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Effect of Vermiwash and Humic Acid on the Germination and Growth of *Capsicum annum* L and *Abelmoschus esculentus.*

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ABSTRACT

The present study is undertaken to develop a formulation comprising of humic acid and vermiwash for the effective growth of seeds thereby determining their potential as plant nutritional supplement. The seeds used for the study are *Capsicum annum L.* and *Abelmoschus esculents* whose germination rates, root and shoot lengths were taken as parameters. An optimum soaking time for the effective growth of the seeds was determined, followed by finding the root and shoot lengths in different concentrations of humic acid and vermiwash. Growth was effective in the seeds of *Capsicum annum* L when the concentration of humic acid and vermiwash was 0.75: 3 while the seeds of *Abelmoschus esculents* showed maximum growth in 0.5: 5. This study effectively suggests the use of humic acid and vermiwash as supplements for the growth of the plants.

Keywords: *Humic acid, Vermiwash, Capsicum annum, Abelmoschus esculentus, seed germination*

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INTRODUCTION

The recent past has witnessed an increase in developing sustainable agriculture methods for the production of crops. The depleting soil nutrients also augmented the search towards alternate nutrient supplements preferably organic for their utilization in the growth of plants. The production and use of synthetic phytohormones poses difficulty in terms of economic difficulty and pollution caused and their effective functioning in all conditions seem to be ambiguous. This paved the way for the use of liquid fertilizers like vermiwash derived from vermicompost, organic manure. Vermicompost is shown to display great prospective as plant growth media [1-3]. The main attribute of processing the compost using earthworms is that the nutrients produced in the conversion process are more readily taken up by plants hence making it a sought after option for the growth of the plants [4]. As reported by Kale (1998) the vermiwash also contains enzymes and secretions of earthworms and would stimulate the growth and yield of crops [5]. Another interesting and possible nutrient is the humic acid which is now looked upon as a plant growth supplement. It is known to improve soil fertility, increase the water holding capacity thereby affect the plant growth and yield. It also helps the plants to resist droughts and stimulates seed germination [6]. Previous study on the use of humic acid for plant growth has been demonstrated by Prakash et al (2009) where in humic acid was produced biologically by *Trichoderma viridi* and also reported its growth promoting activity on sorghum plant [7]. In view of the advantages posed by humic acid and vermiwash as growth supplements for plants, the present study is undertaken to study the combined effect of these nutrients on the growth of *Capsicum annum* L. and *Abelmoschus esculentus*.

MATERIALS AND METHODS

Collection of Lignite

Lignite sample was collected from Neyveli Lignite Corparation ltd., Neyveli, Tamilnadu, India. The sample was powdered by Mortar and Pestle and sieved (≤2mm). The powdered sample was packed in polythene bag and stored at room temperature for further studies.

Preparation of Humic acid

Humic acid was prepared by adding 1 N KOH solution (100 ml) to 7.5 g of lignite and mixed with magnetic stirrer for 30 min followed by filtration using Whatman filter paper 12. The filtrate was acidified by conc HCL to obtain the precipitate which was further filtered and dried to obtain humic acid.

Effect of Vermiwash and Humic acid on seed germination of *Capsicum annum L.* and *Abelmoschus esculentus*

The seeds were purchased from local market and healthy seeds were selected for this study. Ten seeds were soaked in sterile distilled water and treated with various concentrations (1%, 2%, 3%, 4% and 5%) of Vermiwash (obtained from vermicompost) for various time intervals (10 min, 20 min, 30 min, 40 min, 50 min and 60 min). All the treated seeds were placed in sterile petri dishes containing a thin layer of wet cotton covered with wet filter paper. Seeds germinated in distilled water served as control.

Combined effect of Vermiwash and humic acid on the germination of *Capsicum annum L.* and *Abelmoschus esculentus*

Various combinations of Vermiwash with humic acid percentage was formulated (1: 0.1, 2: 0.25, 3: 0.5, 4: 0.75 and 5:1). Seeds were treated in this formulated vermiwash for 20 mins. These seeds were grown in petri dishes using sterile water. The growth of seeds was periodically checked for germination rates and other parameters namely shoot and root length. Seeds germinated in distilled water were used as control.

