Int.J.Curr.Microbiol.App.Sci (2018) *7*(3): 3292-3303

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 03 (2018)**
Journal homepage: http://www.ijcmas.com

EXCELLENT PUBLISHERS

Original Research Article https://doi.org/10.20546/ijcmas.2018.703.379

Quality, Yield and Economics of *Rabi* Groundnut as Influenced By Irrigation Scheduling and Phosphogypsum Levels

R. Naresha*, P. Laxminarayana, K.B. Suneetha Devi and V. Sailaja

Professor Jayashankar Telangana State Agricultural University, Department of Agronomy, College of Agriculture, Rajendranagar, Hyderabad-500030, Telangana State, India

**Corresponding author*

Keywords

Phosphogypsum, Irrigation scheduling, Economics of rabi Groundnut, Quality of groundnut

Article Info

Accepted:
26 February 2018
Available Online:
10 March 2018

A B S T R A C T

The field experiment was conducted at College farm, Acharya N. G. Ranga Agricultural University (now Professor Jayashankar Telangana State Agricultural University), Rajendranagar, Hyderabad during *rabi* 2013-14 to study the influence of three moisture regimes *viz.*, 0.6, 0.8 and 1.0 IW/CPE ratios and five phosphogypsum levels *viz.*, Control (500 kg ha^{-1} gypsum at flower initiation), Phosphogypsum @ 250 kg ha^{-1} at flower initiation, Phosphogypsum @ 250 kg ha^{-1} (½ as basal and ½ at flower initiation), Phosphogypsum @ 500 kg ha^{-1} (½ as basal and ½ at flower initiation) and Phosphogypsum @ 500 kg ha^{-1} at flower initiation and was replicated thrice. Highest yield, yield attributes and quality of groundnut recorded with I_3 (1.0 IW/CPE) moisture regime and with Pg_5: Phosphogypsum @ 500 kg ha^{-1} at flower initiation while highest B: C ratio (2.4) was obtained at I_2 (0.8 IW/CPE ratio) and I_3 (1.0IW/CPE) moisture regimes. Among phosphogypsum levels, 500 kg ha^{-1} applied at flower initiation recorded the highest (2.4) B: C ratio.

Introduction

Groundnut is an important oil and protein source to a large portion of the population in India. It is an annual, herbaceous legume and considered as king of vegetable oil seed crops in India and occupies a pre-eminent position in national edible oil economy. Groundnut seed contain 47-53 per cent oil, 26 per cent protein and 11.5 per cent starch. It is currently grown in an area of 42 Million hectares over the globe. Cultivation of groundnut under rainfed conditions and imbalanced nutrient management are the main reasons for low productivity of groundnut in Andhra Pradesh. Irrigation water, a crucial input in crop production is scarce and expensive. Efficient use of this input is essential which can be achieved through judicious water management practices. Adequate and timely supply of water is essential for higher yields. Keeping the total quantity of irrigation water constant, increasing the frequency of irrigation would maximize the yield in groundnut (Giri *et al.*, 2017).

Groundnut is grown during rainy, winter and summer seasons in India. The average productivity is relatively low in rainy season. Groundnut has specific moisture needs due to its peculiar feature of producing pods underground. In groundnut early moisture stress restricts the vegetative growth which in turn reduces the yield and at the peak flowering and pegging period is most sensitive as the peg cannot penetrate through dry and hard surface. The rabi crop avails the residual moisture and the scanty rainfall during winter and produces substantial yield as compared to the kharif crop and few supplementary irrigations would improve the yield. Because of high productivity under assured irrigation, groundnut cultivation in rabi season is gaining popularity in irrigation scheduling, a climatologically approach based on IW/CPE ratio (IW- irrigation water, CPE- Cumulative pan evaporation) has been found most appropriate. This approach integrates all the weather parameters that determine water use by the crop and is likely to increase production at least 15-20%. Optimum scheduling of irrigation led to increase in pod yield and water use efficiency (WUE) (Taha and Gulati, 2001).

To ensure increased yields of *rabi* groundnut in traditional areas of Andhra Pradesh and Telangana it is necessary to have a thorough understanding of the changes in the soil-plant-water relations and various morpho-physiological processes in relation to scheduling of irrigation water. Studies on various aspects of groundnut nutrition are limited particularly under varied soil moisture regimes, hence efforts are needed to quantify the crop response *vis-a-vis*at different nutrient levels.

