International Journal of Agriculture and Allied Sciences, 6(1): 1-4, 2021

EFFECT OF FOLIAR APPLICATION OF HUMIC ACID ON GROWTH AND YIELD OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)

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Received March24,2021 accepted June15, 2021

ABSTRACT: A field experiment was conducted for *Rabi*-2019 at the research farm, Department of Soil Science and Agricultural Chemistry, COA, Latur, to study the effect of foliar application of humic acid on soil nutrient dynamics, yield and quality of sunflower. The variety LSFH-171 was used. The result indicated that the yield and quality of sunflower were significantly influenced by different treatments. However, yield and yield attributes and quality of sunflower were significantly influenced by the application of 125 % RDF + 0.2 % humic acid at 30, 45 and 60 DAS (T12) while the lowest yield and quality of sunflower were recorded with treatment 75 % RDF (T1).

KEYWORDS: Humic acid, RDF, growth, yield and Sunflower

Sunflower (*Helianthus annuus* L.) is one of the most important oilseeds that contribute considerably to edible oil with an intermediate water requirement. It plays a key role in tackling the country's edible oils shortages due to its short duration, photo-insensitivity, wider adaptability to different agroclimatic regions, and soil types, sunflower gets a lot of popularity among the oilseed crop.

Foliar application of humic substances stimulates plant growth and consequently yield and quality by acting on different mechanisms such as cell respiration, membrane permeability, photosynthesis, protein synthesis, water, nutrient uptake and enzyme activities (Nardi *et al*. 2002). The presence of humic acid raises the plant nitrogen content. Humic acid is especially important because of its ability to chelate micronutrients increasing their bio- availability to plant growth. They are also indirectly involved in the improvement of soil properties such as aggregation, aeration, permeability, the capacity of water holding, serves as an effective adsorption and retention complex for inorganic plant nutrients and thereby enhance the micronutrients transport, uptake and availability (Tan, 2003) and it exhibits auxin-like effects.

MATERIAL AND METHODS

A field experiment was conducted during *Rabi*- 2019 at the Department of Soil Science and Agricultural Chemistry farm, College of Agriculture Latur. The topography of the experiment site was fairly uniform and leveled. The experiment was laid out in Randomized Block Design with three replications consisting twelve treatments comprising T1 -75% recommended dose of fertilizers (RDF), T2 - 100% RDF, T3 - 125% RDF, T4 - 75% RDF + Foliar spray of humic acid @ 0.05%, T5 - 100% RDF + Foliar spray of humic acid @ 0.05%, T6 - 125% RDF + Foliar spray of humic acid @ 0.05%, T7 - 75% RDF + Foliar spray of humic acid @ 0.1%, T8 - 100% RDF + Foliar spray of humic acid @ 0.1%, T9 - 125% RDF + Foliar spray of humic acid @ 0.1%, T10 - 75% RDF + Foliar spray of humic acid @ 0.2%, T11 - 100% RDF + Foliar spray of humic acid @ 0.2%, T12 - 125% RDF + Foliar spray of humic acid @ 0.2%. foliar sprays of humic acid at **30**, **45** and **60** days after sowing. The recommended dose of fertilizer was 60:40:30 kg NPK ha-1. Sunflower variety LSFH-171 was used for the study. After land preparation sunflowers were sown at 60 × 30 cm on 14 October 2019. Half doses of nitrogen, full doses of phosphorus and potassium were applied as basal dose and the remaining 50 per cent of nitrogen was applied as a top dressing. All packages and practices were followed as per recommendations.

RESULTS AND DISCUSSION

Growth Parameters:

The data on growth parameters of sunflowers are presented in table 1. From the data treatment T12 recorded significantly highest plant height at harvest (188.31 cm), the number of leaves of plant-1 at 75 DAS (28.26), leaf area index at 75 DAS (4.51), stem girth at 75 DAS (8.55 cm), head diameter at harvest (21.31 cm), total chlorophyll (1.81 mg g-1) and was found superior over rest of treatments followed by treatment T9, T11, T6, T8 and T5. Plant growth of sunflower increases might be due to elongation and multiplication of cells, increased activity of photosynthates and its mobilization due to sufficient nutrient supply through the recommended dose of fertilizer with humic acid. Sangeeta and Singaram (2007) found that the increase in plant height due to humic acid application is due to better rooting and absorption of nutrients by plants and also due to the auxin activity of humic acid on plant growth. The results are in line with the findings of Fagbenro and Agboola (1993). Trevisan *et al*. (2010) and Dandge *et al*. (2013) observed the increased plant height of soybean by humic acid application. Raghu *et al*. (2017) reported that the increasing number of leaves is due to improvement in the availability of native soil nutrients and synchronized uptake of nutrients. Similar findings were also reported by Syed *et al*.

(2006). Thakur *et al*. (2018) observed that the higher stem girth due to sufficient nutrient supply through the recommended dose of fertilizers and humic acid resulted in higher photosynthates and dry matter production. These results are in line with those of Chandrasekharan (1992). Treatments with foliar application of humic acid may have stimulated the synthesis of chlorophyll stated by Vaughan and Malcolm (1985) and Nardi *et al*. (2002).

