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Effect of foliar nutrition on productivity of groundnut crop

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Abstract
A field experiment was conducted at Agricultural Research Station, Kawadimatti, Karnataka during rabi/summer 2013 and 2014 to study the effect of foliar nutrition on productivity of Groundnut crop. There are nine treatments which were sprayed with different foliar nutrients at 50% flowering and 15 days after the first spray viz, 2% DAP, 2%Urea, 3% Panchagavya, 10% vermiwash, 1% 19:19:19, 1% Multi-nutrient spray, 10% cow urine, 3% Biomax spray, 2% K_2O these nine treatments were supplied with recommended dose of fertilizers, and one treatment was supplied only with RDF without the supplementation of foliar nutrition which was consider as check. Results of the experiment revealed that among the treatments foliar nutrition with 1% 19:19:19 supplied treatment recorded significantly higher pod yield (2874, 2521 and and 2698 kgs/ha) which was on par with treatment receiving 3% Biomax spray, 1% multi-nutrient spray and 10% cow urine spray. The higher pod yield in these treatments might be due to significantly higher pod weight and test weight in these treatments. Significantly lower pod yield was recorded in treatment with 2% DAP which may be owing to its scorching effect on the groundnut crop. The net return and B: C ratio was significantly higher in treatment with 1% 19:19:19 (57514, 73757 and 65636, 2.82, 3.30 and 3.06 respectively) and 3% Biomax spray (57030, 61929 and 59480 and 2.80, 2.92 and 2.86 respectively). In general the treatments with foliar nutrition enhanced the yield and return of groundnut crop except the treatment with 2% DAP which adversely affected both growth and yield of groundnut contributing significantly lower yield and economics over check (treatment with only RDF)

Keywords: Groundnut, foliar nutrition, yield and economics.

Introduction
Groundnut is an important oilseed crop which is grown around the globe for its nutritional and trade values. It is a major source of vegetable oil and protein both for human beings and animals. It is also consumed as a confectionary product. The cake can be used for manufacturing artificial fiber. The haulms are fed to livestock. Groundnut shell is used as fuel for manufacturing coarse boards, cork substitutes. Groundnut is also valued as a rotation crop. Being a legume with a root nodule it can synthesis with atmospheric nitrogen and thereby improve soil fertility. It is an important multipurpose crop for resource less poor farmers in the semi-arid tropics.

The major groundnut producing countries in the world are India, China, Nigeria, Senegal, Sudan, Burma and the United States of America. In which India occupies the first place both in regard to the area and the production. In India groundnut is an important oil, food and forage crop cultivated on 7.5 million hectares with an annual production of 8 million tons and millions of people depend on its cultivation for their livelihood.

As such this crop has to play a major role in bridging the vegetable oil gap in the country. But the current average yield level is very low as compared to what is being obtained in most of the groundnut growing countries. It is grown around the globe but as a result of diverse farming situations there is a large variation in the productivity levels of groundnut around the world. In countries such as USA where it is grown on large farms with assured inputs productivity levels are very high in comparison to the country such as India where the crop is traditionally grown by small holding farmers using local varieties in marginal lands with low inputs, inadequate fertilization and poor plant protection all these factors have jointly contributed to low and unstable yields of groundnut crop in India.

Since oilseeds are energy-rich crops the requirement of major nutrients as well as secondary and micronutrients is very high. The nutrient removal varies considerably, depending upon crop productivity and soil fertility (Hegde, 2000). Though groundnut is called as a self-fertilizing crop, it is very exhaustive compared to other legumes as very little portion of the plant is left in the soil after harvesting (Varade and Urkude, 1982). Among the nutrients nitrogen, phosphorus, potassium, calcium and sulphur plays an important role in the nutrition

of groundnut crop. Soil application of fertilizer leads to losses of nutrients in the form of leaching, volatilization and fixation affecting the nutrient use efficiency. Hence crop frequently suffers by the nutrient deficiency which is one of the major factors responsible for low yield in groundnut. India is the world's largest producer of groundnut where nutritional disorders cause yield reduction from 30-70 percent depending on soil types. Hence correction of these nutrition deficiencies or bridging the gap of nutrient requirement of crop has to be take care for enhancing the productivity of groundnut crop which intern help our country to avoid shortage of edible oils and large scale imports at the expense of huge foreign exchange.

Hence, an effort has been made to increase the crop yield through foliar application of fertilizer along with recommended dose of fertilizers.

