S_3 and S_2) produced significantly higher pod yield during 2003, 2004 and pooled results over control (S_1). Despite non-significant effect on haulm yield in individual years, sulphur fertilization significantly increased

Table 2 : Subsoiling and sulphur fertilization effects on root and shoot growth and yield of groundnut crop

Treatments	Root volume (cm^3)		Plant height (cm)		Dry matter /plant (g)		Pod yield ($q\ ha^{-1}$)			Haulm yield ($q\ ha^{-1}$)		
	2002	2003	2002	2003	2002	2003	2002	2003	Pooled	2002	2003	Pooled
Moisture conservation practices												
M_1- FB	18.88	22.02	24.13	28.00	19.71	24.80	11.25	17.21	14.23	18.35	27.69	23.02
M_2- ABRS	21.13	23.48	26.57	34.26	21.54	26.15	11.82	19.07	15.45	20.06	29.77	24.91
M_3- BRS	25.39	26.57	29.66	34.81	22.83	27.95	13.65	21.31	17.48	22.46	33.39	27.92
M_4- IRS	23.66	25.23	28.14	32.85	20.28	26.48	11.77	19.51	15.64	19.80	31.41	25.61
M_5- BBF	24.10	25.64	30.85	34.95	22.43	26.79	13.16	21.11	17.13	21.65	33.18	27.42
CD (P=0.05)	2.44	2.28	1.56	2.39	1.88	1.89	1.25	2.12	1.16	2.45	3.30	1.95
Sulphur ($kg\ ha^{-1}$)												
S_1- 0	21.74	24.07	26.05	31.47	21.12	25.44	11.59	18.52	15.05	19.71	29.71	24.71
S_2- 25	22.94	24.44	28.06	33.18	21.59	26.59	12.71	20.04	16.37	20.88	31.33	26.10
S_3- 50	23.21	25.24	29.49	34.28	21.35	27.27	12.69	20.38	16.53	20.80	32.23	26.51
CD (P=0.05)	NS	0.92	1.55	1.51	NS	1.19	0.64	0.96	0.56	NS	NS	1.27

haulm yield over control in pooled results. On an average, application of sulphur @ 50 kg ha^{-1} (S_3) and 25 kg ha^{-1} (S_2) increased pod yield by 9.8 and 8.8% and haulm yield by 7.3 and 5.6% over control (S_1), respectively. By virtue of involvement in carbohydrate metabolism and redox processes, sulphur might have promoted growth and yield of the crop. Chaubey *et al.* (2000) and Tripathi and Hazra (2003) also reported parallel results.

REFERENCES

Chaubey, A.K., Singh, S.B. and Kaushik, M.K. (2000). Response of groundnut to source and level of sulphur fertilization in mid-western plains of Utter Pradesh. *Indian Journal of Agronomy,* **45(1) :** 166-169.

Nitant, H.C. and Singh, P. (1995). Effects of deep tillage on dryland production of redgram (*Cajanus cajan* L.) in Central India. *Soil and Tillage Research,* **34(1):** 17-26.

Tripathi, S.D. and Hazra, C.R. (2003). Sulphur requirement of groundnut under wheat based cropping system. *Indian Journal of Agricultural Science,* **73(7):** 368-372.

Velayudham, K., Rajendran, P. and Krishnaswamy, S. (1997). Field evaluation of *in-situ* moisture conservation practices. *Madras Agricultural Journal,* **84(2):** 81-82.

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