Among the sources of sulphur, phosphogypsum is cheaper and potential source. It is a solid waste by-product of the wet phosphoric acid production from rock phosphate. Phosphogypsum contains 16 per cent sulphur and 21 per cent calcium along with meagre amount of phosphorus (0.2-1.2 % P_2O_5) and trace amounts of silica (SiO_2), iron (Fe_2O_3), aluminium (Al_2O_3), sodium (Na_2O), potassium (K_2O) and some heavy metals (Biswas and Sharma, 2008). Approximately 5.5 Million tonnes of phosphogypsum is discharged for every one Million tonnes of phosphoric acid production. In India, 6 to 8 Million tonnes of phosphogypsum is produced annually which supplies 1 to 1.5 Million tonnes of sulphur and 1.5 to 2 Million tonnes of calcium.

The phosphogypsum, unlike other sulphur sources, offers all desirable agronomic features of an efficient sulphur fertilizer besides supplying calcium that is readily available to the growing plant, while elemental sulphur and organic sulphur must undergo microbial conversion before sulphur is made available to plants, but the sulphur in phosphogypsum becomes readily available in sulphate form. At the same time, sulphate form is kept available for a longer period due to its low solubility in water. Most of the other sulphate salts that are used for fertilizer are highly soluble and the sulphate may be leached from the soil before the plant removal (Biswas and Sharma, 2008).

In spite of additional nutritional value and desirable agronomic features, a high proportion is either dumped or staked for increasing concern to the risk of exposure to radiation.

However, the relative radiation risk to people or the environment falls significantly below the level of radiation to which we are exposed through Naturally Occurring Radioactive Material (NORM).

Hence, it may not be prudent, therefore, to allow such wastage of this large sulphur and calcium rich by-product (16% S and 21% Ca) in the back drop of wide spread sulphur and calcium deficiencies in Indian soils (Biswas and Sharma, 2008). Keeping this in view, this study was undertaken to investigate the influence of moisture regimes and phosphogypsum levels on growth and yield of *rabi* groundnut.

Material and Methods

Field experiment was conducted at College farm, Acharya N. G. Ranga Agricultural University, Rajendranagar, Hyderabad during *rabi* 2013-14 on sandy loam soil having low organic carbon (0.53 %) and available nitrogen (238.33 kg ha^{-1}), medium available phosphorous (29.33 kg ha^{-1}), sulphur and calcium (14.30 and 10.00 kg ha^{-1}), high potassium (423.36 kg ha^{-1}) and neutral in reaction.

The experiment was laid out in split plot design with combinations of three moisture regimes *viz.*, 0.6, 0.8 and 1.0 IW/CPE ratios and five phosphogypsum fertilizer levels *viz.*, Pg_1: Control (500 kg ha^{-1} gypsum at flower initiation), Pg_2: Phosphogypsum @ 250 kg ha^{-1} (at flower initiation), Pg_3: Phosphogypsum @ 250 kg ha^{-1} (½ as basal and ½ at flower initiation), Pg_4: Phosphogypsum @ 500 kg ha^{-1} (½ as basal and ½ at flower initiation), Pg_5: Phosphogypsum @ 500 kg ha^{-1} (at flower initiation) and was replicated thrice. Groundnut variety K-6 (Kadiri-6) was sown on 10-10-2013 at a spacing of 22.5 cm x 10 cm with one seed $hill^{-1}$. Recommended N P K applied to all the treatments uniformly @ 30: 50: 50 kg ha^{-1}. Nitrogen and Phosphorus applied through urea and DAP, potassium through muriate of potash. Whole quantity of phosphorus and potassium and ½ nitrogen applied as basal and remaining ½ Nitrogen as top dressing at 25-30 DAS. Mean maximum and minimum temperatures were 32.8°C and 22.1°C respectively and 282.2 mm rainfall was received in 11 rainy days during the crop growing period. Mean bulk density and total available soil moisture in 60 cm depth of soil was 1.6 g cm^{-3} and 127.6 mm respectively. Mean moisture percentage at field capacity and permanent wilting point was 19.2 and 5.9. The total applied irrigation water was 267, 222 and 178 ha.mm for IW/CPE ratio of 1.0, 0.8 and 0.6 respectively. Five, four and three irrigations were given to IW/CPE ratio of 1.0, 0.8 and 0.6 respectively along with one irrigation to all treatments one day before harvesting. For every irrigation, 50 mm of water was applied using water meter in closed channels. Daily readings of evaporation were recorded from USWB class "A" open pan evaporimeter and irrigations were scheduled based on IW/CPE ratios.

Yield attributes and yield were recorded at harvest, while quality and economics were recorded after harvest of groundnut. Statistical analysis was done to all the recorded data as per Panse and Sukhatme (1985).