RESULTS AND DISCUSSION

Modernization of agricultural practices in terms of using pesticides, fertilizers, growth regulators etc has led to increased production of crops. But prolonged exposure of these chemicals in the soil has led to depletion of soil nutrients and increased pollution making these kind of methods non-preferable in the long run. Therefore, looking for organic materials that can act as nutrients for the growth of plants has led to the

present study that focuses on the use of humic acid and vermiwash, both naturally produced for the growth of *Capsicum annum L.* and *Abelmoschus esculentus*.

Table 1: Germination rate of *Capsicum annum L* seeds when soaked in humic acid and vermiwash

Concentration		Germination %					
		Soaking Time (min)					
		10	**20**	**30**	**40**	**50**	**60**
Humic acid %	0.1	60	80	70	70	50	60
	0.25	70	90	60	60	70	50
	0.5	70	90	70	80	60	60
	0.75	80	90	70	60	60	70
	1.0	60	90	80	60	70	70
Vermiwash (%)	1	50	90	70	70	60	60
	2	60	90	70	70	70	60
	3	80	90	70	70	70	60
	4	80	80	80	60	60	80
	5	60	80	80	70	80	70

From the above table, it is understood that humic acid and vermiwash had significant influence on the growth of the seeds compared to that of control. The control seeds showed a germnination rate of 70 % after 60 min while the seeds soaked in humic acid and vermiwash separately showed 90 % germination by soaking the seeds for 20 min. It is noticed that time of soaking influenced the germination rate more than the concentration of humic acid and vermiwash used in the current study. As the soaking time increased, there is decrease in the germination rate indicating that increased exposure to humic acid and vermiwash reduced the germination rate of seeds germination.

Table 2: Germination rate of *Abelmoschus esculentus* seeds when soaked in humic acid and vermiwash

Concentration		Germination %					
		Soaking Time (min)					
		10	**20**	**30**	**40**	**50**	**60**
Humic acid %	0.1	70	100	80	80	70	70
	0.25	70	90	70	70	70	70
	0.5	80	90	70	80	80	80
	0.75	80	90	70	70	70	80
	1.0	70	90	90	70	80	70
Vermiwash (%)	1	60	80	80	80	70	80
	2	60	90	90	80	80	70
	3	90	80	90	70	80	70
	4	90	80	90	70	70	80
	5	80	90	90	70	90	60

Table 2 provides the germination rates of the seeds of *Abelmoschus esculentus* when soaked in humic acid and vermiwash separately using water as control. Positive influence of humic acid and vermiwash has been observed on the germination of seeds compared to that of control. The seeds when soaked in humic acid for 20 min under the mentioned concentrations showed 90 % germination while the seeds soaked in water showed only 60 % germination after the same time. Similarly, 30 min soaking time was sufficient which brought 90% germination in all concentrations of vermiwash used. Prolonged exposure didn't show significant influence on the germination rates.

Similar results were obtained in a study where in the vermiwash was found to increase the germination and growth rate of cow pea and rice [8]. When compared with the growth factors namely

Gibberelic acid and Naphthalene acetic acid, vermiwash was found to enhance growth in the *Abelmoschus esculentus* thereby suggesting this to be a suitable supplement for growth [9].

Combined effect of humic acid and vermiwash on the root and shoot lengths:

Various combinations of humic acid and vermiwash were formulated to determine the best concentration for the growth of *Capsicum annum* L. (Table 3) and *Abelmoschus esculentus* (Table 4) seeds. Seeds were grown in different concentrations of humic acid (0.1, 0.25, 0.5, 0.75, 1 %) and vermiwash (1, 2, 3, 4, 5%) to study the influence of these supplements which is provided in terms of root and shoot length.

