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## EFFECT OF CHLORINE WATER ON SOME VITAL PROCESS OF VIGNA UNGUICULATA L. (COWPEA)

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**Abstract:** *Vigna unguiculata* seeds treated with 0.01% 0.1% and 0.2% (v/v) chlorine water during germination upto 10 days. The control is treated with distilled water. The germination percentage is affected by chlorine water treatment. The effect is severe as concentration of chlorine water goes on increasing. Chlorine water treated seeds shows less number of leaves over control. The length of seedling is affected by chlorine water treatment. More the concentration of chlorine water, less is the length of seedling in *Vigna unguiculata*. The chlorine water has inhibitory effect on root growth (radical length and number of rootlets) in *Vigna unguiculata*. The fresh weight and dry weight goes on decreasing in chlorine water treatment of *Vigna unguiculata* over control.

Chlorine is essential micronutrient in plant vital processes. However, higher concentration of chlorine inhibits the plant vital process during seed germination of *Vigna unguiculata*. The higher concentration of chlorine affects the seed germination percentage, leaves number, seedling growth, radical length with rootlets, fresh weight and dry weight of seedling.

**Keyword:** chlorine water, vital process, germination, micronutrient essential.

### INTRODUCTION:

*Vigna unguiculata* L. is a legume cultivated to be eaten as green pods. Germination is vital process. To study the effect of chlorine water on *Vigna unguiculata* L. the efforts are put in. Germination of *Vigna unguiculata* by treatment of chlorine water is studied in terms of germination percentage, leaves (plumule) formation, length of seedling root growth and fresh weight as well as dry weight. Germination is initiated by water and soil with oxygen. The germination may affect by micronutrient like chlorine.

Chlorine is a micronutrient essential for plant development. It is required in small quantities by all crops. Chlorine has a direct role in photosynthesis, is important in osmotic adjustment of the plant and plays an essential role in stomatal regulation. (Engel et. Al. 1997). According to Chapagain et.al.(2003), chloride improves tomato quality. Potassium chloride enhances and improves the quality of fertigated greenhouse tomato as compared to potassium nitrate in crops.

### MATERIALS AND METHODS :

Dried seeds of *Vigna unguiculata* were collected and sown in mixture of garden soil in pots. 10 seeds were sown in each pot containing garden soil. The pots were watered with chlorine water and normal tap water. The control is watered with tap water while the treated pots were watered with 0.01%, 0.1%, 1% and 2% (v/v) chlorine water solution. Each pot containing 10 seeds of *Vigna unguiculata* was watered with adequate amount of water for the growth and germination. The observations were made in terms of

germination percentage, days required for plumule emergence, the length of seedling, root growth in terms of radicle length and number of rootlets, the fresh weight of germinated seedlings and the dry weight of germinated seedlings.

The germination percentage was observed of control and chlorine water treated seeds of *Vigna unguiculata* on 3rd, 6th as well as 10th day of sowing. Similarly the number of germinated seeds with plumule were noted on 3rd, 6th and 10th day after sowing of control and chlorine water treated seeds. The length of seedling was also considered as one of the parameter to study the effect of various concentrations of chlorine water. The length of seedling of *Vigna unguiculata* was taken from the shoot tip to the soil surface in cm. It was calculated on 3rd, 6th and 10th day of germination. The seedlings of *Vigna unguiculata* of control and treated were uprooted on 10th day to calculate the fresh weight of seedlings. Then the seedlings were kept in oven at 60° C temp. until the constant dry weight. The fresh weight and dry weight were calculated in terms of gm.

The observation were based on arithmetic mean of the ten germinating seeds. The experiment was performed in two replicas simultaneously.

### RESULTS AND DISCUSSIONS :

I. The effect of various concentrations of chlorine water on germination percentage of *Vigna unguiculata* :

No	Observation	control		0.01% Chlorine water		0.1% Chlorine water		1% Chlorine water		2% Chlorine water	
		No	%	No	%	No	%	No	%	No	%
1	Germination after 3 <sup>rd</sup> day of sowing	07	70	06	60	04	50	04	40	02	30
2	Germination after 6 <sup>th</sup> day of sowing	10	100	06	60	06	60	05	50	05	50
3	Germination after 10 <sup>th</sup> day of sowing	10	100	08	80	08	80	05	50	05	50

(Average of 10 seed germination)