Table- 1: Growth parameters of sunflower as influenced by foliar application of humic acid at 30, 45 and 60 DAS.

Treatments	Plant height at harvest	Number of leaves /plants at 75 DAS	LAI at 75 DAS	Stem girth at 75 DAS	Head diameter at harvest	Total chloro-phyll
T_1-75% RDF	111.88	18.80	2.47	4.28	12.24	1.28
T_2-100%RDF	115.20	19.40	2.87	4.63	14.23	1.41
T_3-125%RDF	128.80	21.20	3.63	5.24	17.36	1.63
T_4-75% RDF + 0.05% Humic acid	112.04	19.33	2.72	4.41	12.89	1.36
T_5-100%RDF + 0.05% Humic acid	132.73	21.80	4.11	5.45	17.93	1.66
T_6-125%RDF+ 0.05% Humic acid	146.29	24.53	4.39	5.82	19.01	1.79
T_7-75% RDF + 0.1% Humic acid	119.85	19.40	2.99	4.64	15.52	1.53
T_8-100%RDF + 0.1% Humic acid	137.37	22.80	4.29	5.69	18.53	1.71
T_9-125%RDF + 0.1% Humic acid	181.34	27.66	4.46	8.34	20.9	1.86
T_{10}-75%RDF + 0.2% Humic acid	124.43	20.06	3.45	5.18	16.16	1.56
T_{11}-100%RDF+ 0.2% Humic acid	157.52	26.00	4.44	8.03	19.86	1.83
T_{12}-125%RDF+ 0.2% Humic acid	188.31	28.26	4.51	8.55	21.31	1.88
S. E. ±	1.92	1.21	0.03	0.18	0.40	0.02
C. D. at 5%	5.84	3.67	0.11	0.54	1.23	0.06

Yield:

The data about yield and yield traits are tabulated in Table 2. From the data, it was evident that the application of 125% recommended dose of fertilizer with foliar spray of 0.2% humic acid at 30, 45 and 60 DAS (T12) recorded a significantly maximum test weight (52.71 g) over the rest of the treatments followed by T9, T11, T6, T8, T5 and T3.While the minimum test weight (42.20 g) was recorded in treatment T1 (75% RDF). Waqas *et al*. (2014) reported that the application of a recommended dose of fertilizer along with humic substances consciously increased the test weight. Mahamoudi *et al*. (2016) concluded that the application of humic acid with RDF enhances the performance of sunflowers attributed to increased growth parameters; the higher number of filled seeds increased the test weight of moonbean.

The data on seed and straw yield of sunflower are presented in table- 2. the application of 125 percent recommended dose of fertilizer with foliar spray of 0.2% humic acid at 30, 45 and 60 DAS (T12) recorded the highest seed yield (1631.24 kg ha-1) and straw yield (3050.40 kg ha-1) and found significantly superior over rest of treatments followed by T9, T11, T6, T8, T5 and T3. However, the lower seed yield (1163.74 kg ha-1) and straw yield (2507.58 kg ha-1) were obtained with treatment T1 (75% RDF). Humic acid increases yield through its positive physiological effects on cell metabolism and increased concentrations of chlorophyll reported by Hamid Hatami (2017). Similar increases in seed yield in sunflower under integrated nutrient management were reported by Bombale *et al*. (2009), Gudade *et al*. (2010) and Faisul *et al*. (2013). Sumathi and Rao (2007) observed that straw yield of sunflower is closely associated with plant height, leaf area, stem girth, dry matter accumulation and portioning of dry matter at seed filling stage and post-flowering photosynthesis causes higher straw yield.

Table- 2: Yield and yield traits of sunflower as influenced by foliar application of humic acid at 30, 45 and 60 DAS.

Treatments	Test weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1-75% RDF	42.20	1163.74	2507.58
T_2-100%RDF	43.61	1224.07	2580.62
T_3-125%RDF	45.98	1374.77	2740.74
T_4-75% RDF + 0.05% Humic acid	43.49	1183.09	2566.23
T_5-100%RDF + 0.05% Humic acid	48.80	1415.93	2769.21
T_6-125%RDF+ 0.05% Humic acid	50.04	1498.35	2861.66
T_7-75% RDF + 0.1% Humic acid	44.26	1275.01	2611.93
T_8-100%RDF + 0.1% Humic acid	49.41	1435.84	2827.27
T_9-125%RDF + 0.1% Humic acid	51.35	1582.13	2936.46
T_{10}-75%RDF + 0.2% Humic acid	45.29	1307.16	2716.57
T_{11}-100%RDF+ 0.2% Humic acid	50.85	1513.01	2890.11
T_{12}-125%RDF+ 0.2% Humic acid	52.71	1631.24	3050.40
S. E. ±	0.44	15.41	26.36
C. D. at 5%	1.35	46.75	79.95

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