IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Effect of potassium humate on seed germination, seedling growth and chlorophyll contents of Chickpea (*Cicer arietinum*) and Matki (*Vigna aconitifolia)*

R.B.Patil
Shankarrao Chavan Mahavidyalaya Ardhapur, Dist: Nanded (MS)

And
P.V. Pawar
Madhavrao Patil College, Palam Dist:Parbhani (MS)

Abstract:

A laboratory experiment was conducted to study the effect of potassium humate on seed germination and seedling growth (root length and shoot length) of Chickpea (*Cicer arietinum*) and Matki (*Vigna aconitifolia)* .The seeds of *Cicer arietinum* and *Vigna aconitifolia* were treated with potassium humate at ten different concentrations (from 0.1 to 1.0%) and water as control. The seeds were then sown on moist blotter papers to record percent seed germination, root length and shoot length of *Cicer arietinum* and *Vigna aconitifolia*. The effect of potassium humate (1.0%) on chlorophyll content of *Cicer arietinum* and *Vigna aconitifolia* was visualized using systronic spectrophotometer (Type 106) method. At the end of tenth day, potassium humate treated seeds showed positive correlation between concentration of potassium humate and percent seed germination with root length and shoot length of *Cicer arietinum* and *Vigna aconitifolia* against water (control).The experiment revealed that, Potassium humate treated plants showed higher chlorophyll a and -b contents than control.

Key words: Humic acid, Potassium humate, Percent seed germination, Seedling growth and Chlorophyll contents.

INTRODUCTION:

Soil organic matter includes the remains of all plants and animals bodies that fell on earth surface. The final residue obtained from microbial decomposition of organic mater is called as humus and process of formation of humus is called as humification. Humic substances are component of humus and are widely distributed over earth surface. Humic substances can be classified into three general categories like humic acid, fulvic acid and humin (Solange and Rezende, 2008).

Humic acid is recognized as dark gold of agriculture.It is a major constituent of Humic materials contributed the main essential elements of peat, coal and soil. It is extremely soluble in water and simply absorbed up by a plant as related to fertilizer because it has frequent vigorous locations which mark it soluble in water. There is a rising attention in the use of Humic acid as organic manures or soil tonic.(Jawad Ali Jam *et.al, 2020)* .

These substances improve the biological and structural characteristics of the soil and also the plants, their effects varying among different plant species, which respond differently at each stage of their development to the dose and method of application of humic acid (Canellas, Santos, 2005).Potassium humate is the salt of humic acid and dark colored, water soluble but alkali insoluble.

In a review of published reports, it is found that the application of humic acid extracts to wheat and soybean crops increased water absorption, respiration and seed germination rate (Smidova (1962), Ishwaran and Chonkar (1971)). Applied humic acids to sand culture of soybean increases shoot length, root length and nodule dry weight in response to treatment up to 400 to 800 mg/kg soil (Tan and Tantiwiramannond 1983). Humic acid stimulate shoot growth of various plants when applied either as foliar spray or in nutrient solutions (Chen and Aviad, 1990).
The various functional groups of humic acid such as acidic (e.g. carboxylic acid and phenol), alkaline (e.g. amine, imines) or neutral groups (e.g. alcohol, aldehyde, ketone, ether, ester and amide) stimulated enzymatic activities in several metabolic pathways (Jackson, 1993).Humic acids extracted from peat and leonardite stimulated plant growth (Adani *et al*, 1998).

Effect of seed soaking with plant growth regulators (IAA, GA, humic acid) on wheat seedling growth under normal (4 ds / cm) and saline (15 ds / cm) conditions and results showed that seed soaking with growth regulators increased root length, shoot length, and fresh and dry weight of seedling (Irfan *et al*. 2005).Lignite humic acid showed stimulatory effects on growth and yield of turmeric in Afisol (Baskar, 2006).

The positive impact of humic acid on plant productivity was due to harmonic activities of humic acid such that improving cell respiration, photosynthesis, formation of protein and activation of several enzymes . The similar finding was reported by in wheat, Adani et al. (1998) in tomato and in chilli who concluded that the foliar application of humic acid increased the yield of plant.

Structure of humic acid complex found to be organic containing polyphenolic backbone with carbohydrate and peptide side chain. So, they have high molecular weight. In general, humic acid supplies both macro and micro nutrients to growing plants, increases soil fertility and productivity, increases water holding capacity and enhance seed germination. Jack A, 2000, Prakash P.et al.,2014.

