Int.J.Curr.Microbiol.App.Sci (2017) *6*(11): 2405-2415

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 11 (2017) pp. 2405-2415**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.611.285

Nutrient Concentration and Their Uptake and Available Nutrients in Soil Influenced by Irrigation, Mulching and Integrated Nutrient Management in Summer Groundnut

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Keywords

Available nutrients, Irrigation, INM, Mulching, Nutrient content and uptake.

Article Info

Accepted:
17 September 2017
Available Online:
10 November 2017

A B S T R A C T

An experiment was conducted to assess the effect of irrigation, mulching and integrated nutrient management on nutrient concentration and their uptake and available nutrients in summer groundnut during 2015 and 2016 at the Department of Agronomy, I.Ag.Sc, BHU, Varanasi. Results showed that application of irrigation at 100 mm CPE recorded highest N, K and S content, available nutrients in soil, kernel and haulm yield. However, irrigation at 60 mm CPE recorded significantly the highest P content, NPKS uptake, available nutrients in soil, kernel and haulm yield over 80 and 100mm CPE. Dust mulch recorded higher nutrient content and available nutrients in soil whereas, paddy straw mulch recorded maximum NPKS uptake, kernel and haulm yield. Among INM treatments, an application of 75%NPK +25N through FYM +60 kg sulphur through gypsum recorded significantly highest NPKS content and their uptake, available nutrients in soil, kernel and haulm yield as compared to other INM treatments.

Introduction

Groundnut (*Arachis hypogaea* L.) is the major *kharif* oilseeds crop of India. India ranks first in the world in respect of area and second in production after China. But the productivity (about 1000 kg/ha) of groundnut is quite low as compared to world average productivity (1500 kg/ha) primarily due to its cultivation in acidic soils with low N, P, Ca, S, B, inadequate organic matter (Noman *et al.*, 2015), moisture stress at various growth stages irrespective of production environments, irrigation methods, varieties and other cultivation practices (Thiyagarajan *et al.*, 2009). Under irrigated conditions, water use efficiency for this crop is low due to improper irrigation management.

The reduction in yield will be greater if severe stress occur during the critical crop growth stages like flowering and pod formation (Saha and Gunri, 2014). Thus the water management is most important factor because groundnut has specific moisture need due to the unique feature of developing the pods underground (Baliarsingh and Mahapatra, 2014). Proper irrigation scheduling helps the crop to put good crop growth and yield (Thiyagarajan *et al.*, 2010). Application mulch materials can be of great use for conserving moisture, regulating soil temperature, improves infiltration, soil water retention, decreases bulk density and for suppression of weeds during early stages of crop growth (Sounda *et al.,* 2006). However, the effect varies with soils, climate, kind of mulch material used and the rate of application. The surface mulch favourably influences the soil moisture regime by controlling evaporation from the soil surface (Patel *et al.,* 2017). Irrigation at critical stages and moisture conservation with mulching practices can increase the land and water productivity along with profitability (Ravisankar *et al.,* 2014).

Groundnut is highly responsive to fertilizer application, although groundnut being a legume is capable of fixing atmospheric nitrogen, it responds to small quantity of nitrogenous fertilizer applied as starter dose (Chaudhary *et al.,* 2015). It is an exhaustive crop and removes large amount of macro and micronutrients from soil. None of the sources of nutrient alone can meet the total plant nutrient need of crop adequately. Hence, integrated use of nutrients from chemical, organic, bio-fertilizer is the most efficient way to supply plant nutrients for sustained crop productivity and improved of soil fertility (Mohapatra and Dixit, 2010 and Chavan *et al.,* 2014). Keeping the above points in view, an experiment was conducted to study the combined effect of irrigation, mulching and INM on nutrient content, nutrient uptake and available nutrients in summer groundnut.

