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EFFECT OF FOLIAR NUTRITION ON YIELD, NUTRIENT CONTENT AND UPTAKE OF GROUNDNUT (*Arachis hypogaea* L.)

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ABSTRACT

An investigation was carried out at College Farm, College of Agriculture, Navsari Agricultural University, Bharuch during the *kharif* season of 2023 to study the effect of foliar nutrition on yield, nutrient content and uptake of groundnut (*Arachis hypogaea* L.) under rainfed condition. The experiment was conducted with nine treatments *viz*., T_1 : Control, T_2 : RDF 12.5-25-00 NPK kg ha^{-1}, T_3 : RDF + 2 % Panchagavya, T_4 : RDF + 2 % Cow urine, T_5 : RDF + 2 % Vermi bed wash, T_6 :RDF + 1 % Novel , T_7: RDF + 2 % Urea, T_8 : RDF + 1 % 19-19-19 and T_9 : RDF + Nano urea 2 ml lit^{-1} and tested in factorial randomized block design with three replications. The results revealed that an application of RDF (12.5-25-00 NPK kg ha^{-1}) + 2 % Panchagavya spraying at flowering and pegging stage recorded significantly higher seed and haulm yield, N, P and K content and uptake by seed and haulm of groundnut which was statistically at par with the application of RDF + 1% 19-19-19 and RDF + 1 % Novel.

(Key words: Groundnut, foliar nutrition, nutrient content, seed yield, haulm yield)

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an annual legume, which is also known as peanut, earthnut and monkey nut. Groundnut is known as poor man's almond. The groundnut kernels are a source of high-quality edible oil (44–56%), easily digestible protein (22–30%), carbohydrates (10–25%), vitamins (E, K, and B complex), minerals (Ca, P, Mg, Zn and Fe) and fiber (Variath and Janila, 2017). In Gujarat, total groundnut area, production and productivity were 1.76 million hectare, 4.53 MT and 2570 kg ha^{-1} respectively, during the year of 2022-23 (Anonymous, 2024). Foliar spray technique helps the nutrients to reach the site of food synthesis directly, leading to no wastage and quick supply of food and thereby reduce the requirement of fertilizers. It also credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating uptake of nutrients by the plant. Since foliar nutrients usually penetrate the leaf cuticle or stomata and enters the cell facilitating easy and rapid utilization of nutrients. Groundnut crops, which possess nitrogen-fixing capabilities through *rhizobium*, can benefit from inoculants that provide additional support for *rhizobium*, promoting optimal growth. Additionally, the utilization of nutrient-efficient products ensures that pulses receive the necessary nutrients for healthy development. Furthermore, organic solutions such as panchagavya, cow urine and vermi bed wash, have demonstrated promising effects on pulses crops by enhancing growth and yield parameters while reducing the dependency on excessive fertilizer application. Hence, the present study was conducted to the effect of foliar nutrition on yield, nutrient content and uptake of groundnut (*Arachis hypogaea* L.) under rainfed condition.

MATERIALS AND METHODS

A field experiment was carried out at College farm, College of Agriculture, Navsari Agricultural University, Campus Bharuch during *kharif* 2023. The soil of experimental plot was clayey (*Vertisols*) with low in available N (237 kg ha^{-1}), medium in P_2O_5 (34.2 kg ha^{-1}) and high in K_2O (325 kg ha^{-1}). The soil reaction (pH) was slightly alkaline (7.78). The experiment was conducted with nine treatments viz., T_1 : Control, T_2 : RDF 12.5-25-00 NPK kg ha^{-1}, T_3 : RDF + 2 % Panchagavya, T_4 : RDF + 2 % Cow urine, T_5 : RDF + 2 % Vermi bed wash, T_6 :RDF + 1 % Novel , T_7: RDF + 2 % Urea, T_8 : RDF + 1 % 19-19-19 and T_9 : RDF + Nano urea 2 ml lit^{-1}. These treatments were tested in factorial randomized block design with three replications. Foliar nutrition was applied at flowering and pegging stages of groundnut. The groundnut *var*. Gujarat GJG 22 was used for experimental purpose and sown on 5th July, 2023 at 45 cm x 10 cm spacing, by adopting the recommended seed rate 100 kg ha^{-1} and RDF (12.5-25-00 NPK kg ha^{-1}) given through urea and single super phosphate. The crop was harvested during 25th

