

Original Research Article

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Enhancing *Kharif* Groundnut (*Arachis hypogaea* L.) Yield and Quality through Foliar Nutrition

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ABSTRACT

A field experiment was conducted at Post Graduate Research Farm, College of Agriculture, Kolhapur during *Kharif* season of 2017-18 to study the effect of foliar nutrition of fertilizer on yield, nutrient uptake and quality of groundnut (*Arachis hypogaea* L.). The experiment was laid out in a randomized block design with three replications and seven treatments in which treatments comprised of seven treatments *viz*: absolute control, GRD, GRD+ water spray, GRD+19:19:19 spray (2 %), GRD+Ca(NO₃)₂ spray (2 %), GRD+Micro. gr.II (0.25 %) and GRD+Schoenite spray (1 %), respectively. The results revealed that foliar spray of Ca(NO₃)₂ 2 % at 45 and 60 DAS showed significant effect on yield and yield attributes of groundnut crop, along with quality. Significantly, highest dry pod, kernel and haulm yields (32.6, 22.36 and 39.1 q ha⁻¹, respectively) were recorded by foliar spray of 2 % Ca(NO₃)₂ and among other foliar spray, at par with the corresponding highest yields (29.9, 20.40 and 38.0 q ha⁻¹, respectively) were recorded with foliar spray of 2 % 19:19:19 and significantly superior over 0.25 % Micro. gr. II spray, 1 % Schoenite spray and water spray. Significantly, highest oil yield was recorded by 2 % Ca(NO₃)₂ spray (1016 kg ha⁻¹) and at par with 2 % 19:19:19 spray (924 kg ha⁻¹), respectively. While the oil content was non-significant. The shelling percentage ranged 67-69 % but the effect of various treatments on shelling percentage was non-significant.

Keywords

Groundnut (*Arachis hypogaea* L.),
Kharif, Foliar
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Introduction

Groundnut (*Arachis hypogaea* L.) is one of the important oilseed crops. India ranks 2nd in production after China with 33 per cent of world's total production.

It is the 13th most important food crop, 4th important source of vegetable oil and 3rd main source of vegetable protein in the world. As regards the nutritional value of groundnut, its seed contain high quality of edible oil about

48 %, easily digestible protein about 26 % with carbohydrates content of about 20 % (Singh and Basu 2004). In India, area under groundnut is 40.13 lakh ha, with the total production of 59.30 lakh tonnes and productivity of 1478 kg ha⁻¹ in *kharif* season during the year 2015-16 (Anonymus, 2016).

The lower yields and productivity are attributed to several production constraints, which include poor and imbalanced nutrition and cultivation on marginal lands. It is

therefore, necessary to improve the nutritional aspects so as to obtain better productivity. Although groundnut is a self-fertilizing crop on the other hand nevertheless, it is a very exhaustive crop as compared to other legumes (Varade and Urknde, 1982).

Foliar nutrition is one of the most efficient way of fertilizer application as it facilitates rapid nutrient uptake by penetrating through the leaf cuticle. It is 8-10 times more effective than soil application. It is known to stimulate the increase in chlorophyll production, cellular activity and respiration. It also triggers a plant response to increased water and nutrient uptake from the soil (Veeramani *et al.*, 2012). Foliar feeding could be useful in rainfed conditions when the fertilizers applied are subjected to different losses like runoff, leaching losses, fixation and unavailability of nutrients (Subrahmaniyan *et al.*, 2000, Veeramani *et al.*, 2012, Kabir *et al.*, 2013).

Foliar application of nutrients is feasible, economically viable and environmentally friendly approach of nutrient management. It is often the most effective and economical way to correct plant nutrient deficiencies at critical growth stages. Kene *et al.*, (1991) observed higher pod yield of groundnut with foliar application of phosphorus at flowering stage. Reports indicate that foliar application promoted root absorption of the same nutrient or other nutrients through improving root growth and increasing nutrients uptake (El-Fouly and El-Sayed, 1997). It also helps to maintain a nutrient balance within the plant, which may not occur with soil uptake (Meena *et al.*, 2007). It has the advantage of low application rates, uniform distribution of fertilizer materials and quick response to applied nutrients. Therefore, keeping the above facts in background, relative effect of different foliar sprays on yield and quality of *kharif* groundnut were studied in the present investigation.

