



Effects of Vermicompost in remediation of Chlorpyrifos in *Tagetes* *sps.*

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ABSTRACT

The application of vermicompost to improve the properties of soil has been an established technology. It is to meet the requirement of good plant growth and cost-effective recovery. Therefore the aim of this study has been to investigate the comparative effect of different proportion of vermicompost mixed with plain soil on *Tagetes* *sps.* Different growth parameters viz. germination index, plant height, and size of internodes have been analyzed. The standard evaluation as designed in Edward & Burrow (1988) has followed. In the present investigation highest germination percentage, plant length and size of internodes have been recorded. It has also found that all the selected growth parameters of *Tagetes* *sps.* showed significant improvement in vermicompost treated soil over control soil. The present investigation revealed that the supplementation of vermicompost to soil greatly enhances the yield and reduces the adverse effects of Chlorpyrifos in the plants under studies.

Keywords: Vermicompost, Chlorophyll, Dry weight, Germination

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Introduction

Tagetes *sps.* is an important ornamental plant used in Hindu rituals and other decorations. It has got medicinal importance as it contains Carotenoid mainly lutein. The extract of this plant is also used as anti-oxidant oil. Dye extracted from this plant is used as a natural dye in textile industry. Due to its economic value the plant is cultivated all over India in large scale. Various types of agricultural practices are used to improve the quality and quantity of the plant. It is known that extensive agricultural practices have led to conversion

of soil to toxic nature. *Tagetes* *sps.* encounter such toxicity of the soil. One of the biggest causes of the toxicity of the soil is intensive use of pesticide such as Chlorpyrifos. It is known that during spraying of pesticides most of the pesticides fall on the ground and form residual molecules in the soil. The residual molecules remain active in the soil for various period of time. The soil during cropping affects each and every aspect of plant growth and development. Vermicompost is known to influence plant growth and development in large number of plants (Chan & Griffith,1988; Edward & Burrow,1988; Wilson & Carlisle,1989; Mba,1996; Buckerfield & Webster,1998,1999 ; Atiyeh *etal.* 2000a,b,2002; Arnacon, 2005; Bachman,2008; Azarmi, 2009). It is also known that vermicompost helps in remediation of certain toxic ingredients present in the soil (Boonyapookma *etal.*, 2005; Shweta *etal.*, 2004; Ciura *etal.*, 2005; Schnoor,1997; Yong *et al.*, 2005; Haddi, 2011). Plants such as Indian Mustard (*Brassica juncea*), Corn (*Zea mays*); Sunflower (*Helianthus annuus*) show high tolerance to heavy metals and therefore these are used in phytoremediation studies (Pilon Smits,2005;S Chimdt, 2003; Tang *etal.* 2003). Producing plant species to remove heavy metals such as Zinc and Copper as well as several radio nuclides from contaminated environment (Nehnerajova *etal.* 2005) has been examined. (Ximenaz - embun *etal.* (2001) also describes that sunflower plant is effective in removing Pb, Cr , Zn, Cd and Ni.

During present investigation an attempt has been made to study the impact on growth and development of *Tagetes* *sps.* in presence of vermicompost. Attempt has also been made to study the impact of vermicompost when the host plant is grown in presence of different concentration of Chlorpyrifos.

Materials and Method

1. **Soil used**-Garden soil has been used continuously for studying growth and development. This was cleaned properly to eliminate undesirable materials. The soil was used in various category as –
 - (i) Plain soil
 - (ii) Plain soil mixed with vermicompost
 - (iii) Plain soil with different concentration of pesticides (Chlorpyrifos)
 - (iv) Plain soil mixed with vermicompost and different concentration of pesticides.

Atiye *etal.* (2001) have suggested that when 10%-15% of vermicompost is mixed in the soil. It suggests best growth and development of the treated plant. In the present study 12.5% of vermicompost was used. In 1.75 Kg. of pre cleaned dried and plain garden soil was mixed to 0.25 Kg. of vermicompost obtained from commercial source.

