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Impact of humic + fulvic acid and chemical fertilizer application on plant growth and yield traits of sunflower (*Helianthus annuus* L.) under alfisols

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Abstract
An experiment was conducted during *kharif* 2012 to find the effect of humic and fulvic acid on growth as well as yield traits of sunflower (DRSH- 1) at the college farm, college of agriculture, Rajendranagar, Hyderabad. The results indicated that combined application of RDF + humic acid granules @ 12.5 kg ha^{-1} (basal) significantly influenced stem girth, SPAD chlorophyll meter readings, head diameter and thousand seed. Central unfilled diameter was significantly influenced by different treatments. Application of RDF alone recorded higher central unfilled diameter (2.0 cm). Lowest central unfilled diameter was recorded with RDF + soil application of 12.5 kg ha^{-1} humic acid granules.

Keywords: SPAD, humic acid, fulvic acid, days to 50% flowering and unfilled diameter

Introduction
Application of humic substances in agriculture as fertilizer and soil conditioner were tried on limited scale. Humic substances on soil structure and plant growth showed positive impact was reported earlier by Ihsanullah and Bakhashawin (2013), El-Razek *et al.* (2012) and Fong *et al.* (2007). Proper concentration and application method of humic and fulvic acid can enhance plant and root growth (Ahmed *et al.*, 2013). Humic substances (humic, fulvic acid) attracts positive ions, forms chelates with micronutrients and releases them slowly when required by plants. According to Kadam *et al.* (2010) the humic substances act as chelating agents there by prevents formation of precipitation, fixation, leaching and oxidation of micronutrients in soil. Oilseeds play an important role in the agricultural economy of India. Next to food grains oilseeds are important in terms of area, production and value (Hegde, 2012). Apart from that they fulfill the energy requirements. The shortage of edible oils has become a problem in India with ever increasing demographic pressure. Murthy (2001) critically analyzed the major constraints for low productivity of sunflower in India. The major factors were enumerated to lack of more efficient plant types under cultivation. Besides lower oil yield of sunflower in India is mainly due to the cultivation of crop on the marginal lands with low organic matter and poor fertility. The general low and declining soil fertility and almost disappearing practice of organic manure application has further aggravated the soil fertility problem resulting in low and unsustainable sunflower production. The percentage seed filling is low because of the partial filling of seeds due to insufficient activity of the pollinators and or due to inadequate and imbalanced nutrition. Humic acids also promote antioxidant production in plants which in turn reduce free radicals, which result from stress (drought, heat and ultraviolet light). There radicals are damaging because they are strong oxidizing agents which damage lipids, proteins and DNA within plants cells. Keeping the above points in view, the present investigation was initiated.

Materials and Methods
An experiment was conducted during *Kharif* season 2012 at the college farm, college of agriculture, Rajendranagar, Hyderabad. The soil of the experimental site was sandy loam in texture, neutral in reaction (pH 7.3), low in organic carbon (0.41%), medium in available phosphorus (25.9 kg ha^{-1}) and available potassium (240.3 kg ha^{-1}) and low in available nitrogen (244.6 kg ha^{-1}). The experiment was laid out in randomized block design consisting of seven treatments and replicated thrice. The treatment details are T_1 - RDF (Recommended dose of fertilizer through inorganics 60: 60: 30 kg N, P_2O_5 and K_2O ha^{-1}), T_2 - RDF + FYM @ 5 t ha^{-1}, T_3 - RDF + 12.5 kg ha^{-1} humic acid granules (soil application as basal), T_4 - RDF + foliar spray of humic acid @ 0.5%, T_5 – RDF + foliar spray of humic acid @ 1.0%, T_6 – RDF + foliar spray of fulvic acid @ 0.5%, T_7 - RDF + foliar spray of fulvic acid @ 1.0%. Foliar

spray of humic and fulvic acid was done at button and flowering stages respectively. Sunflower hybrid (DRSH-1) was sown on 6th of July 2012 adopting a spacing 60 x 30 cm. Irrigation was given as required considering the rainfall. During the crop period a total of 519.2 mm rainfall was received in 33 rainy days. Pre- emergence herbicide pendimethalin 30% EC @ 240 ml ha^{-1} was sprayed one day after sowing in optimum soil moisture. The crop was harvested on 7th October, threshed, dried and seed yield was recorded. A uniform dose of 60 kg P_2O_5 and 30 kg K_2O ha^{-1} was applied through single super phosphate and muriate of potash as basal dose to all the plots. Nitrogen (60 kg ha^{-1}) was applied through urea, half at sowing, one fourth at bud initiation stage and the remaining one fourth at flowering stage. Humic acid granules @ 12.5 kg ha^{-1} were applied at sowing as a basal application. Foliar spray of humic and fulvic acid @ 0.5% and 1.0% was done at button and flowering stages respectively. To minimize the drift losses spraying was done during early hours. FYM (5 t ha^{-1}) was applied (T_2) 15 days before sowing. The farm yard manure contained 0.3%, 0.1% and 0.2% N, P_2O_5 and K_2O respectively.