Materials and Methods

The field experiment was conducted during *kharif* season of 2017-18 at Post Graduate Research Farm, College of Agriculture, Kolhapur (16⁰42' N latitude, 74⁰14' E longitude and 548 m AMSL) in sandy clay loam soil (57.90 % sand, 24.20 % silt and 17.90 % clay) containing available N (173 kg ha⁻¹), phosphorus (26.8 kg ha⁻¹), potassium (247 kg ha⁻¹), exchangeable calcium (20.8 cmol (p+) kg⁻¹), exchangeable magnesium (8.4 cmol (p+) kg⁻¹), available sulphur (10.9 mg kg⁻¹), available micronutrients Fe (4.92 mg kg⁻¹), Mn (3.19 mg kg⁻¹), Zn (1.10 mg kg⁻¹), Cu (2.04 mg kg⁻¹) and available boron (1.79 mg kg⁻¹). The status of organic carbon content (0.47 %) was moderate. The soil reaction was slightly alkaline (pH 7.67) and EC was normal (0.23 dS m⁻¹). The total rainfall received during the period of field experiment was 1056.50 mm in 63 rainy days. The relative humidity during the crop period was in the range of 83.57 to 92.28 per cent at morning and 36.28 to 83.28 at evening. The minimum temperature varied from 12.5⁰C to 22.81⁰C, while maximum temperature was in the range of 25.95⁰C to 34.10⁰C. The evaporation during experimentation ranges between 0.8 to 7.84 mm hr⁻¹. The experiment was laid out in the randomized block design. The treatments consisted of seven foliar spray *viz.*, absolute control, GRD, GRD+ water spray, GRD+19:19:19 spray (2 %), GRD+Ca(NO₃)₂ spray (2 %), GRD+Micro. gr.II (0.25 %) and GRD+Schoenite spray (1 %). The groundnut was sown on 28.06.2017 with a spacing 30 cm x 15 cm. After experimental layout FYM and gypsum was applied as per the treatments well in advance before dibbling of groundnut seeds and well mixed in surface soil. All the recommended dose of N and P₂O₅ (25:50 kg ha⁻¹) was applied to all treatments through Urea and Single Super Phosphate. Oil content was determined by Soxhlet Ether Extract method (A.O.A.C. 2016).

Results and Discussion

Effect on dry pod, kernel and haulm yield of groundnut

The yield of dry pod, kernel and haulm of groundnut were increased significantly with foliar nutrition and highest yields (32.6, 22.36 and 39.1 q ha⁻¹, respectively) were recorded by foliar spray of 2 % Ca(NO₃)₂ which was at par with 2 % 19:19:19 spray (29.9, 20.40 and 38.0 q ha⁻¹, respectively) and significantly superior over foliar spray of water, 0.25 % Micro. grade II and 1 % Schoenite spray (Table 1). The nutrient requirement of groundnut is high especially at pegging and pod development stages. Calcium (Ca) is required by groundnut plants from the time when pegs begin to appear, fruit formation, until the pods are mature (Walker 1975). Ca deficiency leads to high percentage of aborted seeds (empty pods), improperly filled pods (Ntare *et al.*, 2008) and causes of the aborted or shrivelled fruit, including darkened plumules and production of pods without seed (Singh and Oswalt 1995). Foliar feeding of major nutrients especially resulted in development and maintenance of more chlorophyll and photosynthetic area in terms of higher leaf area and leaf area index which resulted in higher photosynthesis. Increased photosynthates translocated to developing

Pods and resulted in development of sound and mature kernels. The results are in close conformity with the observations recorded by Patra *et al.*, (1995), Sarkar and Mallik (2009), Veerabhadrapa (2003) and Chandrasekaran *et al.*, (2008) and Hewitt (1983) who also reported response of groundnut to the applied foliar nutrition (Fig. 1).