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October 2023. Weeds were managed by herbicides and plant protection measures were taken up as and when required. The data on seed and haulm yield was recorded from the net plot and converted on a hectare basis. The nitrogen content in groundnut seed was estimated by micro Kjeldahl's method as described by Jackson (1979). Chemical studies about nitrogen, phosphorus, potassium content and their uptake by seed and haulm and available nitrogen, phosphorus, potassium status in the soil after harvest of the crop were determined as per different methods *viz*., Modified Kjeldahl's method (For N), Wet digestion (Diacid) Vanado molybdo phosphoric acid yellow colour method (for P) and Flame photometric method (for K) (Jackson,1979). The data were analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1985). The purpose of the analysis of variance was to determine the significant effect of treatments on groundnut. Uptake of nutrients by seed and plant was calculated by using following formula:

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient content (\%) x seed / haulm yield (kg ha}^{-1})}{100}$$

RESULTS AND DISCUSSION

Seed and haulm yield

The data given in Table 1 indicated that significantly the highest seed yield (1384 kg ha^{-1}) and haulm yield (2146 kg ha^{-1}) of groundnut was observed under treatment T_3 (RDF + 2 % Panchagavya) which was statistically at par with treatment T_8 (RDF + 1 % 19-19-19) and T_6 (RDF + 1 % Novel). On the other hand, significantly lowest seed yield (901 kg ha^{-1}) and haulm yield (1797 kg ha^{-1}) was noted with treatment T_1 (Control). The increase in seed yield with application of foliar nutrient treatments was mainly due to cumulative effect of significant increase in the growth and yield attributing component. The overall improvement in all the growth and yield attributing components might be due to adequate supply of nutrients with easy availability to plant at most critical growth period resulted into better growth and yield attributing characters. The better growth of crop ultimately diverted more energy under sink source relationship which helped in providing more yield. The present findings are in agreement with Vennila and Jayanthi (2008), Kulkarni *et al*. (2016), Mallick and Kar (2023) and Patel *et al*. (2022). Vennila and Jayanthi (2008) revealed that application of 100 per cent recommended dose of fertilizer along with panchagavya spray (2 %) significantly increased fruit yield q ha^{-1} of okra. Kulkarni *et al*. (2016) observed that foliar spray of Panchagavya (647 kg ha^{-1}) recorded significantly higher grain yield of green gram as compared to other treatments. However, it was at par with foliar spray of 19:19:19 (644.2 kg ha^{-1}). Mallick and Kar (2023) recorded significantly highest seed yield (2.77 t ha^{-1}) under foliar application of NPK 10:26:26 (42.05 % higher than control) followed by NPK 19:19:19 (40.51 % higher than control). Patel *et al*. (2022) revealed that application of different foliar sprays had significant differences on seed yield and haulm yield of green gram. Significantly higher seed yield (1352 kg ha^{-1}) and haulm yield (2280 kg ha^{-1}) was recorded under foliar spray of 2 % enriched banana pseudo stem sap along with recommended dose of fertilizer i.e. 20: 40: 00 N:P_2O_5:K_2O kg ha^{-1} which was statistically at par with 2 % urea foliar spray in seed yield (1286 kg ha^{-1}) and haulm yield (2153 kg ha^{-1}).