SPAD measures transmission of red light at 650 nm, at which chlorophyll absorbs light, and transmission of infrared light at 940 nm, at which no absorption occurs. Before the measurement, instrument is calibrated - transmission is measured with no leaf inside. Thus, when a leaf is clamped by the meter, a certain portion of red light is absorbed and the meter can calculate a relative value (in SPAD, from Soil Plant Analysis Development, unit). Unfilled diameter of heads from the five tagged plants was measured with the help of thread which was placed on scale and the reading was noted. The average diameter was worked out and expressed in centimeters. The number of days required for 50 per cent of the plants to flower was recorded by visual observation in each treatment. The number of days required for physiological maturity of the plants was recorded by visual observation in each treatment. The girth at base (1st internode) of stem of the five tagged plants was measured at 30, 45, 60 DAS and at harvest by using thread which was later placed and measured with scale and expressed in centimeters.

Result and discussion

Stem girth (cm)

At 30 DAS there were no significant differences in terms of stem girth among the treatments. At 45 DAS (T3) RDF along with soil application of humic acid granules @ 12.5 kg ha-1 was significantly superior in terms of stem girth (5.3 cm) over T4, T6, T7, T2 and T1 which were comparable with each other, but (T3) was comparable with that of (T5) foliar spray of 1.0% humic acid along with RDF at capitulum and flowering stage (4.86 cm). At 60 DAS and at harvest the treatments T3, T5, T4 and T6 maintained their superiority by recording significantly higher stem girth over rest of the treatments. The treatments T1 and T2 were comparable with each other. Stem girth increased successively till maturity due to increase in cell multiplication, and elongation throughout the period of crop. Higher stem girth recorded under the treatment (T3) might be ascribed to the adequate supply of nutrients through recommended fertilizers and humic acid that resulted in higher production of photosynthates and higher dry matter production as evident from the data (Table 1). These results are in line with those of (Chandrasekaran, 1992).

SPAD Chlorophyll meter readings

The data recorded on SPAD Chlorophyll meter readings of sunflower at different growth stages as influenced by different treatments was tabulated in (Table 1). At 30 DAS and at harvest there were no significant differences in SPAD chlorophyll meter readings due to different treatments. At 45 DAS and 60 DAS (T3) soil applications of humic acid granules along with recommended dose of fertilizer recorded significantly higher reading over T1 and T2 treatments. However T3 was on par with remaining treatments T4, T5, T6 and T7. At harvest also T3 recorded significantly higher reading over T1 and T2 treatments and it was on par with T4, T5, T6 and T7 treatments. The higher readings under T3 would be probably due to the higher leaf photosynthetic area coupled with persistence of the leaf area for relatively longer time. The higher plant N content in the treatment also might have resulted in higher SPAD readings.

Days to 50% flowering and days to physiological maturity

Data on days to 50% flowering and physiological maturity revealed that there were no significant differences among treatments. In general among the treatments days to 50% flowering and physiological maturity ranged from 55 to 59 and 80 to 84 respectively (Table 2). The duration of a variety is basically a genetic character. Different treatments had no significant effect both in terms of days to 50% flowering and physiological maturity on a medium fertility soil.

Central unfilled diameter (cm)

Data pertaining to central unfilled diameter as influenced by different treatments is furnished in (Table 2). Central unfilled diameter was significantly influenced by different treatments. Application of RDF alone recorded higher central unfilled diameter (2.0 cm). Lowest central unfilled diameter was recorded with (T3) RDF + soil application of 12.5 kg ha-1 humic acid granules (1.1 cm) and it was on par with (T4 and T5) RDF + foliar spray of humic acid @ 0.5 and 1.0% at capitulum initiation and flowering stage and (T6 and T7) RDF + foliar spray of fulvic acid @ 0.5 and 1.0%. Adequate supply of nutrients under the treatment consisting of humic substances either as soil application or foliar spray had resulted in improved growth parameters that resulted in more number of seeds and better filling of seeds thus reflecting in less unfilled diameter over application of RDF alone.

Test weight (g)

Data pertaining to 1000-seed weight (test weight) as influenced by different treatments was tabulated in (Table 2). A close perusal of data on thousand seed weight indicated that there were significant differences due to the different treatments. Test weight was significantly higher (51.9 g) with RDF + soil application of humic acid @ 12.5 kg ha^{-1} over T7, T2 and T1 however it was on par with T5, T4 and T6. While lowest 1000-seed weight recorded in plots fertilized with RDF alone (45.0 g). Application of recommended fertilizer along with humic substances conspicuously increased the test weight. Supply of all essential nutrients in adequate and available form from added organic sources along with recommended dose of fertilizer would have been better used by the crop for producing bold kernels as compared to treatment applied with inorganic fertilizers alone. Further, humic acid with its comparatively slower oxidisable nature might have released the nutrients slowly up to seed filling stage thereby enhancing the kernel weight on account of better mobilization of nutrients to seeds (Chandrasekaran, 1989 and Babu *et al.* (1989). Seed filling percentage was significantly higher with (T3) combined application of RDF + humic acid granules @ 12.5 kg ha-1 (85.2%) over rest of the treatments. While, lower seed filling percentage was recorded with application of RDF alone (78.3%). This could be ascribed to the higher number of unfilled seeds recorded under this treatment.