Materials and Methods

A field study was conducted during the summer season of 2015 and 2016 at Agronomy Farm, BHU, Varanasi (23^{o}.20' N, 83^{o}.03' E and 128.93 m above mean sea-level). The experimental soil was sandy clay loam with pH 7.86. The soil was low in available nitrogen (206.9 kg ha^{-1}) and available phosphorus (17.8 kg ha^{-1}) and medium in available potassium (233.1 kg ha^{-1}) and sulphur (15.6 kg ha^{-1}). Average values for bulk density 1.45 g cm^{-3}, particle density 2.62 g cm^{-3}, filed capacity 19.6%, permanent wilting point 4.30% and EC were 0.181

dSm^{-1}. The experiment was conducted in split plot design with twenty four treatment combinations. The treatments consisted of three irrigation regimes (I_1- 60 mm CPE, I_2- 80 mm CPE and I_3- 100 mm CPE) and two mulch treatments [M_1- paddy straw mulch and M_2- dust mulch] in the main plots and four INM levels (N_1- 100% NPK, N_2- 75% NPK+ 25% N through FYM+ 20 kg S through gypsum, N_3- 75% NPK+ 25% N through Vermicompost+ 40 kg S through gypsum and N_4- 75% NPK+ 25% N through FYM + 60 kg S through gypsum in sub plots. The experiment was replicated three times. Keeping irrigation frequency constant pre-determined quantity of water was applied by using Parshall flume. The entire quantity of nutrients as per treatment was applied in at sowing. Groundnut variety ‘HG 37’ was sown at row distance of 30x10 cm manually on 25 March 2015 and 10 March 2016. CPE was worked out from the daily Epan data taken from institute observatory. Irrigation was applied to crop at 60, 80 and 100 CPE as per treatment.

The experiment was repeated on the fixed site in the second year. All the general crop management practices were followed to the crops. The crop was harvested by hand on 29^{th} May, 2015 and 20^{th} May, 2016, when about 70% of haulms were dry. Observations on kernel and haulm yield were recorded at harvest of crop. The soil samples were taken from each plot at 0-15 cm depth at sowing and after harvesting of groundnut crop for the analysis of nutrient concentration in plant and available nutrients in soil as per the standard procedure. The available nutrients in soil (kg ha^{-1}) were calculated by multiplying the nutrient content and weight of soil (0-15 cm). Nutrient uptake (kg ha^{-1}) was calculated by multiplying their nutrient concentration with crop yield. All the experimental data were analysed statistically to draw a valid conclusion.

Results and Discussion

Nutrient content

In groundnut, irrigation regimes and mulching did not affect significantly the total N, P, K and S contents (Table 1). However, N, K and S contents decreased with increasing number of irrigation and moisture availability, which was mainly due to dilution effect as a consequence of increased dry matter production. The higher P content in kernels and haulms was recorded with irrigation at 60 mm CPE and in paddy straw mulching. Results are corroborated with the findings of Singh *et al.,* (2006) and Verma *et al.,* (2012). Nutrients concentration in kernels and haulms increased with increasing nutrients level and more so with application of 75% NPK+ 25% N through FYM + 60 kg S through gypsum as compared to other INM treatments. This might be due to increased availability in presence of FYM, vermicompost and the synergy between nutrients. The results corroborate the finding of Arunachalam *et al.,* (2012) and Noman *et al.,* (2016).

Nutrient uptake

Nutrients uptake by groundnut significantly influenced by irrigation regimes, mulching and INM (Table 2 and 3). Irrigation at 60 CPE and paddy straw mulch recorded maximum N, P, K and S uptake by kernels, haulms and the total nutrients uptake. Better soil moisture conditions prevailing in these treatments could have facilitated more uptake of nutrients. Researlts are corroborated with the research findings of Verma *et al.,* (2015). In INM treatments, application of 75% NPK+ 25% N through FYM + 60 kg S through gypsum recorded significantly highest N, P, K and S uptake followed by 75% NPK+ 25% N through vermicompost+ 40 kg S through gypsum, 75% NPK+ 25% N through FYM+ 20 kg S through gypsum and100% NPK, respectively during both the years. Higher uptake was due to the higher dry matter production and higher nutrient content in different parts of plants, which corroborated the findings of Mohapatra and Dixit (2010) and Yadav *et al.,* 2015. The higher uptake of plant nutrients due to application of the organic manures was reflected in the trend of growth and yield performance of the crop Choudhary *et al.,* (2011) and Patra *et al.,* (2011). Noman *et al.,* (2014) reported the increase in S-uptake from 66.3 to 92.4% due to application of 20 and 40kg S ha^{-1} over control, respectively. Increase in P uptake was due to increase in P availability from applied fertilizer and inherent soil source and combined effect of released organic acids and organic anions on decomposition of farmyard manure in acid lateritic soil (Dutta and Mondal, 2006, and Vishwakarma *et al.,* 2012).