Effect on yield attributes of groundnut

In general, the yield attributes *viz.*, number of filled and unfilled pods and shelling percentage were influenced by different foliar treatments. Significantly, highest number of filled pods plant⁻¹ (28.9) were recorded with application of 2 % Ca(NO₃)₂ and significantly lowest unfilled pods plant⁻¹ (5.76) were recorded with 2 % Ca(NO₃)₂ (Table 2). The results are in close proximity with the findings reported by Patra *et al.*, (1995) (Fig. 2).

The shelling percentage was not much more influenced by the different foliar treatments and it was found non-significant. The highest shelling percentage was recorded by foliar spray of 2 % Ca(NO₃)₂ (69 %) and lowest in absolute control (68 %) (Table 2). Similar findings have been reported by Patra *et al.*, (1995) for groundnut where foliar spray of 2 % Ca(NO₃)₂ recorded highest shelling % over absolute control.

Table.1 Dry pod, kernel and haulm yield of groundnut as influenced by different foliar treatments

Treatments	Dry pod yield (q ha ⁻¹)	Kernel yield (q ha ⁻¹)	Haulm yield (q ha ⁻¹)
T ₁ - Absolute control	17.2	11.63	31.6
T ₂ - GRD	22.6	15.40	33.0
T ₃ - GRD + Water spray	23.0	15.50	34.1
T ₄ - GRD + 19:19:19 spray of 2 %	29.9	20.40	38.0
T ₅ - GRD + Ca(NO ₃) ₂ spray of 2 %	32.6	22.36	39.1
T ₆ - GRD + Micro. grade II spray of 0.25 %	27.1	18.71	35.2
T ₇ - GRD + Schoenite spray of 1 %	25.0	17.07	34.5
S.E. ±	1.01	0.792	0.99
CD at 5 %	2.70	2.421	3.05

Table.2 Yield attributing characters of groundnut as influenced by different foliar treatments

Treatments	Filled pods (plant ⁻¹)	Unfilled pods (plant ⁻¹)	Shelling (%)
T ₁ - Absolute control	23.1	8.91	68
T ₂ - GRD	24.9	8.29	68
T ₃ - GRD + Water spray	26.0	7.65	67
T ₄ - GRD + 19:19:19 spray of 2 %	28.2	6.44	69
T ₅ - GRD + Ca(NO ₃) ₂ spray of 2 %	28.9	5.76	69
T ₆ - GRD + Micro. grade II spray of 0.25 %	27.4	7.12	69
T ₇ - GRD + Schoenite spray of 1 %	27.1	7.24	69
S.E. ±	1.14	0.386	3.5
CD at 5 %	3.52	1.158	NS

Table.3 Oil content and yield of groundnut as influenced by different foliar treatments

Treatments	Oil content (%)	Oil yield (kg ha ⁻¹)
T ₁ - Absolute control	44.9	523
T ₂ - GRD	45.0	694
T ₃ - GRD + Water spray	45.1	700
T ₄ - GRD + 19:19:19 spray of 2 %	45.2	924
T ₅ - GRD + Ca(NO ₃) ₂ spray of 2 %	45.4	1016
T ₆ - GRD + Micro. grade II spray of 0.25 %	45.7	844
T ₇ - GRD + Schoenite spray of 1 %	45.5	778
S.E. ±	2.15	39.8
CD at 5 %	NS	122.9

Fig.1 Effect of different foliar treatments on pod, kernel and haulm yields of groundnut