Results and Discussion

The data pertaining to yield attributes as influenced by moisture regimes and phosphogypsum levels was presented in Table 1. Yield attributes *viz.*, number of pods $plant^{-1}$, 100 kernel weight (g), shelling percentage were significantly influenced by moisture regimes and phosphogypsum levels were higher at I_3 (1.0 IW/CPE) and was on par at I_2 (0.8 IW/CPE) for number of pods $plant^{-1}$, 100 kernel weight (g), shelling percentage. Frequent irrigation under I_3 treatment might have created favorable moisture conditions for the crop growth consequently increased the values of the yield attributes than other treatments (I_1 and I_2). These results are in close conformity with the findings of Santosh Behera *et al.*, (2015), Patel *et al.*, (2009), Dey *et al.*, (2007) and Shaikh *et al.*, (2004).

Among the phosphogypsum levels, application of phosphogypsum @ 500 kg ha^{-1} at flower initiation recorded significantly higher yield attributes and was statistically on par with application of gypsum @ 500 kg ha^{-1} at flower initiation for all yield attributes except number of pods $plant^{-1}$. Interaction between moisture regimes and phosphogypsum levels was significant only with number of pods $plant^{-1}$. Significantly highest number of pods $plant^{-1}$ (15.8) noticed at interaction of I_3 (1.0 IW/CPE) and phosphogypsum @ 500 kg ha^{-1} at flower initiation (Pg_5) followed by I_2Pg_5 and I_3Pg_2 respectively. Lowest number of pods $plant^{-1}$ (12.2) recorded at interaction of I_1Pg_3 (0.6 IW/CPE) (phosphogypsum @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation) (Table 1.b). The marked improvement in yield attributes might be due to balanced nutrition and efficient and greater partitioning of metabolites and adequate translocation of nutrients to the developing reproductive parts resulting in the production of greater pod number and shelling percentage These results are in close conformity with the findings of Surendra singh and Singh (2016), Somnath chattopaddhyay and goutam kumar ghosh (2012), Rout and Jena (2009) and Dey *et al.*, (2007).

The data pertaining to groundnut pod and haulm yield were presented in Table 1 and fig.1. The highest pod and haulm yields (21.5 and 38.4 q ha^{-1}) were recorded when irrigation was scheduled at I_3 (1.0 IW/CPE), which was on par with I_2 (0.8 IW/CPE) treatment and both were significantly superior over I_1 level of moisture regimes where in lowest yields (17.4 and 32.3 q ha^{-1}) were recorded. The higher pod and haulm yields with more frequent irrigation (I_3) might have accounted for their favorable influence on the yield attributing characters *viz.* number of pods per plant, number of kernels pod^{-1} and 100 kernel weight.

Pod and haulm yield of groundnut was significantly increased with increase in the frequency of irrigation which was ascribed to adequate moisture availability in turn have favoured congenial conditions for the luxurious growth of crop and consequently increased the values of the yield attributes with I_3 compare to I_2 and I_1 treatments. These results are in close conformity with the findings of Santosh Behera *et al.,* (2015), Suresh *et al.*, (2013) and Shaikh *et al.*, (2004).

Effect of phosphogypsum levels on pod and haulm yields were presented in Table 1 and fig. 2. Among the phosphogypsum levels, application of phosphogypsum @ 500 kg ha^{-1} at flower initiation were recorded significantly highest pod and haulm yields (21.4 and 37.6 q ha^{-1}) whereas haulm yield was on par with gypsum application @ 500 kg ha^{-1} at flower initiation. Lowest pod and haulm yields (17.9 and 34.4 q ha^{-1}) were recorded under Pg_3 (phosphogypsum @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation) treatment. Phosphogypsum application @ 500 kg ha^{-1} at flowering stage might have ensured adequate supply of calcium and sulphur, have favoured for obtaining good yield.

The results of the experiment clearly suggest that phosphogypsum is also efficient in increasing the pod and yield of groundnut similar to that of gypsum.

The higher pod and haulm yield with application of phosphogypsum @ 500 kg ha^{-1} might attributed for their favorable influence on the yield. As phosphogypsum has relatively low solubility as compared to highly soluble sulphur carriers, availability of sulphur is made for a longer period. These results are in close conformity with the findings of Surendra Singh and Singh (2016), Somnath Chattopaddhyay and Goutam Kumar Ghosh (2012), Rout and Jena (2009).

The interaction effect of moisture regimes and phosphogypsum levels on pod and haulm yields were presented in Table 1.a. and fig. 3.

