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Residual effect of organic sources and fertilizer levels to preceding maize on the growth parameters of Succeeding groundnut

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Abstract: *A field experiment was conducted during 2014-2015 and 2015-16 on integrated nutrient management in maize and its residual effect on groundnut under maize-groundnut crop sequence in Southern telanagana region. The plot receiving combination of residual 50% RDF+50% RDN through urban compost (M_5) and 100% RDF (S_1) exerted significant effect on most of the growth parameters at different stages of succeeding groundnut. The maximum increase in the growth parameters like plant height, dry matter accumulation of groundnut were obtained due to residual effect of residual 50% RDF+50% RDN through urban compost (M_5) through 100% RDF (S_1) and was closely followed by the treatments having residual 50% RDF+50% RDN through FYM (M_3) and 100% RDF(S_1). With regard to interaction between residual treatments and fertilizer levels was not observed during both years of study.*

Keywords*: Urban compost, FYM, INM*

I. Introduction

One of the most important challenges faced by human beings today is to conserve/sustain natural resources, including soil and water, for increasing food production while protecting the environment. As the world population grows, stress on natural resources increases, making it difficult to maintain food security. Long term food security requires a balance between increasing crop production, maintaining soil health and environmental sustainability. In India, effective nutrient management has played a major role in accomplishing the enormous increase in food production from 52 million tonnes in 1951-52 to 264 million tonnes during 2014-15. However, application of imbalanced and excessive nutrients led to declining nutrient-use efficiency making fertilizer consumption un economical and producing adverse effects on atmosphere (Aulakh and Adhya, 2005) and groundwater quality (Aulakh *et al*. 2009) causing health hazards and climate change.

Groundnut, the premier oilseed crop of India, occupies in an area of about 6.7 million ha and contributes 7.3 million tonnes towards the oilseed production. India stands first in area and second in production, and fifth in productivity (1,000 kg ha^{-1}) after USA, China, Indonesia and Nigeria. The productivity of groundnut is low in India when compared with other countries mainly due to rain dependency (85%), monoculture (60%) and cultivation on marginal soils of low fertility. Groundnut is an energy rich crop and needs sufficient amount of nutrients and moisture to meet their requirement for growth and development and high yields. Sustainable groundnut production can be achieved by diversifying the groundnut cropping system and nutrient management practices (Dudhatra *et al*., 2002, and Balaguravaiah *et al*., 2005). Integration and incorporation of organic manure (FYM/urban compost) in the agricultural systems helps to improve soil structure, soil microbial activity and soil moisture conservation and which in turn helps to stabilize the production and productivity of the crops. INM is also important for marginal farmers who cannot afford to supply crop nutrients through costly chemical fertilizers.

II. Materials And Methods

A field experiment entitled "Direct and residual effect of integrated nutrient management in Maize-Groundnut crop sequence in Southern Telangana region" was conducted during *kharif* and *rabi* 2014-15 and 2015-16 at College Farm, College of Agriculture, Rajendranagar, Hyderabad, Southern Telangana climatic Zone of Telangana. The soil of experimental site was sandy clay loam with pH of 7.6, Electrical conductivity 0.86 dSm^{-1}, low in organic carbon (0.73 dSm^{-1}), low in available nitrogen (217 kg ha^{-1}) and medium in phosphorus (64 kg ha^{-1}) and high in potassium (402 kg ha^{-1}). The experiment was laid out in a randomized block design for maize during *kharif* 2014 and 2015 with six treatments consisting of combinations of three fertilizer levels 100,75 and 50 per cent RDF through fertilizer and 25 and 50 per cent RDN through two manures (FYM, Urban compost) with four replications. In succeeding *rabi* season, the experiment was laid out in split- plot design by taking five residual treatments from preceding maize as main plots and each at 50, 75 and 100 per cent RDF as

three sub-treatments with 3 replications for groundnut during *rabi* 2014-15 and 2015-16. The data on growth parameters viz.plant height and dry matter accumulation were recorded at 30, 60,90DAS and at harvest in groundnut during both years of study.