N, P and K content

The data given in Table 1 revealed that the N content in seed was not significantly influenced by different treatments. Numerically the highest N content (3.838 %) in seed was found in treatment T_3 (RDF + 2 % Panchagavya) while the lowest value of N content (3.400 %) obtained in treatment T_1 (Control). Application of 100 % RDF along with 2 % Panchagavya spraying was recorded significantly highest P content (0.599 %) and K content (0.268 %) of seed which was statistically at par with treatments T_8 (RDF + 1 % 19-19-19) and T_6 (RDF + 1 % Novel). N, P and K content in haulm significantly affected by different foliar nutrition treatments. Significantly higher N (0.1.713 %), P (0.273 %) and K (0.700 %) content in haulm was recorded by treatment T_3 (RDF + 2 % Panchagavya) followed by T_8 (RDF + 1 % 19-19-19) and T_6 (RDF + 1 % Novel) over control and rest of the treatments under study. Nutrient accumulation in plant is function of nutrient concentration and dry matter accumulation. Application of plant nutrient through foliar application increase supply of plant nutrient in available form hence might have increased accumulation of dry matter by affecting root system. Dry matter which accumulates in above ground parts favours translocation of more carbohydrate towards developing roots which in enhanced the root volume and concomitantly increased content of more plant nutrients. These findings are substantiated with those reported by Patel *et al*. (2021). They reported that 50 % RDF soil application + 2 % foliar spray of urea, urea phosphate and MOP at 30, 45 and 60 DAS recorded significantly higher N, P and K content in wheat grain (2.20, 0.390 and 0.344 %, respectively) and straw (0.738, 0.290 and 1.075 %, respectively) which was found at par with 50 % RDF soil application + 2 % foliar spray of soluble NPK (19:19:19) at 30, 45 and 60 DAS [N, P and K contents in grain (2.14, 0.378 and 0.334 %, respectively) and straw (0.698, 0.276 and 1.073%, respectively)].

N, P and K Uptake

The data given in Table 1 indicated that among the different foliar nutrition treatments, treatment T_3 (RDF + 2 % Panchagavya) recorded significantly highest total N uptake (95.60 kg ha^{-1}) which was statistically at par with treatments T_8 (RDF + 1 % 19-19-19) and T_6 (RDF + 1 % Novel) in respect of P and K uptake. Treatments T_4 (RDF + 2 % Cow urine), T_5 (RDF + 2 % Vermi bed wash), T_7 (RDF + 2 % Urea) and T_9 (RDF + Nano urea 2 ml l^{-1}) were also found significantly superior over control in respect of N, P and K uptake. Application of panchagavya along with RDF has always stimulated the uptake of nutrients partly because of stimulated microbes flush and improved root growth due

Table 1. Effect of foliar nutrition on yield, N, P and K content and uptake of groundnut

Treatments	Seed yield (kg ha^{-1}) ha^{-1})	Haulm yield (kg ha^{-1})	Content (%)						Total uptake (kg ha^{-1})			Available soil nutrients (kg ha^{-1})		
			Seed			Haulm								
			N	P	K	N	P	K	N	P	K	N	P_2O_5	K_2O
T_1: Control	901	1797	3.400	0.502	0.536	1.406	0.233	0.593	57.37	8.97	16.13	239.1	35.3	327.7
T_2: RDF (12.5-25-00 NPK kg ha^{-1})	943	1947	3.797	0.523	0.545	1.501	0.240	0.611	66.29	9.76	17.60	241.9	38.7	337.8
T_3: RDF + 2 % Panchagavya	1384	2620	3.838	0.599	0.628	1.713	0.273	0.700	95.60	15.06	26.10	277.2	42.5	349.9
T_4: RDF +2 % Cow urine	1155	2146	3.818	0.547	0.566	1.574	0.248	0.641	80.21	12.01	21.31	251.7	41.5	343.4
T_5: RDF + 2 % Vermi bed wash	1151	2141	3.810	0.537	0.561	1.559	0.246	0.639	79.18	11.78	21.01	250.6	41.3	339.5
T_6: RDF + 1 % Novel	1223	2437	3.824	0.577	0.587	1.689	0.264	0.657	86.76	13.30	22.97	256.8	41.7	344.9
T_7: RDF + 2 % Urea	1076	2129	3.800	0.531	0.554	1.559	0.245	0.637	74.66	11.01	19.76	245.6	40.7	339.5
T_8: RDF + 1 % 19-19-19	1249	2557	3.831	0.591	0.593	1.701	0.269	0.673	89.36	13.94	24.08	273.9	41.7	348.4
T_9: RDF + Nano Urea (2 ml lit^{-1})	1065	2003	3.793	0.525	0.553	1.549	0.241	0.631	72.32	10.63	19.02	243.6	39.4	338.4
SE m ±	70.9	156.1	0.11	0.02	0.02	0.04	0.01	0.02	2.91	0.51	1.01	8.31	1.26	8.85
CD (p=0.05)	212	467.0	-	0.06	0.06	0.12	0.03	0.06	8.71	1.52	3.03	24.91	-	-