Humate treatment enhanced overall metabolism of crop plants, thus chlorophyll contents were also increased. Increased contents of chlorophylls enhanced overall photosynthetic rate there by yield in general. (Sladky 1959 in Tomato, Kui Zeng 2002 in Wheat)

In the present paper, an attempt was made to discuss the importance of potassium humate on seed germination and seedling growth (root length and shoot length) and chlorophyll contents (chlorophyll-a and chlorophyll-b) of *Cicer arietinum* and *Vigna aconitifolia*.

MATERIALS AND METHODS:

The effect of ten different concentrations of potassium humate (0.1 to 1.0%) against control (tap water) in three replications for each crop were tested for seed germination and seedling growth (root length and shoot length) of Chickpea and Matki. Seeds of *Cicer arietinum* and *Vigna aconitifolia*. were collected from field during year 2007. Seeds of each crop (4kg) were stored in small gunny bags at 27 ± 2^{0}C six month in laboratory for the experiment. The seeds were tested on moist blotter methods following ISTA (1966) procedure. The observation recorded after ten days included percent seed germination (%), root length (cm) and shoot length (cm).

Potassium humate formulation (Stock solution)

The commercial product of potassium humate is black, crystalline and water soluble. It is obtained from M/S. VKumar and Sons, Aurangabad (M.S). The stock solution of potassium humate of various concentrations like 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%, 0.9%, and 1.0% were prepared by dissolving 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0 gm of potassium humate in 100 ml water. The effects of ten different concentrations (0.1 to 1.0 %) of potassium humate were tested on percent seed germination, root length and shoot length of crop plants as these concentrations gave better results. Concentrations above 1.0% were found to be inhibitory.

Blotter Method

A laboratory experiment to screen the percent seed germination for potassium humate was conducted in the Petri dishes of size 10 cm in diameter. The Petri dishes well sterilized by using 0.1 percent H_2Cl_2 solution. A thin layer of cotton was placed at the bottom of Petri dishes and it was covered with filter paper. In each Petri dish 10 seeds were sown and regularly watered with potassium humate solution. Final value was taken as mean (average) of three replicates for treatment and control. Seed germinated in tap water was served as control for comparison. The percent seed germination, root length and shoot length was recorded 10 days after sowing.

Chlorophyll content

In order to see the effect of potassium humate on content of chlorophylls, pot experiment was conducted. The amount of chlorophyll-a and chlorophyll-b in leaf extracts was determined by using systronic spectrophotometer (Type 106). Crop plants were raised in pots and irrigated as per requirements with 1.0% potassium humate and with water as control. Fresh leaves were collected from crops for determination of amount of chlorophylls on 42th day (*Cicer arietinum*) and 30nd day *(Vigna aconitifolia*.). For this study, 1 gm of fresh leaves of experimental crop plant was taken into a clean mortor. 25 ml of 80% acetone was added in mortar and leaves were ground into fine pulp. The acetone extract was filtered first through muslin cloth and then through Whatman filter paper No.1. The acetone filtrate was collected in volumetric flask and volume was made up to 100 ml by adding distilled water. The optical density of chlorophyll-a and chlorophyll-b was measured with the help of systronic spectrophotometer (Type106) set at 645 nm and 663 nm. The amount of chlorophyll pigments (chlorophyll-a and chlorophyll-b) in the extract was expressed in mg chlorophyll per gram of fresh leaves by using following formula.

$$\text{Chlorophyll-a} = [12.7\ (D\ 663) - 2.59\ (D645)] \times \frac{V}{1000 \times W}$$

$$\text{Chlorophyll-b} = [22.9\ (D\ 645) - 4.68\ (D663)] \times \frac{V}{1000 \times W}$$

Total chlorophyll = chlorophyll- a + chlorophyll-b

Where,

D = Optical density of wavelength indicated

V = Final volume of the 80% acetone chlorophyll extract

W = Fresh weight of leaves in gram

RESULTS AND DISCUSSION

It is clear from the results presented in Table-1 that with the increase in concentrations of potassium humate from 0.1 to 1.0% there was concomitant increase in seeds germination over control in *Cicer arietinum* and *Vigna aconitifolia*.

0.1% potassium humate treated seed of *Cicer arietinum* showed 83.00% seed germination and seeds treated with 1.0% showed 96.66% germination as against 70.00% in water (control). *Cicer arietinum* seeds treated 1.0% potassium humate showed maximum root length (18.9 cm against 12.8 cm in water-control) and shoot length (17.4 cm against 13.9 cm in water-control).