Available nutrients

OC, EC and soil pH

Effect of irrigation regimes, mulching and INM on pH, organic carbon (OC) and electrical conductivity was found to be non-significant (Table 4). However, it was slightly higher under 100 mm CPE and with dust mulch. Paddy straw mulch recorded lower pH and EC and the OC over dust mulch. This was due to fact that residue when left on soil surface and after decomposition increased the organic carbon which lowers down the electrical conductivity and soil pH (Monsefi *et al.,* 2016). Amongst INM treatments, 75% NPK+ 25% N through FYM + 60 kg S through gypsum recorded highest pH, organic carbon and electrical conductivity than other INM treatments.

Table.1 Effect of irrigation regimes, mulching and integrated nutrient management on N, P and K content in kernel and haulm

Treatment	N content in kernel (%)		N content in Haulm (%)		P content in kernel (%)		P content in Haulm (%)		K content in kernel (%)		K content in Haulm (%)		S content in kernel (%)		S content in Haulm (%)	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
I_1	3.15	3.09	1.45	1.42	0.33	0.32	0.117	0.115	1.05	1.00	1.17	1.15	0.186	0.175	0.117	0.113
I_2	3.21	3.15	1.46	1.43	0.32	0.31	0.115	0.113	1.06	1.01	1.19	1.17	0.189	0.178	0.117	0.113
I_3	3.24	3.18	1.49	1.46	0.30	0.29	0.113	0.111	1.07	1.02	1.20	1.18	0.190	0.179	0.119	0.115
SEm±	0.05	0.04	0.03	0.04	0.03	0.04	0.002	0.003	0.03	0.02	0.04	0.05	0.003	0.004	0.002	0.002
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M_1	3.16	3.10	1.46	1.43	0.33	0.32	0.114	0.112	1.05	1.00	1.18	1.16	0.190	0.179	0.117	0.113
M_2	3.24	3.18	1.48	1.45	0.31	0.30	0.116	0.114	1.06	1.01	1.19	1.17	0.191	0.180	0.119	0.115
SEm±	0.03	0.03	0.02	0.02	0.02	0.03	0.002	0.003	0.02	0.02	0.03	0.03	0.002	0.003	0.002	0.002
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N_1	3.16	3.10	1.41	1.38	0.30	0.29	0.113	0.111	1.03	0.98	1.15	1.13	0.178	0.167	0.115	0.112
N_2	3.21	3.15	1.43	1.40	0.31	0.30	0.114	0.112	1.05	1.00	1.16	1.14	0.185	0.174	0.116	0.113
N_3	3.20	3.14	1.49	1.46	0.32	0.31	0.116	0.114	1.06	1.01	1.21	1.19	0.191	0.180	0.119	0.115
N_4	3.24	3.18	1.53	1.50	0.33	0.32	0.118	0.116	1.09	1.04	1.23	1.21	0.193	0.181	0.121	0.117
SEm±	0.02	0.02	0.01	0.03	0.01	0.01	0.001	0.002	0.01	0.01	0.02	0.02	0.001	0.002	0.001	0.001
CD (P=0.05)	0.07	0.06	0.03	0.10	0.03	0.03	0.003	0.005	0.04	0.04	0.06	0.07	0.003	0.007	0.003	0.003

I_1- irrigation at 60 mm CPE, I_2- irrigation at 80 mm CPE, I_3- irrigation at 100 mm CPE, M_1- paddy straw mulch, M_2- dust mulch, F_1- 100% NPK, F_2- 75% NPK+ 25% N through FYM+ 20 kg S through gypsum, F_3- 75% NPK+ 25% N through Vermicompost+ 40 kg S through gypsum, F_4- 75% NPK+ 25% N through FYM + 60 kg S through gypsum.