Kharif maize hybrid (DHM-117) was sown on 27th July during first year and 19th June during second year adopting a spacing of 60 x 20 cm. Succeeding rabi Groundnut (Kadire-6) was sown on 26th November during first year and 16th October during second year adopting a spacing of 30 x 10 cm. In general the climatic conditions were congenial during crop growth period and incidence of pest and disease attack was noticed to a some extent.

III. Results And Discussion

Growth Parameters

Plant height at different stages

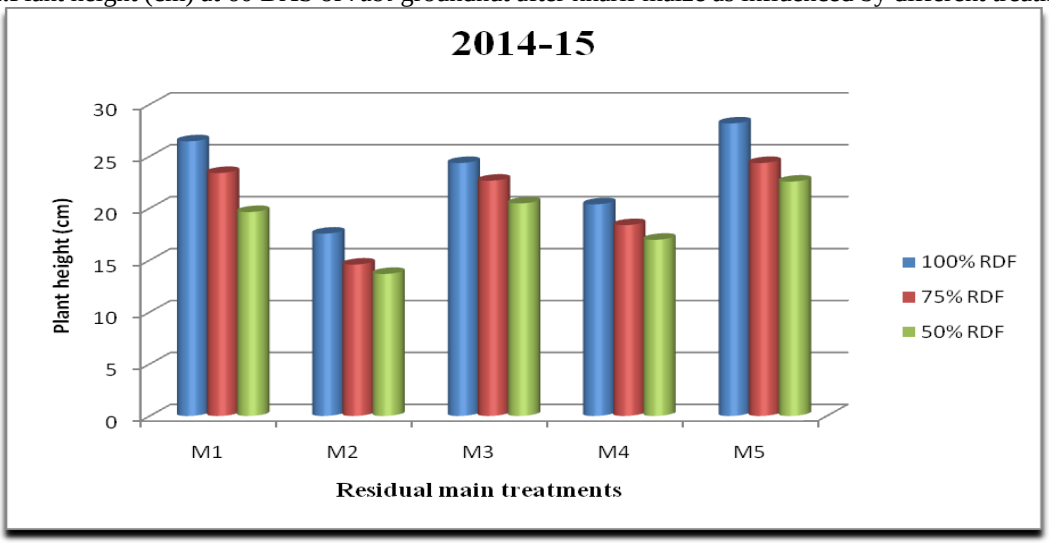
During both years of study, the plant height was not significantly different with residual treatments of preceding maize crop on *rabi* groundnut at 30 days after sowing. The interaction between residual treatments in maize crop and succeeding fertilizer levels in groundnut was not significant at 30 days after sowing.

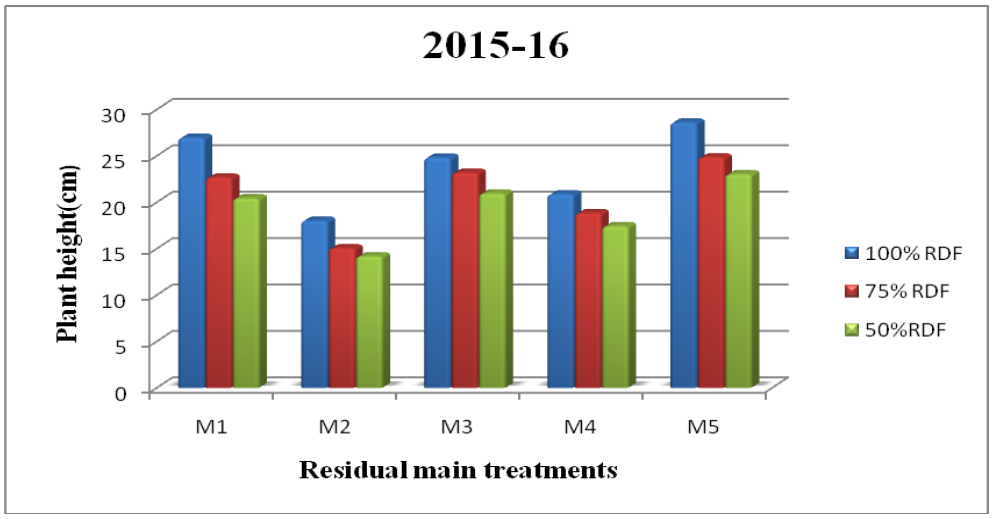
During first year of study, the plant height was the highest in 50% RDF+50% RDN through urban compost (M_5) followed by 50% RDF+50% RDN through farmyard manure (M_3) and 100% RDF (M_1), with significant disparity between rest of the treatments tried, while during second year, the highest plant height was obtained with 50% RDF+50% RDN through urban compost (M_5), which was however, on par with 50% RDF+50% RDN through farmyard manure (M_3) and 100% RDF (M_1), significantly superior to rest of the treatments. Significantly lowest plant height was recorded with 75% RDF+25% RDN through farmyard manure (M_2) during the both years of study at 60, 90 days after sowing and at harvest.