The seed Germination test has been widely used bioassay for the determination of allelopathy activity (Lovett and Ryuntu, 1992). In present studies the seed germination is 70% in control while 60%, 50%, 40% and 30% at the 0.01% chlorine water, 0.1%, 1.0% and 2.0% chlorine water treatment respectively. It seems to be germination percentage of *Vigna unguiculata* L. is affected by chlorine water. The effect is seivour as concentration of chlorine water goes on increasing. More the concentration of chlorine water, less is the germination of seeds of *Vigna unguiculata*. The same results are seen after 6th day of germination and 10th day of germination in *Vigna unguiculata* in control as well as chlorine water treated seeds. Bewley and Black (1985) used germination percentage as indice to show allelochemical effects on germination. Bewley and Black (1985) stated that the behavior of a seed population with respect to germination has several quantitative aspects that must be considered, and quantification obviously should not be limited to one parameter, say maximum germination percentage (germination capacity) or germination rate. Joel F (2005) also observed the effect of chlorine concentration on the germination of soybeans. He also observed that chlorine water lowers the germination of soybeans.

I Present research also conclude that even 0.01% chlorine water affects the germination rate in *Vigna unguiculata*.

II. Effect of various concentrations of chlorine water on the leaves formation in *Vigna unguiculata* -

No	Observation	Control	0.01% Chlorine water	0.1% Chlorine water	1% Chlorine water	2% Chlorine water
1	Germination of seeds with leaves after 3 <sup>rd</sup> day of sowing	02 leaves	02 leaves	02 leaves	02 leaves	02 leaves
2	Germination of seeds with leaves after 6 <sup>th</sup> day of sowing	06 leaves	06 leaves	04 leaves	04 leaves	04 leaves
3	Germination of seeds with leaves after 10 <sup>th</sup> day of sowing	10 leaves	08 leaves	06 leaves	04 leaves	04 leaves

(Average of 10 seed germination)

Table II depicts that number of leaves formed in *Vigna unguiculata* at control and at 0.01%, 0.1%, 1% and 2% chlorine water treatment. The observations were recorded on 3rd, 6th and 10th day of germination. Number of leaves on 3rd day of germination is same in control as well as chlorine water treated seeds. On 6th day germination, control seeds shows 6 leaves, 0.01% chlorine water treated seeds

have 6 leaves while 0.1%, 1% and 2% chlorine water treated seeds have 4 leaves each. On 10th day of germination, the control seeds shown 10 leaves, 0.01% chlorine water treated seeds shown 8 leaves, 0.1% treated seeds shown 6 leaves. The 1% and 2% chlorine water treated seed shown 4 leaves each. It is observed from above table that the chlorine water treated seeds shown less number of leaves as compared to control after 3rd day, 6th day and 10th day of germination. Cayanan et.al.(2009) observed growth reduction on shrubs like *Salix integra*, *Hydrangea paniculata*, *Pranus xcistena*, *Weigela florida*, *Physocarpus opulifolius* as response of container grown nursery plants to chlorine.

III : Effect of various concentrations of chlorine water on the length of seedling of *Vigna unguiculata*

No	Observation	Control cm	0.01% Chlorine water cm	0.1% chlorine water cm	1% chlorine water cm	2% chlorine water cm
1	Germination after 3 <sup>rd</sup> day of sowing	8.5	6.6	6.3	5.1	5.0
2	Germination after 6 <sup>th</sup> day of sowing	21.6	17.8	17.5	15.3	13.2
3	Germination after 10 <sup>th</sup> day of sowing	28.7	22.4	21.6	19.5	17.6

(Average of 10 seed germination)

Measurement of growth rate of young plants and seedlings are important in order to obtain information about early developmental processes in plants (Orbovic, V and Kieu K. 1996)

From the table III it is clear that the length of seedling is 8.5cm, 6.6cm, 6.3cm, 5.1cm and 5.0cm of control, 0.01% chlorine water treatment, 0.1%, 1% and 2% chlorine water treatment of *Vigna unguiculata* seeds on 3rd day of germination. Length of seedling in more in control condition than chlorine water treatment seeds of *Vigna unguiculata*. The length of seedling is affected by chlorine water. More the concentration of chlorine water, less is the length of seedling in the *Vigna*. Similar results are observed on 6th day of germination and 10th day of germination.