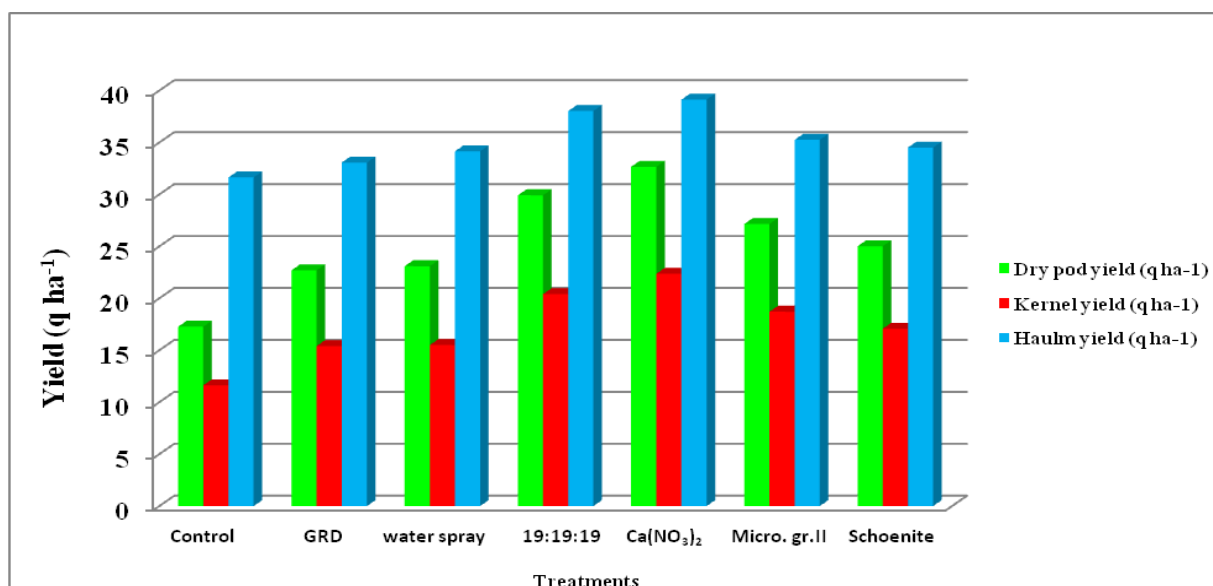


Fig.2 Effect of different foliar treatments on filled and unfilled pods plant⁻¹ of groundnut