During both the years of study, fertilizer levels exerted a significant influence on plant height of groundnut and it was the highest with 100% RDF (S_1), which was however, comparable with 75% RDF (S_2) and significantly superior to 50% RDF (S_3) at 60, 90 days after sowing and at harvest. At 30 day after sowing no significant difference was observed in terms of plant height.

With regard to interaction between residual treatments and fertilizer levels, combination of M_5S_1 recorded the tallest plants, which were on par with M_3S_1 and M_1S_1 during both the years of study at 60 days after sowing. Significant increase in plant height with different levels of RDF along with FYM and urban compost was probably due to cell and internodal elongation, plant metabolism, there by promoting vegetative growth which is positively correlated to the productive potentiality of plant which corroborates with the results of Masood *et al.* (2011).

Fig.1. Plant height (cm) at 60 DAS of *rabi* groundnut after kharif maize as influenced by different treatments





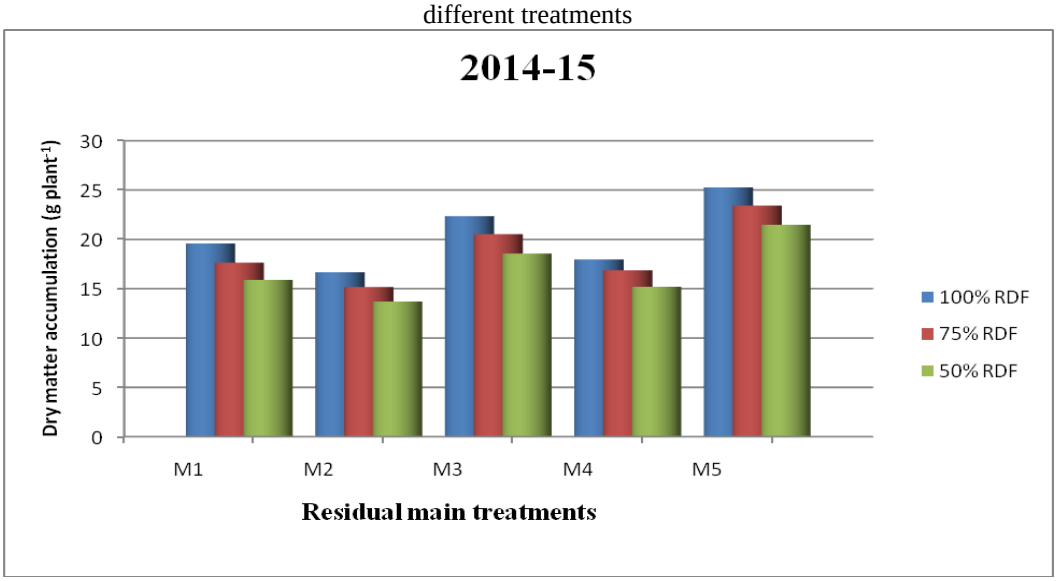
Dry matter accumulation (g plant^{-1}) at different stages