Foliar feeding is often the most effective and economical way to correct plant nutrient deficiencies or bridging the gap of crop nutrient requirement. During the last decades, foliar feeding of nutrients has become an established procedure in crop production to increase yield and improve the quality of crop products (Roemheld and El-Fouly 1999). Foliar application of nutrients could improve the nutrient utilization and lower environmental pollution through reducing the amounts of fertilizers added to soil (Abou-El-Nour 2002). Foliar feeding of nutrient might have actually promoted root absorption of the same nutrient or other nutrients through improving root growth and increasing nutrients uptake (El-Fouly and El-Sayed, 1997).

Materials and methods

A field experiment was conducted at Agricultural Research Station, Kawadimatti, Yadgiri (District) Karnataka during two successive rabi/sumer 2013 and 2014. The soil was red sandy loam with normal soil reaction (P^H 7.53) and electrical conductivity (E_C 0.14), low in organic carbon percent (0.3) and available N (142 kg/ha), medium in available P_2O_5 (51 kg/ha) and K_2O (120 kg/ha).

The experiment was laid out in Randomized complete block design replicated thrice comprised of ten treatments, out of which nine treatments were supplied recommended dose of fertilizers along with foliar nutrients viz.T_1-2% DAP spray, T_2-2% urea spray, T_3-3% panchagavya spray, T_4-10% vermiwash spray, T_5-1% 19:19:19 spray, T_6-1% multi-nutrient spray, T_7-10% cow urine spray, T_8-3% biomass spray and T9-2% K_2O spray. Treatment T_{10} with only RDF without foliar spray was considered as control. The experiment crop was sown in the month of September during both the year. The variety used was TMV-2. The crop was sown in lines of 30cm apart. Recommended fertilizer (25:75:25 kgs of N: P_2O_5: K_2O) were supplied in the farm of urea, DAP, MOP as in 2 splits. Further zinc sulphate @ 25kgs/ha were applied to soil along with FYM before sowing for all the treatments. Gypsum @ 500 kgs/ha was also applied to all the treatments at the time of sowing. Pre-emergent herbicide pendimethalin was sprayed on the day of sowing @ 700 g a. i. /ha and two intercultivation operations were carried out to keep the crop weed free condition. Commercially available DAP, Urea, K_2O, commercially available growth promoters viz, Biomax and Multinutrient and water soluble fertilizer 19:19:19, Vermiwash, freshly collected cow urine were used for foliar spraying whereas panchagavya was prepared as per the procedure and used as foliar spray. Two foliar supplementation was given when the crop attains at 50% flowering and 15 days after the first spray. The crop was kept free from major incidence of insect posts and diseases.

Results and Discussions

Foliar application of nutrients significantly and positively influenced the growth and yield of the crop.

Result Two years of data and pooled data (Table-1) on the growth parameters revealed that though there is no significant difference among the treatments foliar nutrition's helped in numerical improvement in different growth components. Higher plant height (cm) was recorded in treatment receiving RDF + 1% 19:19:19 (32.8, 29.7 and 31.3cm respectively) and it was on par with all the foliar nutrition receiving treatments. Lower plant height was noticed in treatment with 2% DAP spray because it has scorching effect on leaf, which reduced the photosynthetic area available to the plant. The increase in the plant height in all the foliar nutrition treatments except 2% DAP was due to increased cell division and cell elongation at higher level of nutrients. The pronounced effect of water soluble fertilizers on plant height have also reported by Vivek kumar singhal *et al*. (2015) and Venkatesh and Basu (2011). Similarly there was no significant differences were found among the treatments but total dry matter accumulation but it was recorded higher in treatment with T_5-RDF + 1% 19:19:19 (35.7,31.5 and 33.6 gms/pl respectively) and treatments with other foliar supplementations were shown numerical improvement in dry matter accumulation except treatment with 2% DAP. The improvement in TDM (gms/pl) may be due to the instant assimilation of nutrients supplied through the foliar application meeting the required nutrient demand of the crop. Better availability and uptake of nutrients could be assigned as the proper reason behind the significant increase in dry matter production and its accumulation in foliar spray treatments. Similar observations were made by Dalei *et al*. (2014)

