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RESPONSE OF HUMIC ACID 18% + FULVIC ACID 1.5% ON GROWTH, YIELD AND QUALITY OF CHILLI UNDER MALWA PLATEAU CONDITIONS OF MADHYA PRADESH, INDIA

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ABSTRACT

A field experiment was conducted on Rabi 2021-22 at Bahadari farm of KNK College of Horticulture, Mandsaur, Madhya Pradesh, India to evaluate the impact of Humic acid 18% + Fulvic acid 1.5% on growth, yield and quality of chilli. The experiment was laid out in Randomized Block design with five replications and four treatments (T_1- Humic acid 18% + Fulvic acid 1.5% @750 m/ha, T_2- Humic acid 18% + Fulvic acid 1.5% @1000 m/ha, T_3- Humic acid 18% + Fulvic acid 1.5% @1250 m/ha and control). The treatments included Humic acid 18% + Fulvic acid 1.5% spray with different concentrations at five days after transplanting and control without any chemical spray. The results indicated that, among all the treatments, treatment T_3 (Humic acid 18% + Fulvic acid 1.5% @1250 ml/ha) was found most effective with respect to growth parameters like plant stand (95.63%), root length (14.25 cm), number of white root (39.30), number of branches (17.43), plant-height (84.31 cm), canopy diameter (61.00 cm), yield attributes like number of fruits/plant (82.10), fruit weight (163.40 g), fruit yield of green chilli (132.40 kg/ha), capsaicin content (0.37%) and other parameters like chlorophyll content/LCC value (0.59) and nutrient content in plant tissues (N-6.45%, P-0.59% and K 5.52%).
Keywords : Chilli, humic acid, fulvic acid, chlorophyll, capsaicin.

Introduction

Chilli (*Capsicum annum* L.) is one of the most valuable commercial crops of India. The crop is grown largely for its fruits all over the India. It is used in India as a principle ingredient of various curries, and chutneys. It is also used for vegetables, spices, condiments, sauces and pickles. Chilli is an significant source of Vitamin A, C, potassium, carotenoides, flavonoides, thiamine, dietary fiber and phenolic compounds (Lee and Kader, 2000; Litoriya *et al*., 2014). Capsaicin has pharmaceutical applications, while capsanthin, the red pigment is used as a natural food colorant.

The inherent genetic yield potential of the cultivars along with several environmental factors and cultivation practices govern the production of chilli. Flower and fruit drop caused by physiological and hormonal imbalance in the plants particularly under unfavourable environments, such as extremes of temperature i.e. too low or high temperatures is one of the major problem in chilli production. Over 60% of the flowers produced in a chilli plant are shed. So, yield can be increased by decreasing flower drop. This problem can be solved by selection of breeding lines which retain large proportion of flowers or physiological manipulations by spraying of humic acid and fulvic acid (plant growth promoters) which reduces the flower drop. Plant growth regulator is an organic compound, either natural or synthetic, that modifies or controls one or more specific physiological processes within a plant. The plant growth promoters are known

to enhance the source sink relationship and stimulate the translocation of photo assimilates thereby helping in better retention of flowers and fruits. Besides this, the growth promoters have the ability to cause accelerated growth in plants. Application of plant growth promoters in small amounts modifies the growth of plants usually by stimulating or inhibiting part of the natural growth regulatory system.

Research indicated that humic acid could be used as a growth regulator to regulate hormone levels, improve growth of the plants and enhance stress tolerance (Serenella *et al*., 2002). Humic acid (HA) was in general not only beneficial to shoot and root growth but also nutrient uptake of vegetable crops (Padem *et al*., 1997; Akinremi *et al*. 2000; Dursun *et al*. 2002; Cimrin and Yilmaz 2005). Positive effects of growth substances on plant growth and yield in chilli (Dod *et al*., 1989) have been well documented. Fulvic acid, a humic acid compound, enhances crop stress tolerance. Existing research indicated that the mechanism by which fulvic acid promotes plant growth mainly involves increasing cell membrane permeability and intracellular signal transduction functions, thereby stimulating root growth, enhancing chlorophyll content and photosynthetic efficiency and activating carbon and nitrogen metabolism (Jannin *et al*., 2012; Haghighi *et al*. 2012). Hence, the present study was conducted to know the effect of foliar application of humic and fulvic acid on plant growth, yield and quality of chilli under field conditions.