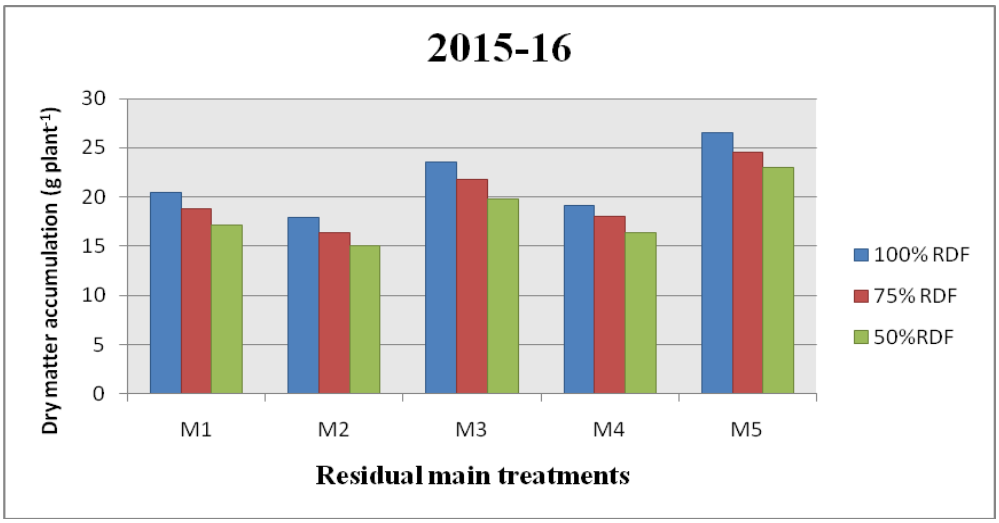
During both years of study, the dry matter accumulation was not significantly different with residual treatments of preceding maize crop on *rabi* groundnut at 30 days after sowing. During first year of study, the dry matter accumulation was the highest in 50% RDF+50% RDN through urban compost (M_5) followed by 50% RDF+50% RDN through farmyard manure (M_3) and 100% RDF (M_1), with significant disparity between rest of the treatments tried at 60,90 days after sowing and at harvest, while during second year, the highest dry matter accumulation was obtained with 50% RDF+50% RDN through urban compost (M_5) , which was however, on par with 50% RDF+50% RDN through farmyard manure (M_3) and 100% RDF (M_1) which are significantly superior to rest of the treatments at 60,90 days after sowing and at harvest.75% RDF+25% RDN through farmyard manure (M_2) was recorded the lowest dry matter accumulation during both the years of study at 60, 90 days after sowing and at harvest. Higher dry matter production with residual effect of manure and RDF could be attributed to enhanced plant height, leaf area index and photosynthates accumulation, thereby improving the plant vigor due to source-sink relationship. These findings are in conformity with those of Pokharel *et al.* (2009), Tetarwal *et al.* (2011) and Ravi *et al.* (2012).

During both the years of study, fertilizer levels exerted a significant influence on dry matter accumulation of groundnut and it was the highest with 100% RDF (S_1), which was however, comparable with 75% RDF (S_2) and significantly superior to 50% RDF (S_3) at 60,90 days after sowing and at harvest.

With regard to interaction between residual treatments and fertilizer levels, combination of M_5S_1 recorded the highest dry matter accumulation, which was on par with M_3S_1 and M_1S_1, during both year of study at 60 days after sowing.

Fig.2. Dry matter accumulation (g plant^{-1}) at 60 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatments





IV. Conclusions

The growth parameter *viz.*, plant height and dry matter accumulation were recorded significantly higher with integration of residual 50% RDF+50% RDN through urban compost (M_5) and 100% RDF (S_1) for succeeding groundnut on par with residual 50% RDF+50% RDN through FYM (M_3) and 100% RDF (S_1) for succeeding groundnut, while growth parameters *viz.*, Plant height and dry matter accumulation were not significantly influenced at 30 days after sowing during both the years.