to congenial soil physical condition. Biofertilizer inoculations increase the numbers of such microorganisms in soil or rhizosphere and consequently improve the extent of microbiologically fixed nitrogen for plant growth. They are used either to fix nitrogen or to solubilize plant nutrients like phosphate. Phosphate solubilizing micro-organism (PSM) solubilizes the unavailable bound phosphate of the soil and makes them available to plants which increase overall plant growth. These results are in accordance with Patel *et al.* (2021). They found that 50 % RDF soil application + 2 % foliar spray of urea, urea phosphate and MOP at 30, 45 and 60 DAS recorded significantly higher uptake of N, P and K (140.46, 33.69 and 75.15 kg ha^{-1}, respectively) followed by 50 % RDF soil application + 2 % foliar spray of soluble NPK (19:19:19) at 30, 45 and 60 DAS (131.64, 31.48, 72.43 kg ha^{-1}, respectively) in wheat.

Available soil nutrient status

The mean data pertaining to available N, available P_2O_5 and available K_2O status after the harvest of groundnut are presented in Table 1. Significantly higher available N (277.2 kg ha^{-1}) after harvest of crop was recorded in treatment T_3 (RDF + 2 % Panchagavya) which was at par with T_8 (RDF + 1 % 19-19-19) and T_6 (RDF + 1 % Novel). However, data regarding available P_2O_5 and K_2O were found non-significant due to different foliar nutrition, but numerically higher available P_2O_5 (42.50 kg ha^{-1}) and K_2O (349.86 kg ha^{-1}) recorded in treatment T_3 (RDF + 2 % Panchagavya). This might be due to the additional nitrogen supplied through foliar application of panchagavya and novel can stimulate the growth of groundnut plants, leading to increased root biomass and root nodulation. This can enhance the biological nitrogen fixation (BNF) process, further increasing the nitrogen content in the soil. Similar results were also obtained by Patel *et al*. (2022), Vijayakumari *et al*. (2012), Aher *et al*. (2019) and Kulkarni *et al*. (2024). Patel *et al*. (2022) reported that foliar spray of 2 % enriched banana pseudostem sap increased available N, P_2O_5 and K_2O. Vijayakumari *et al*. (2012) observed the higher N (88 kg ha^{-1}), P (8.6 kg ha^{-1}) and K (325 kg ha^{-1}) content of post harvested soil of soybean with the application of panchagavya 10 %+ humic acid 2 % + micro herbal fertilizer 10 g pot^{-1} treated soil. At the time of soybean harvesting Aher *et al*. (2019) recorded higher available N (114.5 and 116.5 kg ha^{-1}) and P (16.8 and 17.1 kg ha^{-1}) with the application of organic manure on nitrogen equivalent basis + foliar spray of 3 % Panchagavya and organic manure on nitrogen equivalent basis + Biodynamic preparation (BD 500 (Cow horn manure) as soil application @ 75 g ha^{-1} + BD 501 (Cow Horn Silica) as foliar application @ 2.5 g ha^{-1}) + foliar spray of 3 % Panchagavya, respectively. Kulkarni *et al*. (2024) obtained highest available values of nitrogen, phosphate and potassium (196.54, 21.11 and 281.69 kg ha^{-1}) with the application of 100% GRDF + 2 foliar sprays of 1% 19:19:19 and seed treatment of *Rhizobium*, PSB and KSB liquid forms but it was found at par with 100% GRDF + 2 foliar sprays of 1% 19:19:19 and seed treatment of *Rhizobium*, PSB and KSB solid form and 100% GRDF + 2 foliar sprays of 2% DAP and seed treatment of *Rhizobium*, PSB and KSB liquid form and also with 100% GRDF + 2 foliar sprays of 2 % DAP and seed treatment of *Rhizobium*, PSB and KSB solid form in case of N and P in soybean crop.

From the results of one year experimentation, it can be inferred that groundnut crop should be sprayed with 2 % Panchagavya or 1 % 19-19-19 or 1 % Novel at flowering and pegging stage with the application of 12.5-25-00 NPK kg ha^{-1} for getting higher yield and nutrient uptake.

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