Table.1 Yield and yield attributing characters of *rabi* groundnut as influenced by moisture regimes and phosphogypsum levels

TREATMENTS	YIELD ATTRIBUTES			Yield (kg ha^{-1})	
	No. of Pods Plant^{-1}	100 Kernel Weight (g)	Shelling %	Pod yield	Haulm Yield
MOISTURE REGIMES (I)					
I_1-0.6 IW/CPE	13.0	40.1	64.7	1742	3234
I_2-0.8 IW/CPE	13.7	41.0	68.0	2081	3719
I_3-1.0 IW/CPE	14.1	41.4	69.8	2147	3799
SEm±	0.1	0.2	0.8	18	28
CD (P=0.05)	0.5	0.8	3.2	73	109
PHOSPHOGYPSUM LEVELS (Pg)					
Pg_1-Gypsum @ 500 kg ha^{-1} at flower initiation	13.7	41.3	68.2	2060	3665
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	13.3	40.2	66.8	1958	3556
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	13.0	40.0	64.9	1795	3444
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	13.4	40.7	67.1	2001	3555
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	14.6	42.1	70.6	2136	3701
SEm±	0.1	0.4	0.8	20	55
CD (P=0.05)	0.4	1.0	2.4	59	161
INTERACTION (I x Pg)					
Sub treatments at same level of main treatments					
SEm±	0.3	0.5	1.9	41	62
CD (P=0.05)	0.8	NS	NS	36	287
Main treatments at same level of sub treatments					
SEm±	0.3	0.6	1.5	111	90
CD (P=0.05)	0.8	NS	NS	116	270

Table.1a Pod Yield and haulm yield (kg ha^{-1}) of *rabi* groundnut as influenced by interaction between moisture regimes and phosphogypsum levels

	Pod yield (kg ha^{-1})				Haulm yield (kg ha^{-1})			
PHOSPHOGYPSUM LEVELS	MOISTURE REGIMES			MEAN	MOISTURE REGIMES			MEAN
	I_1-0.6 IW/CPE	I_2-0.8 IW/CPE	I_3-1.0 IW/CPE		I_1-0.6 IW/CPE	I_2-0.8 IW/CPE	I_3-1.0 IW/CPE	
Pg_1-Gypsum @ 500 kg ha^{-1} at flower initiation	1820	2134	2224	2060	3351	3822	3821	3665
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	1634	2064	2175	1958	3046	3641	3982	3556
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	1560	1848	1978	1795	3262	3371	3698	3444
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	1788	2162	2054	2001	3100	3775	3789	3555
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	1908	2197	2303	2136	3411	3985	3706	3701
MEAN	1742	2081	2147	1990	3234	3719	3799	3584
Sub treatments at same level of main treatments								
SEm±				41				62
CD (P=0.05)				111				287
Main treatments at same level of sub treatments								
SEm±				36				90
CD (P=0.05)				116				270

Table.1b Number of pods $plant^{-1}$ and Oil content (%) of *rabi* groundnut as influenced by interaction between moisture regimes and phosphogypsum levels

	Number of pods $plant^{-1}$				Oil content			
PHOSPHOGYPSUM LEVELS	MOISTURE REGIMES			MEAN	MOISTURE REGIMES			MEAN
	I_1 (0.6 IW/CPE)	I_2 (0.8 IW/CPE)	I_3 (1.0 IW/CPE)		I_1 (0.6 IW/CPE)	I_2 (0.8 IW/CPE)	I_3 (1.0 IW/CPE)	
Pg_1-Gypsum@ 500 kg ha^{-1} at flower initiation	14.5	13.8	12.6	13.7	39.6	41.5	40.8	40.6
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	12.5	12.7	14.7	13.3	40.1	39.8	40.4	40.1
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	12.2	13.0	13.7	13.0	37.7	39.7	40	39.1
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	12.6	14.1	13.5	13.4	40.7	40.3	41.4	40.8
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	13.3	14.7	15.8	14.6	41.2	41.1	41.7	41.3
MEAN	13.0	13.7	14.1	13.6	39.8	40.5	40.8	40.4
Sub treatments at same level of main treatments								
SEm±				0.3				0.2
CD (P=0.05)				0.8				0.8
Main treatments at same or different level of sub treatments								
SEm±				0.3				0.3
CD (P=0.05)				0.8				0.8

Table.2 Oil content and Oil yield of *rabi* groundnut as influenced by moisture regimes and phosphogypsum levels

TREATMENTS	Oil content (%)	Oil Yield (kg ha^{-1})
MOISTURE REGIMES (I)		
I_1-0.6 IW/CPE	39.8	1131
I_2-0.8 IW/CPE	40.5	1417
I_3-1.0 IW/CPE	40.9	1500
SEm±	0.1	14.3
CD (P=0.05)	0.3	55.6
PHOSPHOGYPSUM LEVELS (Pg)		
Pg_1-Gypsum@ 500 kg ha^{-1} at flower initiation	40.6	1410
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	40.1	1315
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	39.1	1169
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	40.8	1345
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	41.3	1508
SEm±	0.2	20.8
CD (P=0.05)	0.5	60.8
INTERACTION (I x Pg)		
Sub treatment at same level of main treatment		
SEm±	0.2	31.9
CD (P=0.05)	0.8	NS
Main treatment at same or different level of sub treatment		
SEm±	0.3	35.3
CD (P=0.05)	0.8	NS