Materials and Methods

The experiment was carried out at Bahadari farm of KNK College of Horticulture, Mandsaur during Rabi season in 2021-22. The trial was laid out in Randomized Block Design with five replications. The experiment was framed with four treatments viz, T_1- Humic acid 18% + Fulvic acid 1.5% @750 m/ha, T_2- Humic acid 18% + Fulvic acid 1.5% @1000 m/ha, T_3- Humic acid 18% + Fulvic acid 1.5% @1250 m/ha and control (no chemical spray) respectively were laid out in plots of 5.00 m x 5.00 m. Healthy plants of AK 47 variety were selected for sowing. Seedlings of chilli were transplanted to the plots with 75 cm × 45 cm spacing. The foliar spray was carried out ones at 5 days after transplanting (early vegetative stage) by the use of Knap sack sprayer with hollow cone nozzle.All the plots were manured with FYM @ 25 t / ha, nitrogen @ 150 kg ha, phosphorus @ 75kg / ha and potassium @ 75 kg / ha. Nitrogen was applied in two splits @ 75 kg N at the time of planting and remaining 75 kg N as top dressing after six weeks of planting. The humesol was used as an organic growth promoter containing humic acid 18% + fulvic acid 1.5%. The plant protection measures were taken up as and when required. All other agronomic management were carried out as per the package of practices. The total number of plants were recorded from each replication and percent plant stand was calculated at 20 days after transplanting. The root length of 10 randomly selected plants were measured at 15 days after application from each replication and mean was calculated in cm. The number of white roots of 10 randomly selected plants were measured at 15 days after application from each replication and mean number of white roots were calculated. The number of primary & secondary branches were measured from 5 representatives' tagged plants from each plot at pre bloom stage and mean number of branches was calculated. The plant-height of 20 randomly selected plants were measured at flowering stage from each replication and mean was calculated in cm. The canopy diameter of 20 randomly selected plants were measured from each replication at flowering stage and mean diameter was calculated in cm. Analyze NPK content from leaves with representative samples from each plot at 25 days after application. The number of fully open flowers of 20 randomly selected plants were measured at 05 and 10 days after application from each replication and mean number of fully open flowers per plant was calculated. The total number of fruits of 20 randomly selected plants were measured at each picking from each replication and mean number of fruits per plant was calculated. The fruit weight per plant from 20 randomly selected plants were measured at each picking from each replication and mean fruit weight per plant was calculated in gm. The number of 10 leaves from randomly selected plants were measured at 10 days after application from each of the replication plots and measured chlorophyll content in leaves. Chlorophyll content was recorded on standing crop in the field with the help of SPAD chlorophyll meter (Arnon, 1949). Twenty fruits per plot were collected randomly as sub-samples for quality assessment. The green chilli weight was measured at 1st, 2nd,3rd and 4th picking respectively from each plot and mean weight was calculated in kg/ha. Calculate the percentage increase over untreated control. The percentage increase in green chilli yield over control was calculated by using the following formula;

$$PDC = \frac{T - C}{C} \times 100$$

Where T= Yield of respective treatment (q/ha), C=Yield of control (q/ha).

The capsaicin of chilli fruits was measured at 2nd picking of randomly sampling fruits from each plot. The capsaicin content was estimated by

colorimetrically using a spectrophotometer at 650 nm (Quagliottil, 1971) . The data obtained from the experiment were analyzed for analysis of variance (ANOVA) and the difference between treatment means was tested for their statistical significance with appropriate critical difference (CD) at 5% level of probability (Gomez and Gomez, 1984).