Table.2 Effect of irrigation regimes, mulching and integrated nutrient management on N, P and K uptake in grain and straw

Treatment	N uptake in Kernel (kg ha^{-1})		N uptake in Haulm (kg ha^{-1})		P uptake in Kernel (kg ha^{-1})		P uptake in Haulm (kg ha^{-1})		K uptake in Kernel (kg ha^{-1})		K uptake in Haulm (kg ha^{-1})		S uptake in Kernel (kg ha^{-1})		S uptake in Haulm (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Irrigation regimes																
I_1	57.9	63.0	59.0	60.1	6.07	6.52	4.76	4.87	19.3	20.4	47.6	48.7	3.42	3.57	4.76	4.78
I_2	57.7	61.0	58.4	58.8	5.75	6.00	4.60	4.64	19.0	19.5	47.6	48.1	3.39	3.44	4.68	4.64
I_3	55.6	59.2	58.3	58.3	5.15	5.40	4.42	4.44	18.4	19.0	46.9	47.2	3.26	3.33	4.65	4.60
SEm±	0.72	1.04	0.19	0.37	0.17	0.27	0.07	0.10	0.15	0.15	0.27	0.80	0.06	0.06	0.03	0.03
CD (P=0.05)	2.13	3.11	0.58	1.09	0.51	0.78	0.20	0.29	0.45	1.21	0.82	2.39	0.18	0.19	0.10	0.09
Mulch																
M_1	57.7	63.6	58.8	60.6	5.70	6.10	4.61	4.75	19.3	20.5	47.3	49.2	3.43	3.63	4.73	4.79
M_2	56.4	58.5	58.5	57.8	5.62	5.84	4.57	4.55	18.5	18.6	47.3	46.7	3.28	3.27	4.59	4.69
SEm±	0.41	1.03	0.09	0.33	0.14	0.23	0.06	0.07	0.12	0.37	0.24	0.71	0.04	0.05	0.03	0.02
CD (P=0.05)	1.22	3.08	0.26	1.02	0.43	0.67	0.19	0.22	0.34	1.09	0.74	2.14	0.13	0.15	0.08	0.07
Nutrient management																
F_1	51.3	54.4	52.6	53.8	4.91	5.12	4.21	4.32	16.7	17.2	42.9	44.0	2.91	2.97	4.29	4.36
F_2	55.1	59.5	55.9	55.8	5.36	5.70	4.45	4.47	18.0	18.9	45.3	45.5	3.20	3.32	4.51	4.53
F_3	58.7	63.0	60.9	61.2	5.91	6.24	4.74	4.78	19.5	20.3	49.5	49.9	3.53	3.64	4.82	4.87
F_4	63.1	67.4	65.0	65.7	6.47	6.81	5.01	5.08	21.3	22.1	52.3	53.0	3.79	3.87	5.12	5.14
SEm±	0.33	0.93	0.06	0.28	0.11	0.17	0.05	0.05	0.07	0.26	0.21	0.65	0.03	0.03	0.02	0.01
CD (P=0.05)	0.97	2.78	0.19	0.85	0.32	0.52	0.14	0.16	0.22	0.76	0.62	1.96	0.08	0.10	0.06	0.04

I_1- irrigation at 60 mm CPE, I_2- irrigation at 80 mm CPE, I_3- irrigation at 100 mm CPE, M_1- paddy straw mulch, M_2- dust mulch, F_1- 100% NPK, F_2- 75% NPK+ 25% N through FYM+ 20 kg S through gypsum, F_3- 75% NPK+ 25% N through Vermicompost+ 40 kg S through gypsum, F_4- 75% NPK+ 25% N through FYM + 60 kg S through gypsum.