Table.3 Effect of moisture regimes and phosphogypsum levels on economics of *rabi* groundnut

TREATMENTS	Cost of cultivation (□ ha^{-1})	Gross returns (□ ha^{-1})	Net Returns (□ ha^{-1})	B:C ratio
MOISTURE REGIMES (I)				
I_1-0.6 IW/CPE	29462	59228	29767	2.0
I_2-0.8 IW/CPE	29709	70751	41042	2.4
I_3-1.0 IW/CPE	30080	72999	42909	2.4
SEm±	-	625	625	-
CD (P=0.05)	-	2442	2442	-
PHOSPHOGYPSUM LEVELS (Pg)				
Pg_1-Gypsum@ 500 kg ha^{-1} at flower initiation	300847	70022	39175	2.3
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	29104	66555	37451	2.3
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	29104	61036	31932	2.1
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	29848	68043	38195	2.3
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	29848	72624	42776	2.4
SEm±	-	690	690	-
CD (P=0.05)	-	2014	2014	-
INTERACTION (I x Pg)				
Sub treatment at same level of main treatment				
SEm±	-	1398	1398	-
CD (P=0.05)	-	3788	3788	-
Main treatment at same or different level of sub treatment				
SEm±	-	1238	1238	-
CD (P=0.05)	-	3926	3926	-

Cost of pods: Rs. 34 kg^{-1}

Table.3a Gross returns and Net Returns of *rabi* groundnut as influenced by interaction between moisture regimes and Phosphogypsum levels

	Gross returns (₹ ha^{-1})				Net Returns (₹ ha^{-1})			
PHOSPHOGYPSUM LEVELS	**MOISTURE REGIMES**			**MEAN**	**MOISTURE REGIMES**			**MEAN**
	I_1 (0.6 IW/CPE)	**I_2 (0.8 IW/CPE)**	**I_3 (1.0 IW/CPE)**		**I_1 (0.6 IW/CPE)**	**I_2 (0.8 IW/CPE)**	**I_3 (1.0 IW/CPE)**	
Pg_1-Gypsum @ 500 kg ha^{-1} at flower initiation	61894	72546	75628	70022	31334	41740	44451	39175
Pg_2-PG @ 250 kg ha^{-1} at flower initiation	55548	70187	73932	66555	26732	41124	44498	37451
Pg_3- PG @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation	53034	62819	67255	61036	24218	33756	37821	31932
Pg_4- PG @ 500 kg ha^{-1} ½ as basal and ½ at flower initiation	60807	73496	69826	68043	31247	43689	39650	38195
Pg_5- PG @ 500 kg ha^{-1} at flower initiation	64863	74707	78302	72624	35303	44900	48124	42776
MEAN	59228	70751	72999	67656	29767	41041	42909	37906
Sub treatment at same level of main treatment								
SEm±				1398				1398
CD (P=0.05)				3788				3788
Main treatment at same or different level of sub treatment								
SEm±				1238				1238
CD (P=0.05)				3926				3926

Fig.1 Effect of moisture regimes on pod yield and haulm yield (kg ha^{-1}) of *rabi* groundnut

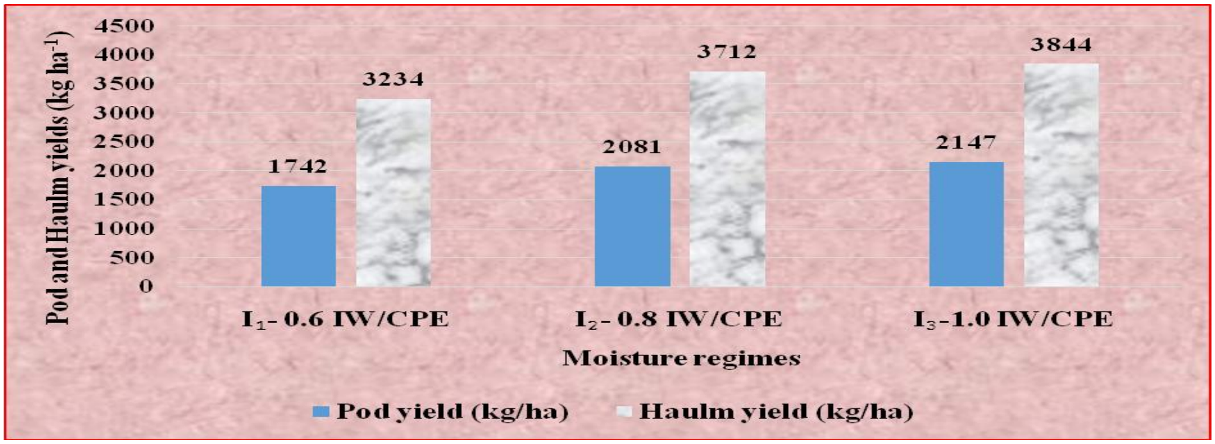


Fig.2 Effect of phosphogypsum levels on pod yield and haulm yield (kg ha^{-1}) of *rabi* groundnut