Result and Discussion

Growth and yield parameters

A perusal of data in Table 1 and 2 revealed that, all the growth parameters were significantly superior to untreated control. Humic acid 18% + Fulvic acid 1.5% @ 1250 ml/ha was found superior as compared to the untreated control. The percentage plant stand (95.63 %) at 20 days after transplanting, root length (14.25 cm) at 15 days after application, number of white roots (39.30) at 15 days after application, number of branches (17.43) at pre bloom stage, plant height (84.31 in cm) at flowering stage, canopy diameter (61.00 cm) at flowering stage, nutrient uptake N (6.45), P (0.59) & K (5.52) at 25 days after application were observed higher in treatment receiving Humic acid 18% + Fulvic acid 1.5% @ 1250 ml/ha as compared to untreated control. While, these parameters was recorded significantly lowest in control plot (Table 1).

The number of fully open flowers per plant (76.00), (83.90), number of fruits per plant (82.10), fruit weight per plant (163.40 gm), fruit yield of green chilli (132.40 q/ha) were observed higher in treatment receiving Humic acid 18% + Fulvic acid 1.5%@ 1250 ml/ha as compared to untreated control (Table 1). The increase in fruit weight per plant in response to humic acid might be due to enhanced growth of the plant, plant canopy due to which plant can intercept light in a better way and as a result fruit weight of plant increased (Kasperbauer, 1987). Similar findings were also highlighted by Yildirim (2007) in tomato and El-Nemr *et al*. (2016) in cucumber. The application of humic acid significantly increased the rate of photosynthesis, root development and plant nutrients content of the plant and thus increased the fruit weight and width (Liu *et al.*, 1998). The highest nutrient content (N-6.45%, P-0.59% and K 5.52%) was recorded in treatment receiving Humic acid 18% + Fulvic acid 1.5%@ 1250 ml/ha over control.

Quality Parameters

The significantly highest chlorophyll content/LCC value (0.59) was recorded in treatment T_3 (Humic acid 18% + Fulvic acid 1.5% @ 1250 ml/ha.). While significantly lowest chlorophyll content was recorded in T_4 (control) *i.e*. 0.47 (Table 2). The increased leaf chlorophyll content by the foliar application of humic acid might be due to the acceleration of NO_3 and N uptake, enhancing N metabolism and production of protein by humic acid that ultimately increase chlorophyll contents (Haghighi *et al.*, 2012). Similar findings were also reported by Thakur *et al.* (2018) in sunflower, Dawood *et al.* (2018) in faba bean, and Kakakurt *et al.* (2009) in pepper plant.

The capsaicin content was numerically increased with the application of varying levels of Humic acid 18% + Fulvic acid 1.5%. Capsaicin content (0.37) were observed significantly higher in treatment receiving Humic acid 18% + Fulvic acid 1.5% @ 1250 ml/ha as compared to untreated control. Lowest capsaicin content was recorded in T_4 (Control) *i.e*. 0.29 (Table 1). These results are in harmony with those noticed by Aminifard *et al.* (2012) who highlighted that capsaicin content was affected by nutritional fertility and increased by humic acid application.

The treatment T_3 (Humic acid 18% + Fulvic acid 1.5% @ 1250 ml/ha.) was observed highest yield increases (18.25 %) as compared to untreated control.

Conclusions

Based on the findings of the above investigation, it may be concluded that foliar application of humic acid 18% + fulvic acid 1.5% @ 1250 ml/ha (Humesol) on chilli crop found to be safe and enhanced growth, yield and quality of chilli under climatic conditions of Malwa Plateau of Madhya Pradesh, India.

Table 1: Effect of humic acid 18% + fulvic acid 1.5% on plant stand, root length, number of white roots, numner of branches, plant height, canopy diameter and nutrient uptake of chilli.