The data on the yield parameters have shown significant differences among the treatments. Significantly higher pod weight per plant was recorded in T_5: RDF + 1% 19:19:19 (15.8, 14.8 and 15.3gms/pl) during both the year and in pooled data over treatment with only RDF and also the treatment receiving 2% DAP spray. Similar results were also noticed in kernel weight (gm) and test weight, wherein treatment receiving 1% 19:19:19 foliar spray recorded significantly higher kernel weight (100,97.6 and 98.8 respectively) and test weight (123.7, 121.5 and 122.6 respectively) over T_1: RDF + 2% DAP (71.3, 67.5 and 69.4 respectively) and T_{10}: control (75.3, 69.9 and 72.6 97.3, 92.7 and 95.0 respectively) and it was on par with rest of the treatments receiving different foliar nutrients. Improved kernel weight and test weight under foliar treatments was mainly because of increased translocation of photosynthates from leaves and stem to developing pods resulted in sound mature pods and bolder seeds. And might be due to foliar feeding maintains the leaf area for longer duration which extends period of photosynthates translocation to developing seeds and hence helps in recording bolder and well-shaped seeds (Vinodkumar *et al.* 2016)

Significantly higher pod yield was recorded in treatment receiving RDF + 1% 19:19:19 (2874, 2521 and 2698 kg/ha) followed by RDF + 3% Biomax spray (2861, 2241 and 2551 kg/ha). These were on par with treatment with 1% multinutrient, 10% cow urine and significantly superior over RDF with 2% DAP [1596, 1387 and 1492 kgs/ha] and RDF without foliar nutrition (1806, 1708 and 1757 kgs/ha).Since 19:19:19 water soluble fertilizer has all the macronutrient might have helped in showing higher yield compare to other

foliar feeding treatments. The increase in yield might be due to easy assimilation of nutrients and balance in NPK ratio which affects the crop productivity. The spraying of water soluble nutrients increases the uptake of nutrients and water, resulting in more photosynthates and enhanced food accumulation in economical parts (Phandis, 2010). Similar findings were found in agreement with Rahman *et al*. (2014). Whereas adverse effect of DAP has resulted in reduced pod yield of Groundnut even over control (treatment with RDF alone). The maximum improvement in grain and biological yield with all the foliar sources might be associated with increased yield attributes due to concomitant increase in drymatter accumulation (Kumawat *et al.* 2009,)

Treatments with all the foliar feeding of nutrients (except 2% DAP) helped in achieving increased yield of groundnut over RDF alone. The superiority of foliar nutrition might be due to coincidence of foliar application with peak nutrition requirement of the crop as a supplementation to soil application. The quantity of nutrients absorbed by roots at peak period of nutrient requirement may not be sufficient to meet the needs at pod development stage. Supplementing nutrients through foliage might have resulted in better nutrient balance in the plants leading to increased yield components. Economic benefits ultimately matters for farmers. Results on economic parameters (Table-2) revealed that significantly higher gross return was noticed in treatment with 1% 19:19:19 (Rs. 89096, 105882 and 97489 respectively) and it was on par with treatment receiving 1% multinutrient, 10% cow urine and 3% Biomax spray and significantly superior over rest of the treatments. Similarly net return and B: C ratio were significantly super in treatments receiving 1% 19:19:19 (57514, 73577, 65636, and 2.82, 3.30, 3.06 respectively) followed by 3% Biomax spray (57030, 61,929, 59480 and 2.80, 2.92 and 2.86) and these were significantly superior over rest of the treatments. The results clearly announced that the use of water soluble fertilizers (19:19:19) increased the yield and thereby gave remunerative return to the grower. Similar views in the direction of present findings were also expressed by Premsekhar and Rajshree (2009). Significantly lower net return and B: C ratio was noticed in 2% DAP spray.

Conclusions

Groundnut is energy rich crop and hence the requirement of major nutrients as well as secondary and micronutrients is very high. Foliar feeding is often the most effective and economical way to meet the nutrient demand of the crop at critical stage. From this investigation it can be inferred that water soluble fertilizer 1% 19:19:19 along with recommended dose of fertilizers performed better in enhancing the groundnut productivity. And in general all the foliar nutrients except 2% DAP along with recommended dose of fertilizers improved the growth and yield parameters intern the economics of the groundnut production.