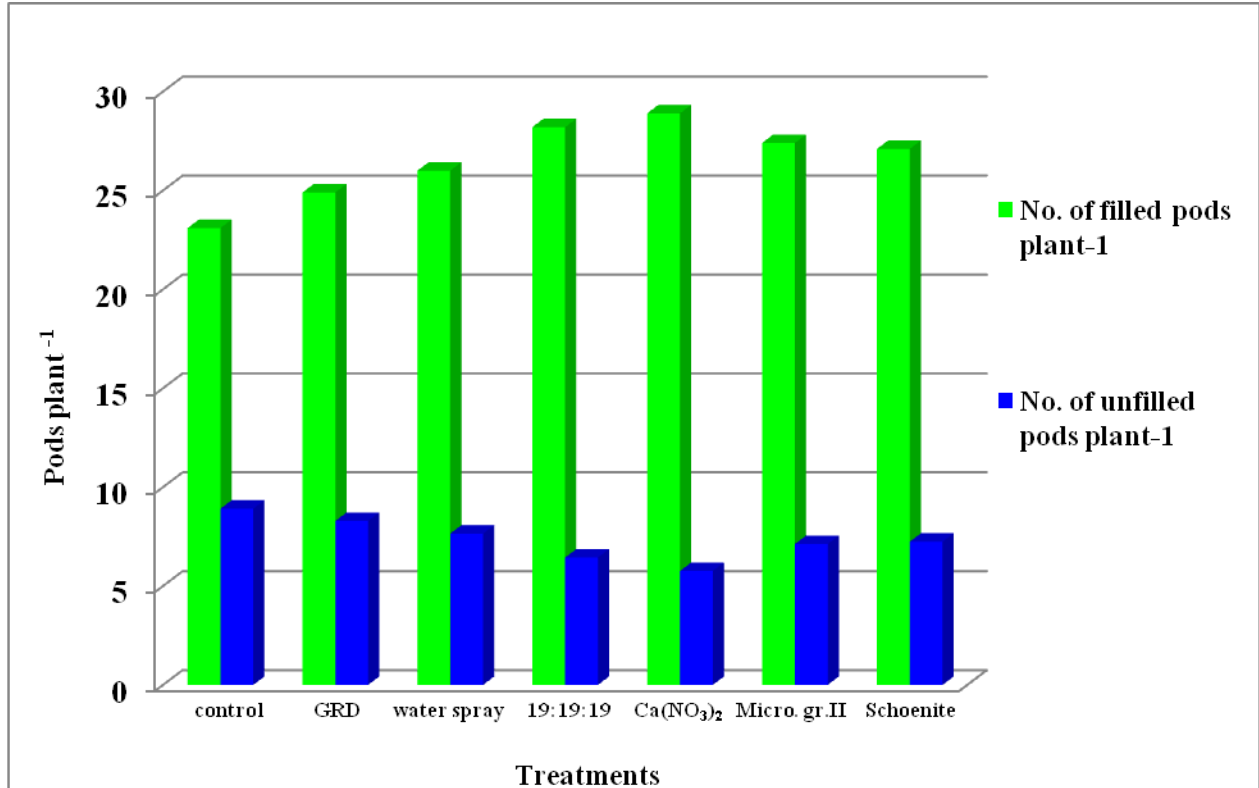


Fig.3 Effect of different foliar treatments on oil content (%) of groundnut

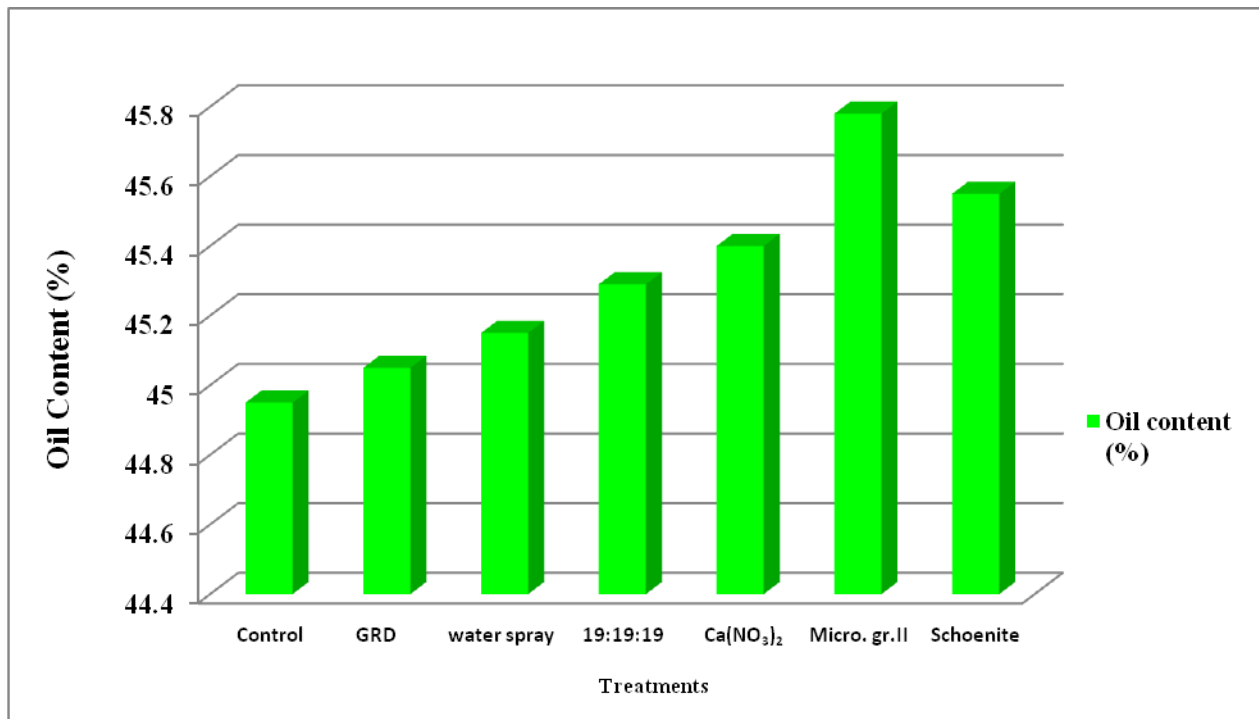
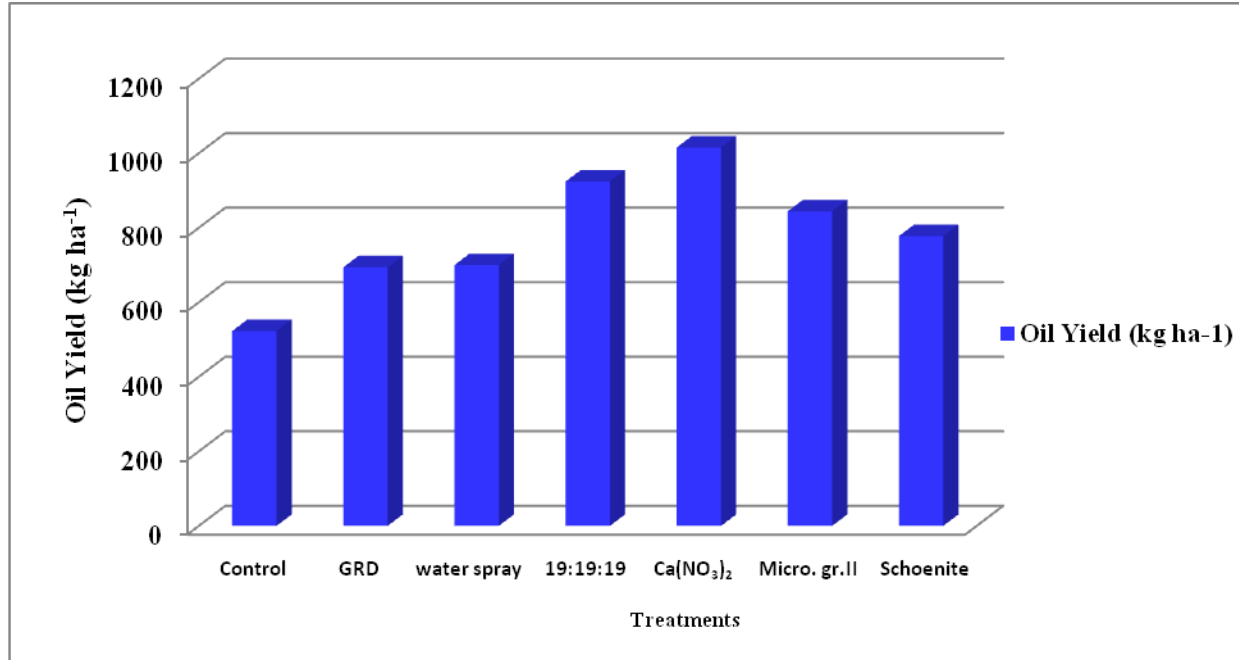