Treatments	Dose/ha (ml)	Plant stand (%)	Root length (cm)	Number of White root	Number of branches	Plant height (cm)	Canopy diameter (cm)	Nutrient content in plant tissues At 25 DAA		
								N (%)	P (%)	K (%)
T_1-Humic acid 18% + Fulvic acid 1.5%	750	91.20 (72.74)	11.67 (3.49)	26.18 (5.16)	12.50 (3.60)	73.40 (8.59)	50.10 (7.11)	4.89 (2.32)	0.51 (1.00)	4.23 (2.17)
T_2-Humic acid 18% + Fulvic	1000	92.00 (73.86)	12.50 (3.60)	35.27 (5.98)	15.36 (3.98)	75.10 (8.69)	54.25 (7.39)	5.63 (2.47)	0.52 (1.01)	4.96 (2.34)

acid 1.5%										
T_3-Humic acid 18% + Fulvic acid 1.5%	1250	95.63 (78.17)	14.25 (3.84)	39.30 (6.30)	17.43 (4.23)	84.31 (9.20)	61.00 (7.84)	6.45 (2.63)	0.59 (1.04)	5.52 (2.45)
T_4-Untreated (control)	---	90.10 (71.85)	10.09 (3.25)	21.42 (4.68)	11.16 (3.41)	64.30 (8.05)	42.64 (6.57)	4.01 (2.12)	0.50 (1.00)	4.08 (2.14)
S.Em.±		1.36	0.06	0.10	0.06	0.15	0.12	0.04	0.10	0.03
CD (P=0.05)		4.12	0.18	0.30	0.20	0.46	0.38	0.12	0.30	0.11

DAA- Days after Application; N- Nitrogen; P – Phosphorus; K-potassium
*Figures in parentheses are Square root transformed values.
** Figures in parentheses in plant stand and nutrient content in plant tissue are Arcsine transformed values.

Table 2: Effect of humic acid 18% + fulvic acid 1.5% on chlorophyll content, number of flowers & fruits, fruit weight, green chilli yield and capsaicin content of chilli.

Treatments	Dose/ha (ml)	Chlorophyll Content/LCC value	No. of fully opened flowers/plant		No of fruits/plant	Fruit weight per plant (g)	Fruit yield (kg/ha)	Per cent increase in yield over control	Capsaicin content (%)
			5 DAA	10 DAA					
T_1-Humic acid 18% + Fulvic acid 1.5%	750	0.49 (0.99)	65.27 (8.11)	70.12 (8.40)	69.50 (8.36)	136.22 (11.69)	112.55 (10.63)	3.83	0.31 (3.19)
T_2-Humic acid 18% + Fulvic acid 1.5%	1000	0.51 (1.00)	68.51 (8.30)	75.20 (8.70)	73.30 (8.59)	145.78 (12.09)	118.81 (10.92)	8.90	0.33 (3.29)
T_3-Humic acid 18% + Fulvic acid 1.5%	1250	0.59 (1.04)	76.00 (8.74)	83.90 (9.18)	82.10 (9.08)	163.40 (12.70)	132.40 (11.52)	18.25	0.37 (3.49)
T_4-Untreated (control)	---	0.47 (0.98)	58.33 (7.67)	54.30 (7.40)	54.81 (7.44)	110.24 (10.52)	108.24 (10.43)	0.00	0.29 (3.09)
S.Em.±		0.01	0.14	0.15	0.15	0.21	0.19	0.33	0.05
CD (P=0.05)		0.03	0.43	0.45	0.45	0.63	0.57	1.01	0.17

*Figures in parentheses are Square root transformed values.
** Figures in parentheses in chlorophyll content and capsaicin content are Arcsine transformed values.

References

Akinremi, O.O., Janzen, H.H., Lemke, R.L., and Larney, F.J. (2000). Response of canola, wheat and green beans to leonardite additions. *Canadian Journal of Soil Science*, **80**, 437-443.

Aminifard MH, Aroiee H, Azizi M, Nemati H, Jaafar, HZE. (2012). Effect of humic acid on antioxidant activities and fruit quality of hot pepper (Capsicum annum L.). *Journal of Herbs, Spices and Medicinal Plants*, **18**,360-369.

Arnon, D.I. (1949). Copper enzymes in isolated chloroplasts polyphenol oxidase in Beta vulgaris. *Plant Physiology*. **24**,1-15.

Cimrin, K.M., and Yilmaz, I. (2005). Humic acid applications to lettuce do not improve yield but do improve phosphorus availability. *Acta Agriculturae Scandinavica*, Section B-Soil & Plant Science, **55**, 58-63.