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1. Plant height (cm) at 30 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatment

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	12.47	11.00	9.57	11.0	13.13	11.78	10.27	11.7
M_2- 75% RDF of NPK +25% N-FYM	12.86	11.77	10.26	11.8	12.77	11.33	10.35	11.5
M_3- 50% RDF of NPK +50% N-FYM	14.46	12.66	11.27	12.8	15.03	13.33	12.00	13.5
M_4- 75% RDF of NPK +25% N-Urban Compost	13.28	11.96	10.98	12.1	12.86	11.40	10.60	11.6
M_5- 50% RDF of NPK +50% N-Urban Compost	16.23	13.56	13.06	14.2	16.76	14.16	13.40	14.8
Mean	13.9	12.2	11.0		14.1	12.4	11.3	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	1.78	NS			M	1.67	NS	
S	1.46	NS			S	1.52	NS	
M at S	0.54	NS			M at S	0.17	NS	
S at M	0.53	NS			S at M	0.18	NS	

2. Plant height (cm) at 60 DAS of *rabi* groundnut after kharif maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	26.45	23.4	19.64	23.16	26.97	22.67	20.45	23.36
M_2- 75% RDF of NPK +25% N-FYM	17.56	14.58	13.68	15.27	18.03	15.06	14.2	15.76
M_3- 50% RDF of NPK +50% N-FYM	24.36	22.66	20.47	22.50	24.83	23.2	20.96	23.00
M_4- 75% RDF of NPK +25% N-Urban Compost	20.38	18.38	16.97	18.58	20.87	18.83	17.43	19.04
M_5- 50% RDF of NPK +50% N-Urban Compost	28.17	24.36	22.57	25.03	28.63	24.85	23.04	25.51
Mean	23.38	20.68	18.67		23.87	20.92	19.22	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	1.62	3.34			M	1.23	2.48	
S	1.3	2.7			S	1.53	3.14	
M at S	1.43	2.9			M at S	1.46	2.97	
S at M	1.75	3.57			S at M	1.79	3.54	

3. Plant height (cm) at 90 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	34.68	33.24	29.54	28.37	35.12	33.68	30.57	33.12
M_2- 75% RDF of NPK +25% N-FYM	26.26	20.9	21.6	26.55	26.66	21.3	22	23.32
M_3- 50% RDF of NPK +50% N-FYM	33.27	31.78	30.63	30.27	33.6	32.13	31	32.24
M_4- 75% RDF of NPK +25% N-Urban Compost	28.8	26.9	25.33	29.71	29.16	27.33	25.74	27.41
M_5- 50% RDF of NPK +50% N-Urban Compost	36.43	35	32.13	32.71	36.93	35.4	32.43	34.92
Mean	31.89	29.56	27.85		32.29	29.97	28.35	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	1.97	4.56			M	1.71	3.64	
S	1.57	3.18			S	1.57	3.28	
M at S	1.26	NS			M at S	1.26	NS	
S at M	1.27	NS			S at M	1.25	NS	

4. Plant height (cm) at harvest of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	48.6	46.31	43.62	46.18	49.2	47.36	45.96	47.51
M_2- 75% RDF of NPK +25% N-FYM	43.56	42.17	38.96	41.56	44.23	43.06	39.7	42.33
M_3- 50% RDF of NPK +50% N-FYM	47.96	45.56	45.16	46.23	48.6	46.16	45.8	46.85
M_4- 75% RDF of NPK +25% N-Urban Compost	44.67	43.17	41.9	43.25	45.23	43.76	42.5	43.83
M_5- 50% RDF of NPK +50% N-Urban Compost	50.00	47.93	46.57	48.17	50.57	48.70	47.17	48.81
Mean	46.96	45.03	43.24		47.57	45.81	44.23	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	1.22	2.48			M	1.47	2.82	
S	1.15	2.32			S	1.39	2.75	
M at S	1.34	NS			M at S	1.22	NS	
S at M	1.36	NS			S at M	1.28	NS	