Fig.4 Effect of different foliar treatments on oil yield (kg ha⁻¹) of groundnut



Effect on oil content and oil yield of groundnut kernels

The oil content was not influenced by the different foliar treatments and it was found to be non-significant. The highest oil content was recorded in 0.25 % Micro. grade II spray (45.7 %) and lowest in absolute control (44.9 %) (Table 3). The oil yield was significantly influenced due to the application of different foliar spray treatments. Among the foliar treatments, highest oil yield (1016 kg ha⁻¹) was recorded by 2 % Ca(NO₃)₂ spray which was at par with 2 % 19:19:19 spray (924 kg ha⁻¹) and significantly superior over foliar sprays of water, 0.25 % Micro. grade II spray and 1 % Schoenite spray (Table 3). Similar results obtained by Tejeswara Rao and Subbaiah (2006), Nasef *et al.*, (2006), Galavi *et al.*, (2012), Shinde *et al.*, (2001) and Manasa (2013), who also reported response of oilseed crops to the applied foliar nutrition (Fig. 3 and 4).

The result from the present study revealed that, significantly highest pod, kernel and

haulm yield of groundnut were recorded with 2 % Ca(NO₃)₂ and at par with 2 % 19:19:19 and significantly superior over foliar spray of water, 0.25 % Micro. grade II spray and 1 % Schoenite spray. The nutrient requirement of groundnut is high especially at pegging and pod development stages. Because, calcium (Ca) is required by groundnut plants from the time when pegs begin to appear, fruit formation, until the pods are mature (Walker 1975). The highest oil content and oil yield was recorded by 2 % Ca(NO₃)₂ spray which was at par with 2 % 19:19:19 spray and significantly superior over foliar sprays of water, 0.25 % Micro. grade II spray and 1 % Schoenite spray.

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