Dawood MG, Abdel-Baky YR, El-Awadi ME, Bakhoum GS. (2019). Enhancement quality and quantity of faba bean plants grown under sandy soil conditions by nicotinamide and/or humic acid application. Bulletin of the National Research Centre, **43,** 28.

Dursun, A., Guvenc, I., and Turan, M. (2002). Effects of different levels of humic acid on seedling growth and macro and micronutrient contents of tomato and eggplant. *Acta Agrobotanica,* **56**, 81-88.

Dod, V.N., Kale, P.B. and Ranotokar, R.S. (1989). Effect of foliar application of auxins and micronutrients on growth and yield of chilli. *Punjabrao Krishi Vidyapeeth Res. J*., **13,** 29-33.

El-Nemr MA, El-Desuki M, El-Bassiony AM, Fawzy ZF. (2012). Response of growth and yield of cucumber plants (Cucumis sativus L.) to different foliar applications of humic acid and Bio-stimulators. *Australian Journal of Basic and Applied Sciences*, **6(3)**, 630-637.

Gomez, K.A., Gomez, A,A. (1984). Statistical Procedures for Agricultural Research. Edn 2, John Wiley and Sons, New York.

Haghighi, M.; Kafi, M.; Fang, P. (2012). Photosynthetic activity and N metabolism of lettuce as affected by humic acid. *International Journal of Vegetable Science,* **18 (2)**, 182-189.

Jannin, L.; Arkoun, M; Ourry, A; Laine, P; Goux, D; Garnicca, M; Fuentes, M.; Francisco, S.S.; Baigorri, R.; Cruz, F.

(2012). Microarray analysis of humic acid effects on Brassica napus growth: Involvement of N,C and S metabolism. *Plant and Soil*, **359**, 297-319.

Karakurt Y, Unlu H, Padem H. (2009). The influence of foliar and soil fertilization of humic acid on yield and quality of pepper. *Acta Agriculturae. Scand. Sec. B Soil plant Sci*., **59**,233-237.

Kasperbauer M.J. (1987). Far-red light reflection from green leaves and effects on phytochrome mediated assimilate partitioning under field conditions. *Plant physiology*, **85**, 350-354.

Lee, S.K. and Kader, A.A. (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biology and Technology*, **20**, 207-220.

Litoriya NS, Gandhi K, Talati JG. Nutritional composition of different chilli (Capsicum annuum L.) varieties. (2014). *Indian Journal of Agricultural Biochemistry*, **27(1)**, 91-92.

Liu C, Copper RJ, Bowman DC. (1998). Humic acid application affects photosynthesis, root development and nutrient content of creeping bent grass. *Horticulture Science*, **33(6)**,1023-1025.

Padem, H., Ocal, A. and Alan, R. (1997). Effect of humic acid added foliar fertilizer on seedling quality and nutrient content of eggplant and pepper. ISHS Symposium on Greenhouse Management for Better Yields and Quality in Mild Winter Climates, 3-5 November 1997. *Acta Horticulturae*, **491,** 241-246.

Quagliotti L. (1971). Effect of soil moisture and nitrogen level on the pungency of berries of *Capsicum annum* L. *Horticulture Research*,**11**, 93-97.

Thakur H, Rekha KB, Giri YY, Babu SNS. (2018). Impact of humic+fulvic acid and chemical fertilizer application on plant growth and yield traits of sunflower (Helianthus annuus L.) Under alfisols. *Journal of Pharmacognosy and Phytochemistry*. Special Issue 1:2992-2994.

Serenella, N., Pizzeghelloa, D., Muscolob, A., and Vianello, A. (2002). Physiological effects of humic substances on higher plants. *Soil Biol. & Biochemistry*, **34**, 1527-1536.

Yildrim, E. (2007). Foliar and soil fertilization of humic acid affect productivity and quality of tomato. *Acta Horticulturae,* Scand. Sec. B- *Plant Soil Sci*., **56,** 182-184.