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Neha Chaudhary
 Senior Research Fellow,
 AICRP on IFS, S. D.
 Agricultural University,
 Sardarkrushinagar, Gujarat,
 India

Sweta A Patel
 Junior Research Fellow,
 Centre for Natural Resources
 Management, S. D.
 Agricultural University,
 Sardarkrushinagar, Gujarat,
 India

BT Patel
 RTD. Professor, Department
 of Agricultural Chemistry and
 Soil Science, CPCA, S. D.
 Agricultural University,
 Sardarkrushinagar, Gujarat,
 India

Corresponding Author:
Neha Chaudhary
 Senior Research Fellow,
 AICRP on IFS, S. D.
 Agricultural University,
 Sardarkrushinagar, Gujarat,
 India

Residual effect of enriched organics with iron and zinc on growth, yield and quality of summer groundnut in loamy sand

Neha Chaudhary, Sweta A Patel and BT Patel

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Abstract

Study the residual effect of Fe and Zn enriched organics on growth, yield and quality of summer groundnut in loamy sand (Typic Ustipsamments) during the summer seasons of 2016-17 and 2017-18 at SDAU, Sardarkrushinagar. The residual effect of organics enriched 6 kg Fe and 4 kg Zn registered significantly higher plant height, number of pods per plant, pod and haulm yield as well as oil yield over no Fe and Zn (control). The soil of this area is loamy sand and low in Fe and Zn content.

Keywords: Groundnut, iron, zinc, growth, yield

Introduction

Groundnut (*Arachis hypogaea* L.) is an important food, fodder and cash crop for the farmers of India. In India, groundnut is principal oil seed crop has a vital role in Indian agriculture, industry and export trade with economy of country. Groundnut is rich source of energy, as its kernel content about 50.00 per cent edible oil, high quality of protein (21.4-36.4%), carbohydrates (6.0-24.9%), minerals and vitamins (DAS, 1997) [2]. In India, groundnut is grown on 4.56 million hectares and production of 6.77 million tonnes with an average productivity of 1486 kg ha⁻¹ (DAC and FW, 2016). In North Gujarat region, mainly potato-summer groundnut crop rotations commonly followed by the farmers. The farmers often apply NPK nutrients, whereas the application of micronutrients is either absent or insufficient which further affects to soil health that is not only hampering the crop productivity, but also deteriorating produce quality.

Materials and Methods

Experiment was conducted in summer seasons of 2016-17 and 2017-18 to study the residual effect of Fe and Zn enriched organics. The soil was loamy sand, low in OC, available N and DTPA-extractable Fe and Zn. Treatment was FYM 20 t ha⁻¹ (M₁) and vermicompost 5 t ha⁻¹ (M₂) and six treatments of Fe and Zn viz., No Fe and Zn (N₁), 6 kg Fe and 4 kg Zn ha⁻¹ (Inorganic) (N₂), 3 kg Fe enriched by organics 2 t ha⁻¹ (N₃), 2 kg Zn enriched by organics 2 t ha⁻¹ (N₄), 6 kg Fe and 4 kg Zn enriched by organics 2 t ha⁻¹ (N₅) and 3 kg Fe and 2 kg Zn enriched by organics 2 t ha⁻¹ (N₆) were laid out under RRBD with 4 replications. The graded and healthy seeds of groundnut cv. GG 2 was sown. The entire quantity of nitrogen (25 kg ha⁻¹) and phosphorus (50 kg ha⁻¹) in form of urea and diammonium phosphate,

Results and Discussion

Growth, Yield attributes and quality

Effect of organics

The plant height, number of pods per plant and seed index, pod yield, haulm yield, shelling percentage, oil content and oil yield in kernel of summer groundnut crop did not gave significantly result due to residual effect of different organics during both the years as well as on pooled basis.

Fe and Zn supplementation

The plant height and number of pods per plant of summer groundnut measured at harvest was significantly influenced due to residual effect of Fe and Zn fertilization during both the

years of study as well as on pooled analysis (Table 1). Among different treatments, the residual effect of N₅ produced significantly higher plant height of summer groundnut which remained statistically on par with N₆, N₄ and N₃ treatments, but significantly superior to N₂ and N₁ treatments during both the years as well as in pooled. The residual effect of N₅ produced significantly maximum number of pods per plant of 42.72, 44.73 and 43.58 during 2016-17, 2017-18 and in pooled data, respectively, but it was remained at par with treatment of organics 2 t ha⁻¹ enriched with 3 kg Fe and 2 kg Zn (N₆) during individual year as well as in pooled analysis. No significant influence on seed index and shelling percentage (Table 2) of summer groundnut crop during both the years and in pooled analysis. The significantly higher pod yield (Table 2) of summer groundnut was recorded due to residual effect of N₅ than that of straight application of 6 kg Fe and 4 kg Zn ha⁻¹ (N₂) and N₁ treatment, but it was at par with N₆, N₄ and N₃ treatments during both the years as well as in pooled analysis. Though the highest haulm yield of summer groundnut was recorded due to residual effect of organics 2 t ha⁻¹ enriched with 6 kg Fe and 4 kg Zn (N₅) in both year as well as in pooled result, respectively over no application of

Fe and Zn (N₁) and straight application of 6 kg Fe and 4 kg Zn ha⁻¹ (N₂), but it was on par with treatments of N₆, N₄ and N₃. The maximum oil yield of kernel (Table 3) of summer groundnut was recorded due to residual effect of N₅ over no application of Fe and Zn (N₁) and straight application of 6 kg Fe and 4 kg Zn ha⁻¹ (N₂), but it was remained on par with enrichment of organics 2 t ha⁻¹ with either Fe and Zn alone or its combinations (N₆, N₄ and N₃) during both year and N₆ and N₄ during pooled data.