Table 1: Stem girth (cm) and SPAD chlorophyll meter readings of sunflower as influenced by different treatments

Treatment	Stem girth (cm)				SPAD chlorophyll meter readings			
	30 DAS	45 DAS	60 DAS	At harvest	30 DAS	45 DAS	60 DAS	At harvest
T_1 – RDF (60:60:30)	3.37	4.36	7.19	7.30	29.42	30.53	32.03	31.63
T_2 – RDF + FYM @ 5 t ha^{-1}	3.38	4.43	7.27	7.39	31.10	31.23	33.70	32.33
T_3 – RDF + 12.5 kg ha^{-1} HA granules	3.72	5.31	8.36	8.43	33.47	36.08	38.20	34.82
T_4 – RDF + FS of HA @ 0.5%	3.69	4.70	7.70	7.83	32.40	34.57	37.23	33.13
T_5 – RDF + FS of HA @ 1.0%	3.69	4.86	8.03	8.13	32.53	34.77	37.80	33.68
T_6 – RDF + FS of FA @ 0.5%	3.64	4.55	7.65	7.79	32.37	34.41	36.67	33.00
T_7 – RDF + FS of FA @ 1.0%	3.53	4.45	7.31	7.45	31.93	33.93	36.17	32.77
S.Em. ±	0.16	0.16	0.24	0.24	1.30	1.13	1.25	2.12
CD (p=0.05)	NS	0.48	0.75	0.73	NS	3.49	3.86	NS

Table 2: Days to 50% flowering, physiological maturity test weight (g) and seed filling percent of sunflower as influenced by different treatments

Treatment	Days to 50% flowering	Days to physiological maturity	Central unfilled diameter (cm)	Test weight (g)	Seed filling%
T_1 – RDF (60:60:30)	59	80	2.0	45.0	78.3
T_2 – RDF + FYM @ 5 t ha^{-1}	58	83	1.8	46.0	79.0
T_3 – RDF + 12.5 kg ha^{-1} HA granules	55	81	1.1	51.9	85.2
T_4 – RDF + FS of HA @ 0.5%	56	84	1.3	49.0	82.1
T_5 – RDF + FS of HA @ 1.0%	55	81	1.2	49.6	81.5
T_6 – RDF + FS of FA @ 0.5%	56	84	1.4	48.3	81.5
T_7 – RDF + FS of FA @ 1.0%	57	80	1.3	46.3	81.6
S.Em. ±	2	2	0.1	1.4	0.75
CD (p=0.05)	NS	NS	0.5	4.3	2.31

Reference

1. Ahmed AHH, Darwish E, Hamoda SAF, Alobaidy MG. Effect of putrescine and humic acid on growth, yield and chemical composition of cotton plants grown under saline soil conditions. American-Eurasian Journal of Agriculture Environmental Science. 2013; 13:479-497.
2. Babu M, Govidasamy R, Chandrashekaran S. Effect of humic acid on yield and composition of pea nut (Arachis hypogaea L.) in calcareous soil. In National seminar on Humus Acid in Agriculture. Annamalai University, 1989, 139-143.
3. Chandrashekaran S. Possible mechanisms on beneficial effects of humic acids on crop plants. In: National Seminar on Humus Acids in Agriculture, Annamalai University, 1989, 253-260.
4. Chandrashekaran S. Efficient use of fertilizers by crops with humic acid addition in soil. Indian Journal of Agricultural Chemistry. 1992; 25:129-142.
5. El-Razek EA, Abd-Allah ASE, Saleh MMS. Yield and fruit quality of Florida Prince peach trees as affected by foliar and soil applications of humic acid. Journal of Applied Science Research. 2012; 8(12):5724-5729.
6. Fong SS, Seng L, Mat HB. Reuse of nitric acid in the oxidative pretreatment step for preparation of humic acids from low rank coal of mukash, Sarawak. Journal of Brazil Chemistry Society. 2007; 18:41-46.
7. Ihsanullah D, Bakhashwain AA. Effect of humic acid on growth and quality of maize fodder production. Pakistan Journal of Botany. 2013; 45:21-25.
8. Kadam SR, Amrutsagar VM, Deshpande AN. Influence of organic nitrogen sources with fulvic acid spray on yield and nutrient uptake of soyabean on inceptisol. Journal of Soils and Crops. 2010; 20(1):58-63.