Table.3 Effect of irrigation regimes, mulching and integrated nutrient management on N, P K and S uptake

Treatment	Total uptake of N (kg ha^{-1})		Total uptake of P (kg ha^{-1})		Total uptake of K (kg ha^{-1})		Total uptake of S (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016
Irrigation regimes								
Irrigation at 60 mm CPE	116.9	123.1	10.83	11.39	66.9	69.1	8.18	8.42
Irrigation at 80 mm CPE	116.1	119.8	10.35	10.64	66.6	67.6	8.07	8.15
Irrigation at 100 mm CPE	113.9	117.5	9.57	9.84	65.3	66.2	7.91	8.00
SEm±	0.99	1.07	0.24	0.34	0.15	0.20	0.09	0.09
CD (P=0.05)	2.96	3.21	0.70	1.00	0.46	0.59	0.26	0.28
Mulch								
Paddy straw mulch (10 t ha^{-1})	116.4	124.0	10.31	10.85	66.7	69.8	8.19	8.42
Dust mulch	114.8	116.1	10.19	10.39	65.9	65.4	7.90	7.96
SEm±	0.53	0.70	0.20	0.14	0.12	0.15	0.08	0.06
CD (P=0.05)	1.56	2.10	NS	0.45	0.37	0.46	0.25	0.19
Nutrient management								
100% NPK	103.8	108.1	9.10	9.43	59.5	61.1	7.21	7.34
75% NPK + 25% N through FYM+ 20 kg S through gypsum	110.9	115.2	9.79	10.16	63.2	64.3	7.72	7.86
75% NPK+ 25% N through vermicompost+ 40 kg S through gypsum	119.5	124.1	10.63	11.01	68.9	70.1	8.36	8.52
75% NPK + 25% N through FYM + 60 kg S through gypsum	128.0	133.0	11.46	11.88	73.5	75.0	8.92	9.02
SEm±	0.32	0.31	0.16	0.12	0.09	0.13	0.05	0.04
CD (P=0.05)	0.96	0.92	0.45	0.37	0.26	0.38	0.17	0.11

Table.4 pH, EC and bulk density after harvest as influenced by irrigation regimes, mulching, integrated nutrient management on summer groundnut

Treatments	pH		EC (dS m^{-1})		Organic carbon (%)		Kernel yield (kg ha^{-1})		Pod yield (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Irrigation regimes										
Irrigation at 60 mm CPE	7.85	7.78	0.188	0.178	0.354	0.360	1839	2038	4070	4232
Irrigation at 80 mm CPE	7.86	7.79	0.187	0.175	0.352	0.356	1796	1935	3998	4110
Irrigation at 100 mm CPE	7.86	7.79	0.188	0.177	0.350	0.352	1715	1863	3910	3995
CD (P=0.05)	NS	NS	NS	NS	NS	NS	31.4	35.3	11.9	18.5
Mulching										
Paddy straw mulch (10 t ha^{-1})	7.85	7.78	0.182	0.172	0.353	0.359	1827	2051	4010	4238
Dust mulch	7.86	7.80	0.197	0.190	0.350	0.354	1740	1840	3976	3987
CD (P=0.05)	NS	NS	NS	NS	NS	NS	25.6	28.8	9.8	15.1
Nutrient management										
100% NPK	7.86	7.79	0.185	0.174	0.349	0.354	3729	3895	1626	1758
75% NPK+ 25% N through FYM+ 20 kg S through gypsum	7.85	7.80	0.184	0.173	0.352	0.357	3906	3987	1719	1893
75% NPK+ 25% N through vermicompost+ 40 kg S through gypsum	7.85	7.80	0.184	0.173	0.351	0.355	4090	4190	1836	2008
75% NPK+ 25% N through FYM+ 60 kg S through gypsum	7.86	7.79	0.186	0.175	0.353	0.360	4248	4377	1952	2122
CD (P=0.05)	NS	NS	NS	NS	NS	NS	4.2	6.5	16.4	18.1
Initial Value	7.89	7.82	0.186	0.176	0.355	0.361	-	-	-	-