Table 1: Effect of Foliar Nutrition on Growth and Yield Parameters of Groundnut Crop

Sl.No	Treatment Details	Pl. height at harvest (cm)			TDM/Plant (gms/pl)			Number of Pods/Plant			Wt of pods/Plant (gms/pl)			Kernal weight (gms)			Test weight (gms)		
		2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	RDF +2% DAP spray	28.5	24.1	26.3	22.3	18.4	20.4	11.5	11.2	11.3	11.4	10.8	11.1	71.3	67.5	69.4	87.0	84.7	85.8
T_2	RDF +2% Urea spray	27.6	25.3	26.5	26.1	22.6	24.3	12.6	11.5	12.1	14.3	12.6	13.4	99.5	81.2	90.4	118.3	113.0	115.7
T_3	RDF +3% Panchagavya spray	29.1	28.1	28.6	30.9	28.1	29.5	12.7	10.8	11.8	15.7	12.9	14.3	87.3	82.0	84.7	111.0	107.4	109.2
T_4	RDF +10% Vermiwash spray	28.3	27.5	27.9	31.1	28.9	30.0	12.3	11.4	11.9	15.7	13.2	14.4	90.3	88.4	89.4	118.0	115.2	116.6
T_5	RDF +1% 19:19:19 spray	32.8	29.7	31.3	35.7	31.5	33.6	11.5	12.8	12.1	15.8	14.8	15.3	100.0	97.6	98.8	123.7	121.5	122.6
T_6	RDF +1% Multinutrient spray	31.8	28.5	30.2	31.7	29.7	30.7	12.3	12.2	12.3	14.3	14.2	14.3	96.0	92.8	94.4	117.7	115.0	116.3
T_7	RDF +10% Cow urine spray	29.7	27.6	28.6	27.5	25.5	26.5	11.5	10.9	11.2	14.0	13.8	13.9	84.0	81.7	82.9	106.0	102.1	104.1
T_8	RDF +3% Biomax spray	29.1	29.1	29.1	32.3	30.2	31.2	12.1	12.5	12.3	16.4	14.6	15.5	84.7	96.8	90.7	103.7	113.8	108.7
T_9	RDF +2% K20 spray	25.3	24.5	24.9	28.5	24.6	26.5	13.6	12.1	12.9	14.5	13.9	14.2	85.0	82.3	83.7	110.3	108.5	109.4
T_{10}	Control	25.9	23.7	24.8	23.1	19.2	21.1	11.5	11.5	11.5	11.6	11.2	11.4	75.3	69.9	72.6	97.3	92.7	95.0
CD @ 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	3.160	2.557	2.761	18.052	18.522	17.340	21.066	21.416	20.518
CV		11.884	12.433	12.284	12.516	12.844	12.214	12.971	12.619	12.725	12.832	11.282	11.660	12.045	12.859	11.797	11.239	11.623	11.031

Table 2: Effect of Foliar Nutrition on Yield and Economics of Groundnut Crop

Sl.No	Treatment Details	Pod yield/ha (Kgs/ha)			Haulm Yield (Kgs/ha)			Gross Return (Rs./ha)			Net Return (Rs/ha)			B:C Ratio		
		2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	RDF +2% DAP spray	1596	1387	1492	1889	1908	1898	49485	58268	53877	18273	26513	22393	1.59	1.83	1.71
T_2	RDF +2% Urea spray	2009	1733	1871	2287	2054	2171	62287	72800	67544	31289	41259	36274	2.01	2.31	2.16
T_3	RDF +3% Panchagavya spray	2287	1881	2084	2500	2105	2303	7089	79002	74950	39126	46687	42907	2.23	2.44	2.34
T_4	RDF +10% Vermiwash spray	2370	1960	2165	2583	2184	2384	73484	82334	77909	42372	50679	46525	2.36	2.60	2.48
T_5	RDF +1% 19:19:19 spray	2874	2521	2698	3083	2522	2803	89096	105882	97489	57514	73757	65636	2.82	3.30	3.06
T_6	RDF +1% Multinutrient spray	2787	2128	2458	2750	2230	2490	86397	89390	87894	54335	56785	55560	2.69	2.74	2.72
T_7	RDF +10% Cow urine spray	2722	1949	2336	2778	2041	2410	84388	81858	83123	53276	50203	51739	2.71	2.59	2.65
T_8	RDF +3% Biomax spray	2861	2241	2551	2944	2322	2633	88694	94136	91415	57030	61929	59480	2.80	2.92	2.86
T_9	RDF +2% K20 spray	2167	1803	1985	2750	2087	2419	67167	75726	71446	36067	44083	40075	2.16	2.39	2.28
T_{10}	Control	1806	1708	1757	2296	2129	2212	55972	71730	63851	25400	41005	33203	1.83	2.33	2.08
CD @ 5%		497.150	420.792	451.017	562.88	412.67	511.9	15410	18369	16079	8901	10788	9743	0.492	0.559	0.513
CV		12.346	12.701	12.289	12.688	11.303	12.65	12.341	13.206	12.189	12.511	12.757	12.518	12.340	12.725	12.292

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