5. Dry matter accumulation (g plant^{-1}) at 30 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	3.37	3.16	2.87	3.13	3.82	3.61	3.43	3.62
M_2- 75% RDF of NPK +25% N-FYM	3.12	2.89	2.73	2.91	3.54	3.38	3.20	3.37
M_3- 50% RDF of NPK +50% N-FYM	3.78	3.59	3.45	3.61	4.13	3.95	3.77	3.95
M_4- 75% RDF of NPK +25% N-Urban Compost	3.31	3.13	2.91	3.12	3.74	3.56	3.38	3.56
M_5- 50% RDF of NPK +50% N-Urban Compost	4.30	4.11	4.00	4.14	4.58	4.31	4.17	4.35
Mean	3.58	3.38	3.19		3.96	3.76	3.59	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	0.56	NS			M	0.53	NS	
S	0.18	NS			S	0.20	NS	
M at S	0.28	NS			M at S	0.45	NS	
S at M	0.11	NS			S at M	0.12	NS	

6. Dry matter accumulation (g plant^{-1}) at 60 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	19.57	17.63	15.90	17.70	20.44	18.83	17.20	18.82
M_2- 75% RDF of NPK +25% N-FYM	16.67	15.17	13.70	15.18	17.90	16.37	15.00	16.42
M_3- 50% RDF of NPK +50% N-FYM	22.36	20.53	18.57	20.49	23.57	21.83	19.77	21.72
M_4- 75% RDF of NPK +25% N-Urban Compost	17.97	16.87	15.20	16.68	19.17	18.07	16.40	17.88
M_5- 50% RDF of NPK +50% N-Urban Compost	25.27	23.43	21.47	23.39	26.57	24.63	23.00	24.73
Mean	20.37	18.73	16.97		21.53	19.95	18.27	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	2.89	5.97			M	3.14	6.25	
S	1.34	2.67			S	1.14	2.29	
M at S	1.26	2.54			M at S	1.31	2.64	
S at M	1.29	2.59			S at M	1.47	2.96	

7. Dry matter accumulation (g plant^{-1}) at 90 DAS of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	29.36	26.45	23.85	26.55	30.66	28.25	25.80	28.23
M_2- 75% RDF of NPK +25% N-FYM	25.01	22.76	20.55	22.77	26.85	24.56	22.50	24.63
M_3- 50% RDF of NPK +50% N-FYM	33.54	30.80	27.86	30.74	35.36	32.75	29.66	32.58
M_4- 75% RDF of NPK +25% N-Urban Compost	26.96	25.31	22.80	25.02	28.76	27.11	24.60	26.82
M_5- 50% RDF of NPK +50% N-Urban Compost	37.91	35.15	32.21	35.09	39.86	36.95	34.50	37.10
Mean	30.55	28.09	25.45		32.30	29.92	27.41	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	2.51	12.17			M	3.59	10.37	
S	1.12	3.26			S	2.14	4.28	
M at S	2.27	NS			M at S	4.30	NS	
S at M	1.55	NS			S at M	2.64	NS	

8. Dry matter accumulation (g plant^{-1}) at harvest of *rabi* groundnut after *kharif* maize as influenced by different treatments

Treatments given to *kharif* maize(M)	Treatments given to rabi groundnut(S)							
	2014-15				2015-16			
	Recommended Dose of Fertilizer (%)				Recommended Dose of Fertilizer (%)			
	100(S_1)	75(S_2)	50(S_3)	Mean	100(S_1)	75(S_2)	50(S_3)	Mean
M_1- 100% RDF of NPK	42.27	40.03	37.83	40.04	44.27	42.03	39.71	42.00
M_2- 75% RDF of NPK +25% N-FYM	37.97	36.60	35.98	36.83	39.97	38.60	37.93	38.83
M_3- 50% RDF of NPK +50% N-FYM	46.70	44.17	42.77	44.55	48.70	46.16	44.78	46.55
M_4- 75% RDF of NPK +25% N-Urban Compost	40.37	38.50	36.80	38.32	42.37	40.50	38.92	40.28
M_5- 50% RDF of NPK +50% N-Urban Compost	50.23	47.27	44.17	47.22	52.23	49.27	47.03	49.51
Mean	43.51	41.31	39.33		45.51	43.31	41.48	
	S.Em ±	CD(P=0.05)				S.Em ±	CD(P=0.05)	
M	2.58	7.34			M	3.59	8.18	
S	1.21	2.43			S	1.20	2.43	
M at S	1.46	NS			M at S	1.46	NS	
S at M	1.69	NS			S at M	1.68	NS	