Table.5 Available N, P, K and S after harvest as influenced by irrigation, mulching and integrated nutrient management

Treatments	Available N (kg ha^{-1})		Available P (kg ha^{-1})		Available K (kg ha^{-1})		Available S (kg ha^{-1})	
	2015	2016	2015	2016	2015	2016	2015	2016
Irrigation regimes								
Irrigation at 60 mm CPE	197.8	201.4	16.1	17.8	230.2	232.3	14.5	14.7
Irrigation at 80 mm CPE	199.7	202.7	16.8	19.1	231.6	234.7	16.0	16.2
Irrigation at 100 mm CPE	200.7	203.4	17.6	19.7	232.8	235.6	16.2	16.8
SEm±	0.65	0.45	0.21	0.35	0.74	0.48	0.07	0.08
CD (P=0.05)	1.95	1.36	0.63	1.07	2.20	1.42	0.23	0.25
Mulch								
Paddy straw mulch (10 t ha^{-1})	198.1	201.3	16.4	17.9	229.9	232.5	15.1	15.5
Dust mulch	200.6	203.6	17.1	19.8	233.1	235.9	16.0	16.2
SEm±	0.58	0.40	0.19	0.31	0.66	0.43	0.06	0.07
CD (P=0.05)	1.74	1.21	0.56	0.95	1.96	1.27	0.21	0.22
Nutrient managemet								
100% NPK	196.6	199.2	16.4	18.3	230.1	233.4	13.7	14.9
75% NPK+ 25% N through FYM+ 20 kg S through gypsum	198.7	200.6	16.6	18.5	230.3	233.9	15.8	16.0
75% NPK+ 25% N through vermicompost+ 40 kg S through gypsum	200.2	204.9	16.9	19.3	232.4	234.5	16.1	16.2
75% NPK+ 25% N through FYM+ 60 kg S through gypsum	202.2	205.3	17.1	19.5	233.2	234.9	16.6	16.5
SEm±	0.46	0.16	0.08	0.11	0.20	0.19	0.02	0.03
CD (P=0.05)	1.37	0.47	0.25	0.31	0.58	0.55	0.07	0.09
Initial Value	202.0	199.7	18.8	16.8	233.5	232.6	15.5	15.6

Available N, P, K and S in soil

Increased frequency of irrigation significantly decreased the available N, P, K and S in soil and it was found to be the highest with the irrigation at 100 mm CPE. The reason could be that insufficient moisture under this treatment did not support the adequate uptake of N, P, K and S by crop and most of these nutrients were left in the soil. Results are corroborated with the research findings of Verma *et al.,* (2012). Dust mulch resulted significantly higher available N, P, K and S compared to paddy straw mulch. This is because of lower crop yield and poor utilization of nutrients under this treatment by groundnut. Higher amount of available N, P, K and S was recorded with 75% NPK+ 25% N through FYM + 60 kg S through gypsum.

Increase in available N, P, K and S due to organic manure FYM, vermicompost and chemical fertilizers application may be attributed to the direct addition of these nutrients to the available pool of soil. The favourable effect of organic manure and chemical fertilizers in enhancing the availability of nutrients in soil was also reported by Singh *et al.,* (2006) and Mohapatra and Dixit (2010).

The build-up of soil available nutrients may also be attributed to the addition of FYM and vermicompost for the conversion of organically bound nutrients to inorganic forms and helped in the mineralization of soil nutrients leading to build-up of higher available nutrients. Varalakshmi *et al.,* (2005) had reported increase in N content of soil with integrated nutrient management in groundnut. Incorporation of farmyard manure, lime and P fertilizer reduced the fixation of water soluble P and increased the mineralization of organic P due to microbial action which resulted in increase in available P in soil. An increase in K availability probably was from K bearing minerals by the organic acids released as a decomposition of FYM as reported by Singh *et al.,* (2006).