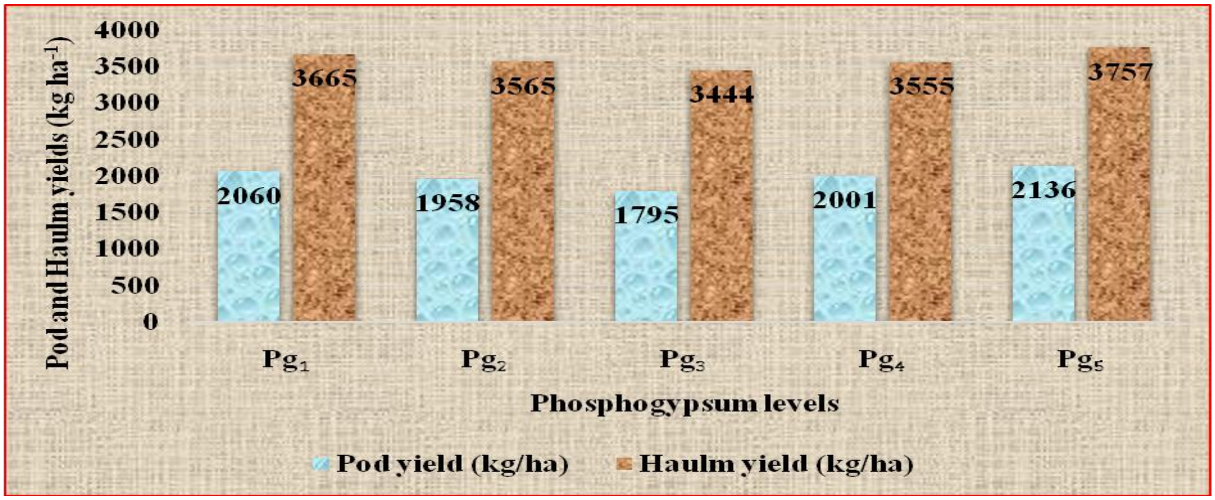
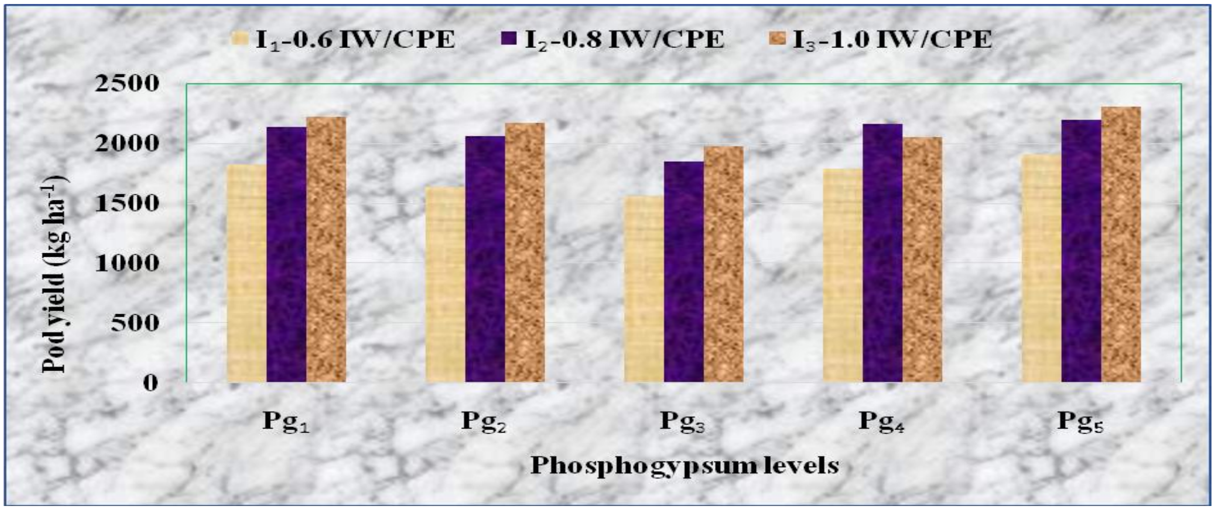


Fig.3 Interaction effect of moisture regimes and phosphogypsum levels on pod yield (kg ha^{-1})



