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Influence of foliar organic nutrition on growth, yield and yield components of sunflower

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Abstract
A field experiment was conducted in Agricultural College Farm, University of Agricultural Sciences, Raichur, Karnataka during *Kharif*- 2017, to study the influence of organic foliar nutrition on growth and yield of sunflower,- hybrid KBSH-44. The experiment was laid out in a randomized complete block design with twelve treatments and was replicated thrice. The sources for organic nutrition were Vermicompost extract (1:10), FYM extract (1:10), Neem cake extract (1:10), Cow dung extract (1:10), Pongamia cake extract (1:10), Panchagavya @ 3%, Jeevamruta @ 3%, Panchamruta @ 3%, Humic acid @ 4ppm and were compared with in organic Boron @ 0.1%, Water spray and Control. Among the organic nutrients spray treatments, the significant increase in the seed yield was observed with Panchagavya @ 3% followed by Jeevamruta @ 3% and it may be attributed to the improvement in the morphological and yield traits viz;, plant height, number of leaves, total dry matter accumulation, leaf area, head diameter, achene filling percentage, test weight and seed yield per plant. However, Boron @ 0.1% recorded numerically higher yield over Panchagavya @ 3% spray.

Keywords: Boron, jeevamruth, panchagavya, sunflower, humic acid, organic

Introduction
Sunflower (*Helianthus annuus* L.) is one of the principal oilseed crops and is well suitable for varied cropping pattern. It is a photoperiod insensitive plant and can be grown in all the three seasons. The global productivity of sunflower is higher (1.73 t ha^{-1}) compared to India (0.736 t ha^{-1}) and Karnataka (0.458 t ha^{-1}) (Anon., 2017-18). One of the reasons for low productivity is attributed to poor seed setting which is largely governed by pollinators and balanced plant nutrition. Further, this crop is considered to be heavy feeder and removes lot nutrients from soil as this crop fixes 2.5 times more energy than cereals and legumes. Hence from the point of providing balanced nutrition to this crop, a proper and effective and efficient foliar nutrition seems to be beneficial 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. In the modern chemical agriculture, 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. There fore an additional supply of nutrients can be made possible through foliar nutrition depending the demand and crop stage. Presently, 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, and herbal extracts of plants. The advantage of liquid organic manure is that they disperse in water and it is rapidly absorbed by plants when compared to solid organic fertilizers and interestingly plant can absorb nutrients about 20 times faster through the leaves than applied through the soil, helping in overcoming acute nutrient shortages in the crops, more so with immobile nutrients. Further the usage of fermented liquid organic fertilizers and beneficial microorganisms(PGPRS) as foliar fertilizers have been introduced in modern agriculture in addition to the soil application of the organics to produce food with good quality and safety (Galindo *et al.*, 2007). Organic liquid fermented manures seems to be good source of essential nutrients, vitamins, essential amino acids and growth promoting substances like

IAA, GA and beneficial microorganisms (Sreenivasa *et al*, 2009) [9]. With this background, a field experiment was planned to find out the appropriate liquid organic fertilizer to increase the growth and yield of sunflower.

Material and Methods

A field experiment was conducted at Agricultural College Farm, University of Agricultural Sciences, Raichur, during *kharif* 2017 to study the response of sunflower to foliar spray of liquid organic fertilizer. The experiment was laid out in a randomized complete block design with 3 replications having 12 treatments in a medium black soil. The sunflower hybrid KBSH-44 was raised as per package of practices published by UAS Raichur. The different treatments were imposed at (grand growth stage) 40 DAS and (ray floret stage) 60 DAS. The 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), fermented organic extracts viz;; Panchagavya (3%), Jeevamrutha (3%), Panchamrutha (3%), commercial grade Humic acid (4 ppm) and results were compared with inorganic nutrient, Boron (0.1%) spray, normal water spray and control ie without spray.

Panchagavya and Jeevamruta were prepared as per Ramya *et al.*, (2016) [8] Panchamrutha is a similar mixture that of panchagavya but it replaces cow dung and urine with honey and sugar. ripe banana pulp and was prepared as per (Pushpangadan *et al.*, (1989) [7]. Extracts of Vermi compost, FYM, Neem cake, Cow dung and Pongamia cake were prepared by taking three 3 kg of respective material and blending with water in a ratio of 1: 10 (w/v). Then the mixture was turned 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 morphological traits were recorded at 75 DAS *viz.*, plant height, number of leaves, total dry matter accumulation, its partitioning, leaf area while, yield components *viz.*,oil per cent, protein per cent, number of seeds per head, test weight, head diameter and yield per hectare were recorded at physiological maturity stage of the crop.

Table 1: Influence liquid organic manures spray on morphological and growth parameters on sunflower