Kernel and haulm yield

The significantly highest kernel and haulm yield was achieved under irrigation at 60 mm CPE followed by irrigation at 80 mm and 100 mm CPE, respectively (Table 4). The better development of crop under irrigated treatments was a result of better moisture availability, which maintained the internal water balance of the plant. Increase in yield is due to the increase in the yield attribute reported by Gupta *et al.,* (2015). Paddy straw mulch recorded significantly higher kernel and haulm yield as compared to dust mulch. The better development of crop under paddy straw mulch treatment was a result of better moisture availability, which maintained the internal water balance of the plant. Increase in yield is due to the increase in the yield attribute reported by Ravisankar *et al.,* (2014). Among INM treatments, an application of 75% NPK+ 25% N through FYM + 60 kg S through gypsum recorded significantly the highest kernel and haulm yield followed by 75% NPK+ 25% N through vermicompost + 40 kg S through gypsum as compared to other INM treatments. These results are corroborated with the research results of Vishwakarma *et al.,* (2012), Chavan *et al.,* (2014) and Patil *et al.,* (2017).

References

Arunachalam, P., Kannan, J., Prabhaharan, G., Kumar, P. and Zadda, K. 2012. Response of groundnut genotypes to soil fertilization of micronutrients in alfisol conditions. *Electronic Journal of Plant Breeding* 4(1): 1043-1049.

Baliarsingh, A. and Mahapatra, P.K. 2015. Effect of date of sowing and irrigation on yield and moisture use dynamics of summer groundnut. *Environment and Ecology* 33:175-179.

Chaudhary, J.H., Sutaliya, R. and Desai, L.J. 2015. Growth, yield, yield attributes and economics of summer groundnut as influenced by integrated nutrient management. *Journal of Applied and Natural Science* 7(1): 369-372.

Chavan, A.P. Jain, N.K. Sagvekar, V.V. and Kumar, T. 2014. Integrated nutrient management in groundnut. *Research on Crops* 15: 454-460.

Choudhary, M. Chovatia, P.K. Jat, R. and Choudhary, S. 2017. Effect of weed management on growth attributes and yield of summer groundnut. *International Journal of Chemical Studies* 5: 212-214.

Choudhary, S.K., Jat, M. K., Sharma, S.R. and Singh, P. 2011. Effect of INM on soil nutrient and yield in groundnut field of semi-arid area of Rajasthan. *Legume Res*. 34(4): 283 - 287.

Dutta, D. and Mondal, S. S. 2006. Response of summer groundnut to moisture stress, organic manure and fertilizer with and without gypsum under lateritic soil of West Bengal. *Indian Journal of Agronomy* 51(2): 145-148.

Gupta, B. Kapil, O and Hovav, R. 2015. The effects of irrigation level and genotype on pod-filling related traits in peanut. *Journal of Agricultural Science (Toronto)* 7: 169-181.

Mohapatra, A. K. B. and Dixit, L. 2010. Integrated nutrient management in rainy season groundnut. *Indian Journal of Agronomy* 55(2):123-127.

Monsefi, A., Sharma, A.R. and Zan, N.R. 2016. Weed management and conservation tillage for improving productivity, nutrient uptake and profitability of wheat in soybean -wheat cropping system. *J. Agr. Sci. Tech.* 18: 411-421.

Noman, H.M., Rana, D.S. and Rana, K.S. 2015. Influence of sulphur and zinc levels and zinc solubilizer on productivity, economics and nutrient uptake in groundnut. *Indian Journal of Agronomy* 60(2): 301-306.

Noman, H.M., Rana, D.S., Choudhary, A.K., Rajpoot, S. and Paul, T. 2016. Sulphur and Zn management in groundnut-wheat cropping system: direct effects on system productivity and residual effects on yield, energetic and Zn biofortification in wheat. *Indian Journal of Agricultural Sciences* 86(4): 441-447.

