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Dixithgouda
Department Crop Physiology, College of Agriculture, UAS, Raichur, Karnataka, India

Dhanoji MM
Department Crop Physiology, College of Agriculture, UAS, Raichur, Karnataka, India

MK Meena
Department Crop Physiology, College of Agriculture, UAS, Raichur, Karnataka, India

Suma TC
Department Crop Physiology, College of Agriculture, UAS, Raichur, Karnataka, India

Hasan Khan
Department of Genetics and Plant Breeding, College of Agriculture, UAS, Raichur, Karnataka, India

Corresponding Author:
Dixithgouda
Department Crop Physiology, College of Agriculture, UAS, Raichur, Karnataka, India

Influence of foliar organic nutrition on morphological, yield and yield components of groundnut (*Arachis hypogaea* L.)

Dixithgouda, Dhanoji MM, MK Meena, Suma TC and Hasan Khan

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Abstract
A field experiment was conducted during *kharif* 2017 at Agricultural College Farm, University of Agricultural Sciences, Raichur, Karnataka to study the influence of foliar organic nutrition on growth and yield of groundnut. The experiment was laid out in randomized complete block design with 3 replications. The experiment treatments comprised of 9 organic extracts *viz.* Vermi compost extract (1:10), FYM extract (1:10), Neem cake extract (1:10), Cow dung extract (1:10), Pongamia cake extract (1:10), Panchagavya at 3%, Jeevamrutha at 3%, Panchamrutha at 3%, Humic acid at 0.004%, Water spray and one inorganic treatment Pulse magic at 2%, and a absolute control. The results indicated significant improvement in plant height, number of branches, total dry matter accumulation, leaf area, oil content, protein contentt, number of pods per plant, test weight, shelling per cent and yield per hectare with foliar application of panchagavya at 3 per cent as compared other organic treatments and control. However, pulse magic at 2 per cent spray showed statistically higher values as compared to panchagavya at 3 per cent.

Keywords: Organic solutions, panchagavya, pulse magic, morphological traits, yield

Introduction
Groundnut (*Arachis hypogaea* L.) also called "king of oil seeds" is the most important oilseed crop. In Karnataka, groundnut is cultivated in all the three seasons. However the productivity of ground nut in Hyderbad –karnataka region is lower than (610 kg $^{ha-1}$) the world average yield (1486 kg $^{ha-1}$) and the national average (821 $^{ha-1}$) One of the reasons for low productivity of groundnut in HK region is poor and imbalanced nutrition of the crop. This can be addressed through proper foliar nutrition in addition to the soil application of fertilizers. Foliar feeding can be 8 to 20 times as efficient as the soil application, because the leaf is a very efficient organ of absorption. This notion is based on the belief that foliar fertilization causes the plant to pump more root exudates into the rhizosphere resulting in increased availability of nutrients, disease-suppressive biochemicals, vitamins, and other factors beneficial to the plant.
On the other hand, the use of chemical fertilizers and manures, to enhance soil fertility and crop productivity has often negatively affected the complex system of the biogeochemical cycles. Further, high input practices, such as heavy use of chemical fertilizers, have given rise to many economic, environmental and social problems. Peasants are becoming increasingly dependent on off-farm supplies, which require cash and may not always be available on time. To overcome all these problems the next best alternative is organic farming.
The soil application of organic manures alone cannot full fill the nutrient requirement of crops. Hence, for an additional supply of nutrients, there is a need to develop liquid organic fertilizers which can supply adequate nutrients at the critical stage of the crop as well as have insecticidal or fungicidal properties. Recently, compost tea and extracts of soluble organic materials are easily homemade and can be foliar sprayed such as include panchamrutha, panchagavya, jeevamrutha, vermicompost, cow dung, farm yard manure, manure teas, molasses, milk, B vitamins, and herbal extracts of plants *viz.* neem and pongamia. With this background, a field experiment was planned to find out the appropriate liquid organic fertilizer to increase the growth and yield of groundnut crop.

Material and Methods

The experiment was conducted at Agricultural College Farm, University of Agricultural Sciences, Raichur, during *kharif* 2017 to study the influence of different locally prepared organic agrochemicals on growth and yield attributes and yield of groundnut. The experiment was laid out in a randomized complete block design with 3 replications The groundnut variety was kadari- 9 was raised as per package of practice and the treatments were imposed at grand growth stage (25 DAS) and pegging stage (45 DAS) of the crop. There were 12 treatments comprising: T_1: Vermi compost extract (1:10), T_2: FYM extract (1:10), T_3: Neem cake extract (1:10), T_4: Cow dung extract (1:10), T_5: Pongamia cake extract (1:10), T_6: Panchagavya at 3%, T_7: Jeevamrutha at 3%, T_8: Panchamrutha at 3%, T_9: Humic acid at 0.004%, T_{10}: Pulse magic at 2%, T_{11}: Water spray and T_{12}: Control.