Treatment	Plant height (cm)	Number of leaves	Leaf area (dm^2 $plant^{-1}$)	Leaf dry weight (g $plant^{-1}$)	Stem dry weight (g $plant^{-1}$)	Head dry weight (g $plant^{-1}$)	Total dry weight (g $plant^{-1}$)
T_1 - Vermicompost extract @ 10%	164.2	20.9	59.24	34.34	64.48	25.17	124.00
T_2– FYM extract @ 10%	168.1	20.7	56.09	32.14	60.33	23.55	116.03
T_3 - Neem cake extract @ 10%	171	21.4	57.89	32.05	59.89	23.75	115.70
T_4 - Cow dung extract @ 10%	166.2	21.1	58.71	33.84	63.52	24.80	122.17
T_5 - Pongamia cake extract @ 10%	167.1	21.4	57.70	32.05	60.16	23.48	115.70
T_6 - Panchagavya @ 3%	186.3	23.0	62.82	35.60	66.84	26.07	128.52
T_7 - Panchamruta @ 1%	156.8	19.5	52.12	30.28	56.86	22.19	109.34
T_8 - Jeevamruth @ 3%	178.2	22.9	61.24	34.96	65.63	25.62	126.22
T_9 - Humic acid @ 4 ppm	165.7	21.1	57.30	31.93	59.95	23.40	115.2
T_{10} –Boron @ 0.1%	165.5	19.3	55.44	31.15	58.48	22.83	112.47
T_{11} - Water spray	159.7	19.2	52.38	30.84	57.90	22.60	111.36
T_{12}– Control	147.1	18.8	52.10	28.24	52.86	20.86	101.98
Mean	166.33	20.8	56.91	32.28	60.58	23.69	116.57
S. Em ±	5.62	0.58	1.29	0.52	0.99	0.39	1.91
CD at 5%	16.5	1.72	3.78	1.55	2.92	1.16	5.60

Table 2: Influence of liquid organic manures spray on yield and yieldtraitsof sunflower

Treatment	Head diameter (cm)	Achene filling percentage (%)	Harvest index (%)	Test weight (g)	Seed yield per plant (g $plant^{-1}$)	Yield (kg ha^{-1})
T_1 - Vermicompost extract @ 10%	26.10	81.85	29.67	5.44	30.80	1662
T_2– FYM extract @ 10%	23.53	79.98	27.31	5.20	28.40	1638
T_3 - Neem cake extract @ 10%	23.50	76.36	25.74	5.20	28.15	1602
T_4 - Cow dung extract @ 10%	23.90	78.47	28.69	5.28	29.76	1649
T_5 - Pongamia cake extract @ 10%	25.93	77.98	27.98	5.34	29.91	1655
T_6 - Panchagavya @ 3%	28.43	85.52	31.50	5.78	31.21	1707
T_7 - Panchamruta @ 1%	22.93	77.85	25.96	4.96	27.29	1510
T_8 - Jeevamruth @ 3%	26.67	84.83	30.94	5.73	31.01	1693
T_9 - Humic acid @ 4 ppm	23.27	78.43	27.58	4.98	27.38	1518
T_{10} –Boron @ 0.1%	23.60	86.57	33.55	5.91	32.59	1729
T_{11} - Water spray	22.80	74.47	25.59	4.93	26.88	1481
T_{12}– Control	21.53	76.64	23.99	4.92	26.58	1480
Mean	24.35	79.91	28.21	5.30	29.16	1610
S. Em ±	1.09	1.46	0.64	0.13	0.54	24.19
CD at 5%	3.20	4.30	1.88	0.40	1.61	70.95

Results and Discussion

Significantly higher plant height (186.3 cm), number of leaves (23), and leaf area (62.82dm^2 $plant^{-1}$), Total dry matter accumulation (128.52 g $plant^{-1}$), leaf dry matter (35.6 g $plant^{-1}$) and stem dry matter (66.84 g $plant^{-1}$) recorded by Panchagavya 3% spray over control (147.1cm, 18.8,,52.1 dm^2 $plant^{-1}$., 101.98 g $plant^{-1}$,28.24 g $plant^{-1}$ and 52.86 g $plant^{-1}$)) The increase in plant height might be due to the fact that panchagavya is rich source of essential and beneficial nutrients and growth promoting substances such as auxins, gibberelins and cytokinin which causes the cell elongation cell division (Meena *et al.*,2012) [6], further increase in Ieaf

area might be due to increased number of leaves and increased size of the leaf (Hladni *et al.*, 2006) [4]. Thus the greater leaf area enabled to intercept more light thereby increasing dry matter production (Kumawat, 2009) [5]. Iintrestingly, higher partition of dry matter into leaf and stem indicates the optimum source- sink relations. This might be due balanced nutrition, persistence of photosynthetic capacity of the plant and its translocation resulted from foliar spray of Panchagavya 3% which rich source of nutrient and PGRs. However, Panchagavya 3% spray numerically differ with inorganic Boron @ 0.1% spray.

Significantly higher yield (1,707 kg ha^{-1}) was obtained with Panchagavya @ 3% over other organic treatments. However it was numerically inferior to Boron 0.1%. The yield is manifestation of the assimilatory surface of the plant and improvement in the yield may be because of supply of required amount of photosynthates to developing heads and was evident from increased head diameter (28.43 cm), number of filled seeds per plant (615), decreased number of unfilled seeds (109), and higher test weight (5.78 g $100seeds^{1}$) with foliar spray of panchagavya and jeevamrutha. Then again, increase in seed yield per plant might be due to adequate supply of nutrients and growth regulators through Panchagavya contributing to higher seed yield per plant. It might be also due to balanced nutritional environment, efficient and greater partitioning of metabolites and adequate translocation of nutrients towards reproductive site. The timely supply of nutrients and growth stimulants to plants through foliar spray of optimum dose of panchagavya might be the reason for enhancement in yield attributes. Increase in test weight of the panchagavya treated plants was due to nutrients induced enhancement in photosynthetic activity coupled with improved source and these resulted in the translocation of photosynthates and amino acids from the leaves to the head. (Abilash (2016) [1] in sunflower and was evident from increase in the total and filled number of grains per head of plants with panchagavya @ 3% spray that foliar organic extract of panchagavya at 3 per cent is more effective as compared to other organic extracts for better performance in sunflower. Thus, panchagavya at 3 per cent can be used as organic substitute for Boron at 0.1%.

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