Patil, D.B. Pawar, P.P. Wadile, S.C. and Patil, H.M. 2017. Effect of integrated nutrient management on growth and yield of *kharif* groundnut. *International journal of Horticulture, Agriculture and Food science* 1:21-23.

Patra, Partha, S., Sinha A.C. and Mahesh, S.S. 2011. Yield, nutrient uptake and quality of groundnut kernels as affected by organic sources of nutrient. *Ind. J. Agron*. 56(3):237-241.

Ravisankar, N., Balakrishnan, M., Ambast, S. K., Srivastava, R. C., Bommayasamy, N. and Subramani, T. 2014. Influence of irrigation and crop residue mulching on yield and water productivity of table purpose groundnut in humid tropical Island. *Legume Res.* 37 (2): 195-200.

Saha, D. and Gunri, S.K. 2014. Effect of polythene mulching, irrigation regimes and fertilizer dise on summer groundnut nodulation, pod yield and nitrogen availability in soil. *Environment and Ecology* 32:1301-1303.

Singh, S., Singh, R. N., Prasad, J. and Singh, B. P. 2006. Effect of integrated nutrient management on yield and uptake of nutrients by rice and fertility in rainfed uplands. *Journal of the Indian Society of Soil Science* 54(3): 327–330.

Sounda, G., Mandal, A. and Moinuddin, G. 2006. Effect of irrigation and mulch on nodulation and yield of summer groundnut. *Journal of Interacademicia.* 10(4): 489-496.

Thiyagarajan, G., Ranghaswamy, M.V., Rajkumar, D. and Kumaraperumal, R. 2010. Deficit irrigation effects on groundnut with micro sprinklers. Madras Agriculture Journal 97:40-42.

Varalakshmi, L.R., Srinivasa, M.C.A. and Bhaskar, S. 2005. Effect of integrated use of organic manures and inorganic fertilisers on organic carbon, available N, P, K in sustaining productivity of groundnut-finger millet cropping system. *Journal of the Indian Society of Soil Science* 53(3):315-318.

Verma, S.K. and Idnani, L.K. 2012. Water use, nutrient content and their uptake as influenced by irrigation and nitrogen management in potato–maize cropping system. *Indian Journal of Agricultural Sciences* 82 (12): 1032–1038.

Verma, S.K. Kumar, A. and Idnani, L.K. 2013. Effect of irrigation and nitrogen management on growth and yield of potato and their residual effect on succeeding maize under potato-maize cropping system. *Indian Journal of Agronomy* 58:48-53.

Verma, S.K., Singh, S.B., Prasad, S.K., Meena, R.N. and Meena, R.S. 2015. Influence of irrigation regimes and weed management practices on water use and nutrient uptake in wheat. *Bangladesh J. Bot*. 44(3): 437-442.

Vishwakarma, A.K. Brajendra; Pathak, K.A. and Ramakrishna, Y. 2012. Effect of different sources of nutrient application on productivity, nutrient uptake and economics of groundnut in Kolasib district of Mizoram Indian. *Journal of Soil Conservation* 40: 152-157.

Yadav, G.S., Datta, M., Babu, S., Saha, P. and Singh, R. 2015. Effect of sources and levels of phosphorus on productivity, economics, nutrient acquisition and phosphorus-use efficiency of groundnut under hilly ecosystems of North-East India. *Indian Journal of Agronomy* 60 (2): 307-311.

How to cite this article:

Avinash Chandra Maurya, S.K. Verma, Sushil Kumar and Kairovin Lakra. 2017. Nutrient Concentration and their Uptake and Available Nutrients in Soil Influenced by Irrigation, Mulching and Integrated Nutrient Management in Summer Groundnut. *Int.J.Curr.Microbiol.App.Sci.* 6(11): 2405-2415. doi: https://doi.org/10.20546/ijcmas.2017.611.285