Panchagavya is a blend prepared by mixing five products of cow and used in traditional Indian rituals. The three direct constituents are cow dung, cow urine, and cow milk and other two derived products are curd and ghee. 7 kg of Cow dung and 1kg ghee was mixed in a clean container on the first day thoroughly both in morning and evening hours and kept aside for 3 days. On the 4th day, 10 *l* cow urine and 10 *l* water were added to the above mixture. The mixture was stirred twice in a day and allowed to ferment for 15 days. On the 19th day, 3 *l* cow milk, 2 *l* cow milk curd, 3 *l* tender coconut water, 3kg jaggery and 12 numbers of well ripened poovan banana were also added to the mixture and mixed well both in the morning and evening hours. This was allowed to ferment for 7 more days (Ramya *et al.*, 2016) [6].

Jeevamruta is prepared by blending cow dung 1 kg, cow urine 1 *l*, jiggery 3kg, garden soil 500 g, gram flour 200 g in a container and 10 liters of water was added to the container. The contents were kept in shade and stirred twice in a day (morning and evening). After a week the jeevamrutha stock solution was ready (Ramya *et al.*, 2016) [6].

Panchamrutha is a similar mixture that of panchagavya but it replaces cow dung and urine with honey and sugar. 500 g ripe banana pulp was to be taken in a container and mixed with 500 ml cow milk, 100 g pure honey, 100 g pure ghee and 250 g sugar candy. These ingredients are beaten well to make a pulpy mixture. Thus, the panchamrutha stock solution was prepared. (Pushpangadan *et al.*, 1989) [5]. Extracts of Vermi compost, FYM, Neem cake, Cow dung and Pongamia cake were prepared by blending 3 kg of extract material with water at the ratio of 1: 10 (w/v). Then the mixture was stirred daily and filtrated after 5 days. One litre of the extract was diluted by water with 1:10 ratio and used for spray (El-Ghamry 2009) [3].

The observations of morphological traits were recorded at 90 DAS. The following parameters were recorded under morphological traits *viz.*, plant height, number of branches, leaf area were recorded at 90 DAS, The total dry matter and its partitioning into leaf, stem dry and pod dry weight., The kernel yield and yield components *viz.*, oil per cent, protein per cent, number of pods per plant, test weight, shelling per cent and yield per hectare were recorded at harvesting.

Results and Discussion

Significantly higher plant height (22.3cm) and branches per plant (6) was recorded with Panchagavya @ 3% spray over control (14.1cm and 4). However it is on par with pulse magic spray (23.4 cm and 6). The increase in plant height and number of branches might be due to the fact that organic formulation panchagavya is rich source of beneficial microorganisms and contains growth promoting substances such as auxins, gibberelins and cytokinin apart from macro and micro nutrients. These growth promoting factors might have stimuli in the plant system and in turn increased the production of growth regulator in the cell system favoring cell division and elongation. Higher response is also due to the fact that nutrient composition of panchagavya was high as compared to other organic extracts. Amalraj *et al.* (2013) [1]. The leaf area provides a fair idea of the photosynthetic capacity of the crop. Leaf area is positively related to number of branches as well as number of leaves and it was seen higher in panchagavya at 3 per cent (9.19 dm^2 $plant^{-1}$) treated plants than the control plants (8.43 dm^2 $plant^{-1}$). The increased leaf area might be due to increased number of leaves coupled with increased branching. Similarly, in groundnut Kumar *et al.* (2012) [4] reported invariably bigger size of leaves and denser canopy in panchagavya sprayed treatment.

The dry matter produced is an indication of overall efficiency of the utilization of resources and better light interception. The data pertaining to the total dry matter and its partitioning (leaf, stem and pods) indicated that dry matter was greatly influenced by foliar spray of organic extracts. Irrespective of the treatments, there is an improvement in leaf dry weight, stem dry weight, pod dry weight and total dry matter production as compared to control and is more so with panchagavya spray @ 3 per cent spray. However, improvement in the dry matter production may be due to the assimilation of nutrients supplied through the foliar application particularly at flowering period which enables the crop to meet the required nutrient demand because flowering stage of crop is characterized by more demand of nutrients for sink development. Foliar application of panchagavya might has enhanced assimilation, translocation and metabolizion of nutrients there by photosynthetic rates. A sound source in terms of plant height, leaf area and leaf weight are logically able to increase the dry matter and its distribution in different parts is important for determination of total yield of the crop. The results are in accordance with Kumar *et al.* (2012) [4].

The yield and yield attributing parameters are given in the Table 2. Among various organic treatments, panchagavya @ 3 per cent spray enhanced oil (45.32%) and protein (27.19%) content as compared to control (42.77% & 24.18%). However, pulse magic 2 per cent spray is numerically higher oil (46.19%) and protein (28.05%) content over panchagavya. It is known fact that, Sulphur promotes the biosynthesis of oil in oilseed crops. Organic extracts particularly Panchagavya possess sufficient amount of secondary and micronutrients, besides the major nutrients. Thus, the large quantities of sulphur present in panchagavya would have manifested in higher oil content in groundnut seeds. The reason for higher protein may be due to more availability of nutrients particularly nitrogen which is an integral part of protein. The reason for higher protein content may also be due to the application of fermented panchagavya which contributed to higher NPK content, thereby favouring the highest protein content in the kernels. Similarly increased oil content by Rao *et al.* (2013) [7] and protein content by Choudhary *et al.* (2018) [2]. Was noticed in groundnut due to foliar spray of panchagavya.