The interaction effect between moisture regimes and phosphogypsum levels was significant on both the parameters and recorded significantly highest pod yield (23.03 q ha^{-1}) at interaction level I_3 Pg_5 (1.0 IW/CPE and phosphogypsum @ 500 kg ha^{-1} at flower initiation), which was on par with I_3Pg_1, I_2Pg_5, I_3Pg_2, I_2Pg_4, I_2Pg_1, I_3Pg_4 and I_2Pg_2. Lowest pod yield (15.6 q ha^{-1}) obtained at interaction level I_1Pg_3 (0.6 IW/CPE and phosphogypsum @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation). Similarly highest haulm yield (39.85 q ha^{-1}) obtained at interaction I_2Pg_5 followed by I_3Pg_2, I_2Pg_1 and I_3Pg_1 interactions respectively. Lowest haulm yield (30.46 q ha^{-1}) observed at I_1Pg_2 interaction.

The data pertaining to groundnut oil content and oil yield were presented in Table 2. Significantly the highest oil content and oil yield (40.9% and 1500 kg ha^{-1}) were obtained with moisture regimes at I_3 (1.0 IW/CPE) over other treatments, while lowest values (39.8% and 1131kg ha^{-1}) were recorded in I_1 (0.6 IW/CPE) treatment. These results were in close confirmity with the findings of Somnath Chattopaddhyay and Goutam Kumar Ghosh (2012), Patel *et al.*, (2009).

Among phosphogypsum levels, application of phosphogypsum @ 500 kg ha^{-1} at flower initiation was recorded highest oil content and oil yield (41.3% and 1508kg ha^{-1}) of groundnut, while oil content was on par with the gypsum application @ 500 kg ha^{-1} at flower initiation (Pg_1) but significantly superior than other treatments. The lowest oil content and oil yield (39.1% and 1169kg ha^{-1}) were obtained under Pg_3 (phosphogypsum 250 kg ha^{-1} ½ as basal and ½ at flower initiation) treatment. The interaction effect between moisture regimes and phosphogypsum levels was significant on oil content. Significantly highest oil content recorded with interaction level of phosphogypsum @ 500 kg ha^{-1} at flower initiation (Pg_5) irrespective levels of moisture regimes. Lowest oil content observed at interaction level I_1Pg_3 (Table 1.b). The increased oil content with phosphogypsum in groundnut might be associated with sulphur and calcium nutrition to groundnut. Sulphur is a constituent of protein and plays a pivotal role in oil synthesis. These results were in close confirmity with the findings of Patel *et al.*, (2009) and Patil *et al.*, (2003).

The data pertaining to groundnut economics was presented in Table 3. The economics of groundnut as influenced by moisture regimes and phosphogypsum levels revealed that highest gross returns (72999□ ha^{-1}), net returns (42909□ ha^{-1}) were recorded at I_3 (IW/CPE 1.0) irrigation level with five irrigations over other treatments. Whereas the highest B: C ratio (2.4) was recorded at irrigation level IW/CPE 1.0 and 0.8 (five and four irrigations). The minimum gross returns (59228□ ha^{-1}), net returns (29767□ ha^{-1}) and B: C ratio (2.0) was obtained under IW/CPE 0.6 moisture regime with three irrigations. This finding was in confirmity with Rathod and Trivedi (2011), Patel *et al.*, (2009), Raskar and Bhoi (2003).

Regarding the phosphogypsum levels, the maximum gross return (72624□ha^{-1}), net return (42776□ ha^{-1}) and B: C ratio (2.4) was recorded at phosphogypsum application @ 500 kg ha^{-1} at flower initiation (Pg_5) followed by Pg_1, $Pg_2$and Pg_4 treatments. This finding was in confirmity with Dash *et al.*, (2013), Patel *et al.*, (2009).

Interaction effect between moisture regimes and phosphogypsum on gross returns and net returns data (Table.3.a) indicated that the highest gross returns and net returns (□ ha^{-1} 78302 and 48124) recorded with interaction level I_3Pg_5 (1.0 IW/CPE ratio and phosphogypsum @ 500 kg ha^{-1} at flower initiation), which was on par with I_3Pg_1, I_2Pg_5 (gross returns) and I_2Pg_5, I_3Pg_2, I_3Pg_1 (net returns) respectively. Lowest gross returns and net returns recorded at interaction of I_1Pg_3 (0.6 IW/CPE and phosphogypsum @ 250 kg ha^{-1} ½ as basal and ½ at flower initiation).

It can be concluded from this study that for maximizing the production of groundnut, moisture regime at I_2 (0.8 IW/CPE) and phosphogypsum at 500 kg ha^{-1} at flower initiation can be recommended in semiarid climate of Andhra Pradesh.

Scheduling irrigation at I_3 (1.0 IW/CPE) and application of phosphogypsum @ 500 kg ha^{-1} at flower initiation recorded higher pod as well as haulm yield.