The low concentration (20%) of aqueous extracts of *Sargassum weightii* and *caulerpa Chemnitzia* promoted the seedling growth including the parameter seedling length by Sivasankari et. Al. 2006. According to Batlang, V. and Shushu, D. (2007) that sunflower leaf and root extracts reduced seedling growth in Bambara groundnut. They also noted that diluted extracts also inhibited seed germination and seedling growth in a concentration dependant manner, Present investigation also shows result similar to Batlang, U and Shashu, D, (2007) that chlorine water not only inhibits seedling growth but also higher concentration of chlorine water treatment further inhibits the seedling length i.e. seedling growth in *Vigna unguiculata*.

IV : Effect of various concentrations of chlorine water solution on root growth of *Vigna unguiculata* .

**Table- IV (Average of 10 seed germination)**

No	Observation	Control		0.01%		0.1%		1%		2%	
		Radicle length	No of rootlets	Radicle length	No of rootlets	Radicle length	No of rootlets	Radicle length	No of rootlets	Radicle length	No of rootlets
1	Germination after 10 <sup>th</sup> day of sowing	4.7 cm	22	4.5 cm	18	4.0 cm	15	3.1 cm	12	2.2 cm	08

Kopyra and Gwozdz (2003) found that Nitric oxide (NO) donor sodium nitroprusside (SNP) stimulates seed germination and root growth of lupin (Lupinus luteus). Kamoshita et al. (2002), Price and Tomos (1997), Price (2002), Tuberosa et al. (2002) are some of researchers who used root phenotype as one of the parameter for research. Root length and number of rootlets during seed germination is considered as one of the parameter to learn the effect of various concentration of chlorine water on seed germination of Vigna unguiculata.

It is observed from Table IV that the root length is 4.7cm with 22 rootlets in control seed germination of Vigna unguiculata on 10th day of germination. The root length is 4.5 cm with 18 rootlets when seeds are treated with 0.01% chlorine water. 0.1% chlorine water treated seeds of Vigna shown 4.0 cm root growth with 15 rootlets. The 1% chlorine water treated seeds of Vigna shown 3.1 cm root growth with only 12 rootlets. The 2% chlorine water treated seeds shown 2.2 cm root growth with 8 rootlets. Thus, it is clear that the chlorine water has inhibitory effect on root growth in Vigna unguiculata. Carrillo et. al. (1995) observed root length in Radish not negatively effected at 1:10000 dilution of Halox. Maurya and Lal (1981) observed significant effects of different mulch materials on the root growth and yield of Vigna unguiculata, Sivasankari et. al. (2006) noted stimulatory effect of seaweed extracts on the root growth of Vigna sinensis. Present observation shows inhibitory action of various concentrations of chlorine water over root length and rootlets in Vigna unguiculata seeds.

V : Effect of various concentrations of chlorine water solution on fresh weight and dry weight of Vigna unguiculata

No	Observation	Control		0.01%		0.1%		1%		2%	
		Fresh Water	Dry Water	Fresh Water	Dry Water	Fresh Water	Dry Water	Fresh Water	Dry Water	Fresh Water	Dry Water
1	Germination after 10 <sup>th</sup> day of sowing	16.1	4.8	14.2	3.64	14.6	3.76	12.6	3.15	10.4	2.3

(average of 10 seed germination)

A number of different weights of such as fresh weight ash free dry weight, air dry weight and oven dry a weight of plant may be used as growth parameters. (Young, 1945; Newcombe, 1949, 1950; Castenholz, 1960, 1961; Sladeckova, 1962).

In the present investigation the fresh weight and dry weight of 10 seedlings on 10th day of germination of Vigna unguiculata is 16.1 gm and 4.8 gm respectively under control condition. At 0.01% chlorine water treatment it is 14.2 gm and 3.64 gm. At 0.1% chlorine water treatment it is 14.6 gm and 3.76gm. At 1% chlorine water treatment it is 12.6gm and 3.15gm At 2% chlorine water treatment, it is 10.4 gm and 2.3gm. Thus, it is clear that the fresh weight and dry weight

goes on decreasing in chlorine water treatment over the control. The fresh weight and dry weight is least in 2% chlorine water treated seeds, Amador et al. (2002) studied comparative effects of NaCl and Polythelene glycol on germination, fresh weight and seedling growth of cowpea. He observed that reduced growth in treated seeds over control.

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