Potassium humate (1.0%) treated seeds of *Vigna aconitifolia* showed similar trends. Seeds treated with 1.0% potassium humate solution in *Vigna aconitifolia* showed 100% seed germination as against 80.00% in water (control).Similar results were recorded as regards to the root and shoot lengths. Seeds treated 1.0% potassium humate showed maximum root length (4.0 cm against 2.0 cm in water-control) and shoot length (6.2 cm against 3.7 cm in water-control).

The results presented in Table 2 revealed that there was an increase in amount of chlorophyll-a and chlorophyll-b in treated plants than control (water) in *Cicer arietinum* and *Vigna aconitifolia*. Potassium humate treated plants of *Cicer arietinum* showed chlorophyll-a 1.32 mg / gm (control 1.12 mg / gm), chlorophyll-b 1.28 mg / gm (control 1.11 mg / gm) and total chlorophylls 2.60 mg / gm (control 2.23 mg / gm).

Similar trends were observed in *Vigna aconitifolia*. Potassium humate treated plants of *Vigna aconitifolia* showed chlorophyll-a 2.22 mg / gm (control 2.00 mg / gm), chlorophyll-b 1.56 mg / gm (control 1.00 mg / gm) and total chlorophylls 3.78 mg / gm (control 3.00 mg / gm).

Table-1 Effect of potassium humate on seed germination, root length and shoot length of *Cicer arietinum* and *Vigna aconitifolia*.

Sr. No.	Potassium humate (%)	*Cicer arietinum*			*Vigna aconitifolia*		
		Seed Germination (%)	Root length (cm)	Shoot length (cm)	Seed Germination (%)	Root length (cm)	Shoot length (cm)
1.	0.1	83.00	15.5	16.0	83.33	1.9	4.2
2.	0.2	83.33	15.8	16.2	86.66	2.6	4.8
3.	0.3	86.66	15.9	16.4	90.00	2.7	4.9
4.	0.4	90.00	16.5	16.5	93.33	2.6	4.9
5.	0.5	93.33	16.6	16.7	96.66	2.5	5.0
6.	0.6	93.33	16.0	17.8	96.66	3.0	6.3
7.	0.7	93.33	17.1	17.9	96.66	3.8	6.3
8.	0.8	96.66	17.2	17.0	96.66	3.8	6.3
9.	0.9	96.66	17.3	17.3	100	3.8	6.5
10.	1.0	96.66	18.9	17.4	100	4.0	6.2
11.	**Control**	70.00	12.8	13.9	80.00	2.0	3.7

Table-2 Effect of potassium humate (1.0%) on chlorophyll contents of *Cicer arietinum* and *Vigna aconitifolia*.

Sr. No	Chlorophyll pigments	*Cicer arietinum* (after 42 days)		*Vigna aconitifolia* (after 30 days)	
		Potassium humate (1.0%)	**Control (Water)**	**Potassium humate (1.0%)**	**Control (Water)**
1	Chlorophyll –a (mg/gm of fresh leaves)	1.32	1.12	2.22	2.00
2	Chlorophyll –b (mg/ gm of fresh leaves)	1.28	1.11	1.56	1.00
3	Total Chlorophylls (a+b) (mg/gm of fresh leaves)	2.60	2.23	3.78	3.00

REFERENCES:

1. **Solange, L.M. and Rezende, M.O. (2008):** Capillary Electrophoresis (CE): A powerful tool to characterize humic acid (HA). J. Brazil Chemical Society. 19:24-28.
2. **Jawad Ali Jan *et .al.* (2020):** Foliar application of humic acid improves growth and yield of Chilli (*Capsicum annum L.)* varieties. *Pakistan Journal of Agricultural Research*, 33(3): 461-472.
3. **Canellas, L. P.; Santos, G. A. (2005):** Humosfera: tratado preliminar sobre a química das substâncias húmicas. Campos dos Goytacazes, RJ: UENF, 2005. 309 p.
4. **Smidova, M., (1962)**: Effect of sodium humate on swelling and germination of plant roots. J.Biol. Plant., 4:112-118.
5. **Ishwaran, V. and Chonkar, P. (1971):** Action of sodium humate and dry matter accumulation of soybean in saline alkaline soil. In B. Novak *et al*. Humus Planta. pp. 613-615.
6. **Tan, K. and Tantiwiramannond, D. (1983):** Effect of humic acid on nodulation and dry matter production of soybean, peanut and clover. J. Soil Sci America., 47: 1121-1124.
7. **Chen,Y. and Aviad, T. (1990):** Effects of humic substances on plant growth. American society of agronomy. J. Soil science of America., 161-186.
8. **Jackson, W.R. (1993):** Humic acid in agriculture data base. Evergreen Colorado. Jackso research centre. Organic soil conditioning. p.537.
9. **Adani, F., Genevini, P., Zaccheo, P. and Zocchi, G. (1998):** The effect of commercial humic acid on tomato plant growth and mineral nutrition. J. Plant Nutrition. 21 (31): 561-575.
10. **Irfan, A., Shahzad, M. and Iqbal, A. (2005):** The effects of seed soaking with plant growth regulators on seedling vigour of wheat under salinity stress. J. Stress Physiology and Biochemistry. 1(1):6-14.
11. **Baskar, K. (2006):** Growth, yield and N uptake of Turmeric (*Curcuma longa* L.) in Alfisol as affected by lignite humic acid. J. Madras Agriculture. 93 (7-12): 282-287.
12. **Adani, F., Genevini, P., Zaccheo, P. and Zocchi, G. (1998):** The effect of commercial humic acid on tomato plant growth and mineral nutrition. J. Plant Nutrition. 21 (31): 561-575.
13. **Jack A. Hartwigsen and Michael R. Evans (2000):** Humic Acid Seed and Substrate treatments Promote Seedling Root Development HORTSCIENCE, 2000, 35(7),1231–1233.
14. **Prakash P. *et.al.* (2014):** Effect of humic acid on seed germination *Rhaphanus sativus* International Journal of ChemTech Research, CODEN (USA): IJCRGG ISSN: 0974-4290 Vol.6, No.9, pp 4180-4185, September 2014.
15. **Sladky, Z. (1959):** The application of extracted humus substances to over ground parts of plants. J. Biol. Plant., 1: 199-204.
16. **Kui Zeng, (2002).** Effect of dissolved humic substances on the phytochemical degradation rate of 1-Aminopurence and Atrazine. J. of Molecular Sciences. 3: 1048-1057.
17. **Adani, F., Genevini, P., Zaccheo, P. and Zocchi, G. (1998).** The effect of commercial humic acid on tomato plant growth and mineral nutrition. J. Plant Nutrition., **21** (**31**): 561-575.
18. **Bama, K., Selvakumari. G., Natesan, R., and Singaran. P. (2004).** Humic acid and fertilizers on nutrition of rice in an Alfisol and Inceptisol. J. Madras Agriculture., **91** (**1-3**): 100-108.
19. **Baskar, K. (2006).** Growth, yield and N uptake of Turmeric (*Curcuma longa* L.) in Alfisol as affected by lignite humic acid. J. Madras Agriculture., **93** (**7-12**): 282-287.
20. **Chen,Y. and Aviad, T. (1990).** Effects of humic substances on plant growth. American society of agronomy. J. Soil science of America., 161-186.
21. **Ishwaran, V. and Chonkar, P. (1971).** Action of sodium humate and dry matter accumulation of soybean in saline alkaline soil. In B. Novak *et al*. Humus Planta. pp. 613-615.
22. **ISTA (1966).** International Rules of Seed Testing. Int. Seed Test. Ass. **31**:1-152.

23. **Irfan, A., Shahzad, M. and Iqbal, A. (2005).** The effects of seed soaking with plant growth regulators on seedling vigour of wheat under salinity stress. J. Stress Physiology and Biochemistry., **1**(**1**):6-14.

24. **Jackson, W.R. 1993.** Humic acid in agriculture data base. Evergreen Colorado. Jackso research centre. Organic soil conditioning. p.537.

25. **Kui Zeng, (2002).** Effect of dissolved humic substances on the phytochemical degradation rate of 1-Aminopurence and Atrazine. J. of Molecular Sciences., **3**: 1048-1057.

26. **Sladky, Z. (1959).** The application of extracted humus substances to over ground parts of plants. J. Biol. Plant., **1**: 199-204.

27. **Smidova, M.,** (**1962**). Effect of sodium humate on swelling and germination of plant roots. J.Biol. Plant., **4**:112-118.

28. **Salman, L.A. (2005).** Fruit yield and quality of water melon as affected by humic acid. J. Science Research., **1:**51-58.

29. **Tan, K. and Tantiwiramannond, D. (1983).** Effect of humic acid on nodulation and dry matter production of soybean, peanut and clover. J. Soil Sci America., **47**: 1121-1124.

30. **Ulukan, H. (2008).** Effect of soil applied humic acid at different sowing times on some yield component in wheat (*Triticum sp*.) hybrids. International Journal of Botany., **4**(**2**) : 164-175.