Significantly higher kernel yield was recorded by panchagavya 3% spray over control and was on par with pulse magic 2% spray. Increase in the grain yield with panchagavya 3% spray may be attributed to increased yield attributing parameters, particularly test weight of kernels, more pods per plant and higher shelling percentage. Thus it indicates

improvement in sink capacity and sink size. This was possible because of improvement in vegetative sink viz; plant height, total dry matter accumulation and its partition into pods. Further, the data also indicates the improvement in source viz leaf area and leaf weight. Thus, it seems optimum source and sink might be the reason for realizing potential yield where in Panchagavya seems to be a source for nutrients and growth promoting substances resulted in balanced source –sink relation there by higher yield. In Conclusions panchagavya may be used in place inorganic chemicals to realize potential yield in groundnut**.**

Table 1: Influence of different organic solutions on morphological characters at 90 days after sowing in groundnut

Treatment	Plant height (cm)	Number of branches plant^{-1}	Leaf area (dm^2 plant^{-1})	Leaf dry weight (g plant^{-1})	Stem dry weight (g plant^{-1})	Dry pod weight (g plant^{-1})	Total dry weight (g plant^{-1})
T_1 – Vermicompost extract (1:10)	21.4	6	11.73	7.20	5.51	11.82	18.3
T_2 – Farm yard manure extract (1:10)	20.2	5	11.15	6.74	5.26	11.51	17.28
T_3 – Neem cake extract (1:10)	18.9	5	10.83	6.42	4.83	10.79	16.1
T_4 – Cow dung extract (1:10)	20.7	5	11.46	6.96	5.46	11.18	17.51
T_5 – Pongamia cake extract (1:10)	19.3	5	10.91	6.51	4.98	11.16	16.57
T_6 – Panchagavya @ 3%	22.3	6	12.61	7.84	6.14	13.34	20.54
T_7 – Jeevamrutha @ 3%	21.7	6	12.09	7.48	5.77	12.42	19.22
T_8 – Panchamrutha @ 3%	18.3	5	10.25	5.92	4.65	10.21	15.09
T_9 – Humic acid @ 0.004%	18.5	5	10.69	6.26	4.75	10.73	15.82
T_{10} – Pulse magic @ 2%	23.4	6	12.95	8.11	6.41	14.37	21.67
T_{11} – Water spray	17.8	5	10.10	5.69	3.98	9.56	13.78
T_{12} – Control	17.7	5	10.08	5.61	3.63	8.89	12.98
Mean	20.0	5.33	11.24	6.73	5.11	11.33	17.07
S.Em (±)	0.69	0.11	0.21	0.26	0.27	0.80	0.86
C.D at 5%	2.03	0.33	0.58	0.75	0.79	2.36	2.51

Table 2: Influence of different organic solutions on yield and yield characters of groundnut

Treatment	Seed oil content (%)	Seed protein content (%)	No. of pods (plant^{-1})	Test weight (100 kernel g)	Shelling percentage (%)	Kernel Yield (kg ha^{-1})
T_1 – Vermicompost extract (1:10)	44.55	26.64	17.46	36.63	76.40	2374
T_2 – Farm yard manure extract (1:10)	44.26	26.03	16.62	36.23	75.2	2358
T_3 – Neem cake extract (1:10)	43.50	25.31	16.10	33.53	73.93	2241
T_4 – Cow dung extract (1:10)	44.49	26.39	17.03	35.54	75.07	2321
T_5 – Pongamia cake extract (1:10)	43.81	25.82	16.58	34.42	73.70	2289
T_6 – Panchagavya @ 3%	45.32	27.19	19.36	40.08	79.36	2445
T_7 – Jeevamrutha @ 3%	45.08	26.98	18.22	39.11	78.15	2395
T_8 – Panchamrutha @ 3%	43.30	24.85	15.36	32.23	72.44	2154
T_9 – Humic acid @ 0.004%	43.37	25.10	15.99	33.02	74.01	2194
T_{10} – Pulse magic @ 2%	46.19	28.05	20.73	37.58	76.56	2478
T_{11} – Water spray	43.15	24.31	14.50	31.11	70.09	2098
T_{12} – Control	42.77	24.18	13.64	30.48	69.64	2042
Mean	46.68	25.90	16.80	34.99	74.55	2282
S.Em (±)	0.91	0.52	1.08	1.10	0.97	33.96
C.D at 5%	1.88	1.52	3.16	3.23	2.85	99.60

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