The better performance in treatments of Fe and Zn enriched organics as residual effect on plant height, number of pods per plant, pod yield, haulm yield and oil yield (Table 1,2,3) of summer groundnut might be due to its influence on soil properties to increase the availability of native nutrients in the soil as the soil was deficient in Fe as well as Zn initially. Besides, the organics enriched with Fe and Zn itself contained appraisable quantity of major and micronutrients which might have resulted into higher nutrients availability due to incorporation in the soil and thereby increased in parameters. Such finding also reported by by Meena *et al.*, (2006) [3], Patel *et al.*, (2007) [4], Rahevar (2015) [5] and Shivran (2016) [6].

Table 1: Residual effect of organics and Fe and Zn supplementation on plant height, number of pods per plant and seed index (g) of summer groundnut

Treatments	Plant height (cm)			Number of pods per plant			Seed index (g)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
Organics (M)									
M ₁	50.3	53.9	52.1	37.82	40.16	38.99	48.73	49.59	49.16
M ₂	51.9	55.7	53.8	39.98	41.40	40.19	48.79	49.70	49.24
S.Em.±	0.99	1.05	0.72	0.56	0.64	0.43	0.25	0.26	0.18
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fe and Zn supplementation (N)									
N ₁	44.0	46.4	45.2	33.20	35.60	34.40	48.38	49.07	48.73
N ₂	49.2	53.4	51.3	36.01	39.14	37.58	48.51	49.26	48.88
N ₃	51.6	55.9	53.8	38.02	40.72	39.37	48.55	49.54	49.05
N ₄	52.7	56.1	54.4	38.40	40.94	39.67	48.79	49.76	49.27
N ₅	54.9	59.6	57.2	42.72	44.43	43.58	49.37	50.33	49.85
N ₆	54.0	57.4	55.7	42.04	43.85	42.94	48.95	49.92	49.44
S.Em.±	1.72	1.81	1.25	0.97	1.11	0.74	0.43	0.45	0.31
C.D. (P=0.05)	4.94	5.21	3.52	2.80	3.19	2.08	NS	NS	NS
Interaction (M×N)									
S.Em.±	2.43	2.56	1.76	1.37	1.57	1.04	0.60	0.64	0.44
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	9.50	9.35	9.43	7.16	7.68	7.44	2.48	2.57	2.53

Table 2: Residual effect of organics and Fe and Zn supplementation on pod yield (kg ha⁻¹), haulm yield (kg ha⁻¹) and shelling (%) of summer groundnut

Treatments	Pod Yield (kg ha ⁻¹)			Haulm Yield (kg ha ⁻¹)			Shelling (%)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
Organics (M)									
M ₁	2114	2149	2132	3186	3262	3224	65.63	66.28	65.96
M ₂	2151	2235	2193	3302	3399	3350	66.17	66.83	66.50
S.Em.±	43.03	42.08	30.09	74.32	72.59	51.95	0.32	0.28	0.21
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fe and Zn supplementation (N)									
N ₁	1895	1972	1933	2838	2909	2873	65.18	65.83	65.51
N ₂	2033	2087	2060	3002	2132	3067	65.51	66.16	65.83
N ₃	2123	2214	2169	3275	3395	3335	65.71	66.36	66.03
N ₄	2210	2257	2233	3373	3471	3422	65.99	66.64	66.31
N ₅	2296	2332	2314	3508	3556	3532	66.72	67.38	67.05
N ₆	2238	2291	2264	3469	3519	3494	66.31	66.96	66.63
S.Em.±	75.53	72.88	52.12	128.73	125.73	89.97	0.55	0.48	0.37
C.D. (P=0.05)	214	210	147	370	362	254	NS	NS	NS
Interaction (M×N)									

S.Em.±	105.40	103.06	73.71	182.05	177.81	127.24	0.78	0.68	0.52
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	9.88	9.40	9.64	11.22	10.68	10.95	2.37	2.04	2.21

Table 3: Residual effect of organics and Fe and Zn supplementation on oil content and oil yield of summer groundnut

Treatments	Oil content (%)			Oil yield (kg ha ⁻¹)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
Organics (M)						
M ₁	47.77	48.25	48.01	664	688	676
M ₂	47.99	48.48	48.23	683	724	704
S.Em.±	0.25	0.20	0.16	14.63	14.39	10.26
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
Fe and Zn supplementation (N)						
N ₁	47.38	47.85	47.61	585	621	603
N ₂	47.72	48.20	47.96	635	665	650
N ₃	47.81	48.40	48.16	670	713	691
N ₄	47.95	48.44	48.19	700	729	714
N ₅	48.23	48.71	48.47	740	766	753
N ₆	48.10	48.59	48.35	712	744	728
S.Em.±	0.43	0.35	0.28	25.34	24.93	17.77
C.D. (P=0.05)	NS	NS	NS	73	72	50
Interaction (M×N)						
S.Em.±	0.61	0.49	0.39	35.84	35.25	25.13
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
C.V.%	2.53	2.03	2.29	10.64	9.98	10.30

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