Table 3: Combined Effect of Humic acid and Vermiwash on the root and shoot length of *Capsicum annum* L. seeds

Conc of Humic acid (%)	Conc of Vermiwash (%) and the corresponding average Root length (R) and Shoot Length (S) values									
	1		2		3		4		5	
	R	S	R	S	R	S	R	S	R	S
0.1	1.22	0.24	0.2	0.04	0.16	0	0.86	0.14	**3.06**	**0.82**
0.25	1	0.22	0.52	0.1	1.18	0.44	**3.04**	**0.7**	1.96	0.5
0.5	1.86	0.5	**1.98**	**0.52**	1.16	0.28	1.12	0.18	1.42	0.26
0.75	0.72	0.26	1.68	0.34	**3.44**	**0.86**	3.2	0.9	3.26	1.02
1	**1.86**	**0.44**	1.48	0.36	1.74	0.36	0.72	0.18	1.42	0.26

Table 4: Combined Effect of Humic acid and Vermiwash on the root and shoot length of *Abelmoschus esculentus* seeds

Conc of Humic acid	Conc of Vermiwash (%) and the corresponding average Root length (R) and Shoot Length (S) values									
	1		2		3		4		5	
	R	S	R	S	R	S	R	S	R	S
0.1	**4.1**	**2.1**	3.6	1.34	0	0	2.02	1.54	2.88	0.9
0.25	3.66	2.08	1.84	1.3	2.26	1.64	**3.8**	**1.74**	2.1	1.8
0.5	3.42	1.9	3.7	1.86	3.96	2.82	4.2	1.58	**4.46**	**3.1**
0.75	2.16	0.72	3.98	0.66	2.52	0.8	3	0.72	**4.9**	**1.38**
1	**4.36**	**2.42**	3.08	2.46	1.94	0.76	2.92	1.6	1.6	2.14

From these tables, it is identified that the effect of different concentrations on the root and shoot length was quite varied. Uniform effect was not noticed in either of the seeds used. The seeds of *Capsicum annum* L showed maximum root and shoot length with humic acid and vermiwash in the ratio of 0.75: 3 where the average root length was found to be 3.44 cm and shoot length was found to be 0.86 cm. The seeds of *Abelmoschus esculentus* showed maximum root and shoot lengths when humic acid and vermiwash was in the ratio of 0.75 : 5 where the average root length was found to be 4.9 cm while the average shoot length was found to be 3.1 cm.

Vermiwash was earlier reported to promote the germination and seedling growth in terms of root and shoot length in a study on vegetable crops conducted by Fatima and Sekhar [10]. A field level experiment was also conducted where in Zea mays was grown using vermicompost and vermiwash as biofertilizer. It was observed that the Zea Mays leaves production increased upon increased application time [11]. Gorakh Nath et al (2009) reported that the vermiwash of various combinations of animal, agro and kitchen wastes have better growth and productivity of crops [12]. The use of humic acid as a growth supplement was earlier demonstrated by this studies conducted by Prakash et al (2014). The seed germination rate of *Raphanus sativus* was found to increase in the presence of humic acid (0.25%) [13]. Likewise, *Spirulina plantensis, Pleurotus florida, Stevia rebaudiana* and *Morus alba* were also found to show an enhanced growth when humic acid was used as a media component[14,15,16]. The capability of humic acid extracted using chemical and biological methods using alkaline solution (KOH or NaOH) and *Trichoderma viride* from lignite was studied Prakash et al. and used for growth of Sorghum seeds [7,17]. Further, studies were carried out to optimize the

media for the production of humic acid using RSM methodology and study its effect on the growth parameters of *Vigna mungo [*18]. The potential of humic acid as seaweed liquid fertilizer on the growth of *Arachis hypogaea* was evaluated and it was noticed that there is significant improvement on the growth, biochemical and yield characteristics of Groundnut in presence of humic acid [19].

CONCLUSION

The present investigation reported the use of humic acid and vermiwash in different concentration and studied their effect on the growth of *Capsicum annum* and *Abelmoschus esculentus* seeds. Optimum concentration for the growth of *Capsicum annum* was found to be was 0.75: 3 (humic acid and vermiwash) while the seeds of *Abelmoschus esculents* showed maximum growth in 0.5: 5 (humic acid and vermiwash). Therefore this study reiterates the use of humic acid and vermiwash as noteworthy supplements for the growth of plants.

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