It is concluded from this study that irrigation with I_2 (0.8 IW/CPE) and application of phosphogypsum @ 500 kg ha^{-1} applied at flower initiation resulted in higher yield, quality and economic returns (B: C ratio 2.4) of *rabi* groundnut under semi- arid climate of Hyderabad.

The results of the experiment clearly suggest that phosphogypsum is also efficient in increasing the pod and haulm yield of groundnut similar to that of gypsum.

References

Bibhu Santosh behera, Mohit Das, Anama Charan Behera and Rudra Ashish behera 2015. Weather based irrigation scheduling in summer groundnut in Odisha condition. *International journal of Agricultural Science and Research*. 5(5): 247-260.

Biswas, P. P. and Sharma, P. D. 2008. Phosphogypsum a potential source of sulphur and calcium to crops. *Indian Journal of Fertilizers*. 4(8): 49-52.

Dash, A. K., Nayak, B. R., Panigrahy, N., Mohapatra, S. and Samant, P. K. 2013. Performance of groundnut (*Arachis hypogaea* L.) under different levels of sulphur and irrigation. *Indian Journal of Agronomy*. 58(4): 578-582.

Dey, J., Basu, T. K. and Bandyopadhyay, S. R. 2007. Effect of different levels of irrigation and sources of sulphur on nodulation and yield of groundnut. *Journal of Mycopathology Research*. 45(1): 73-75.

Giri, U., Paul, N., Giri, S., Bandyopadhyay, P. and Nanda M.K. 2017. Effect of sulphur and different irrigation regimes on PAR distribution, canopy temperature, yield and water use efficiency of Groundnut (*Arachis hypogaea* L.). *International journal of Agriculture, Environment and Biotechnology*. 10(2): 177-187.

Gosh, P. K., Hati, K. M., Mandal, K. G., Misra, A. K., Chaudhary, A. S. and Bandyopadhyay, K. K. 2000. Sulphur nutrition in oilseeds and oilseed-based cropping systems. *Fertiliser News.* 45(8): 27–40.

Panse, V. G. and Sukhatme, P. V. 1985. Statistical methods for agricultural workers. ICAR publication.

Patel, G. N., Patel, P. T., Patel, P. H., Patel, D. M., Patil, D. K. and Patil, R. M. 2009. Yield attributes, yield, quality and uptake of nutrients by *summer* groundnut, *Arachis hypogaea L*. as influenced by sources and levels of sulphur under varying irrigation schedules. *Journal of Oilseeds Research.* 26(2): 119-122.

Patil, S. S., Raut, P. D., Ingle, G. L. and Dongare, S. T. 2003. Effect of sulphur and magnesium on yield, nutrient uptake and quality of groundnut. *New Agriculturist*. 14 (1/2): 49-52.

Raskar, B. S. and Bhoi, P. G. 2003. Response of *summer* groundnut to irrigation regimes and mulching. *Indian Journal of Agronomy*. 48 (3): 210-213.

Rathod, A. B. and Trivedi, S. A. 2011. *Summer* groundnut crop performance and economics under drip irrigation at various water application levels. *National Conference on Recent Trends in Engineering & Technology*.

Rout, K. K. and Jena, D. 2009. Effect of phosphogypsum and its combined use with lime in acid soils of orissa on crop productivity, crop and soil quality. *Indian Journal of Fertilizers.* 5(5): 44-54.

Shaikh, A. A., Nimbalkar, C. A. and Jawale, S. M. 2004. Effect of irrigation scheduling and mulches on yield and yield contributing characters of *summer* groundnut. *Journal of Maharashtra Agricultural U niversity*. 29(2): 163-166.

Somnath Chattopaddhyay and Goutam kumar Ghosh. 2012. Response of rapeseed to various sources and levels of sulphur in red and lateritic soils of west Bengal, India. *International Journal of plant, Animal and Environmental sciences*. 2(4): 50-59.

Surendra singh and Singh, S.K. 2016. Use of indigenous sources of sulphur in soils of eastern India for higher crops yield and quality: A review. *Agricultural Reviews.* 37(2): 117-124.

Suresh, K., Balaguravaiah, D., Ramulu, V. and Sujani rao, C. H. 2013. Comparative efficiency of sprinkler irrigation over check basin irrigation in groundnut at different irrigation schedules. *International journal of plant, animal and environmental sciences.* 3(2): 9-13.

How to cite this article:

Naresha, R., P. Laxminarayana, K.B. Suneetha Devi and Sailaja, V. 2018. Quality, Yield and Economics of *Rabi* Groundnut as Influenced by Irrigation Scheduling and Phosphogypsum Levels. *Int.J.Curr.Microbiol.App.Sci.* 7(03): 3292-3303.
doi: https://doi.org/10.20546/ijcmas.2018.703.379