2. **Test plant** – Seeds of certified nature was obtained from commercial source.
3. **Chlorpyrifos**- This was obtained from commercial source. Its different concentrations (05%, 10% & 15%) were prepared by mixing it in different type of soil.
4. **Method of Sowing**- Seeds was sown at marked places in the earthen pots, 05 c. m. below the top soil keeping a proper distance between the two seeds.
5. **Period of work**: January to May **Year**: 2021
6. **Place**: Post graduate Department of Botany and Department of Biotechnology, Maharaja College, Ara.

RESULT AND DISCUSSION

Effects of Chlorpyrifos on germination of *Tagetes sps.* with and without vermicompost.

Ten seeds of *Tagetes sps.* were placed at different marked places in an earthen pot. Sowing was done 5.44 cm below the top soil to augment germination. Water was sprinkled occasionally to favour germination. The concentration of Chlorpyrifos used was 05%, 10% and 15%. The entire set of experiment were arranged in two groups i.e. one without vermicompost and the other with 12.5% of vermicompost. The observations were made at regular intervals and recorded in Table:1

Table 1

On the review of Table 1, it appears that in presence of vermicompost there has been increase in the rate of germination to the extent of 60% after 04 days of sowing of seeds. This value becomes 12.5% after 6 days and 11% after 8 days of sowing of seeds. The vermicompost reduces the adverse effects of Chlorpyrifos as in presence of 05% of Chlorpyrifos the rate of germination remains the same after 04 days i.e. there is neither increase nor decrease in germination. Whereas without vermicompost a decrease of 20% has been reported with same concentration of Chlorpyrifos. The similar one is with the adverse effects of Chlorpyrifos has been found as use of vermicompost decreases the adverse effect of chlorpyrifos up to 16.66% after 06 days and 28.57% after 08 days of sowing of seeds. Whereas without vermicompost there is decrease in germination up to 25% and 22% after 06 days and 08 days of showing. The similar trend has been seen with 10% of Chlorpyrifos with vermicompost i.e. 16.66% after 06 days. Without vermicompost the inhibitory effect of Chlorpyrifos is same as in case of 05%. These inhibitory effects in 15% of Chlorpyrifos have been reduced by vermicompost up to 40% in 06 days and 50% after 08 days of showing. Without vermicompost inhibition of Chlorpyrifos is 37.5% and 33.33% after 06 and 08 days of showing. The presence of vermicompost in the medium has been proven to be

supportive to germination as in concentration of 15% of Chlorpyrifos none of the seeds has been germinated in the absence of vermicompost but in presence of vermicompost germination has been seen. The highest germination percentage was also observed in radish grown in vermicompost treated soil compared to the control soil (Bucker field, *et al.*, 1999).

These plants of *Tagetes sps.* after onset of germination were allowed to grow under the same environmental conditions and the plant height was recorded after different periods of time and has been recorded in Table 2.

Table 2

Effect of Chlorpyrifos on plant height of *Tagetes sps.*

On the review of Table 2, it appears that in presence of vermicompost there has been an increase in the rate of growth in height of plant to the extent of 50% after 20 days of germination. This value becomes 109.6% after 40 days and 129% after 60 days of germination. The vermicompost also reduces the adverse effects of Chlorpyrifos. In presence of 05% of Chlorpyrifos with vermicompost the rate of increase in height enhance 105.8% after 20 days. Whereas without vermicompost a decrease of 16 % in height has been reported with same concentration of Chlorpyrifos. The similar one is with the adverse effects of Chlorpyrifos has been found as use of vermicompost decreases its adverse effect up to 53.8% after 40 days and 55% after 60 days of germination of seeds. Whereas without vermicompost there is decrease in rate of growth of plant height up to 16% and 09% after 40 days and 60 days respectively of germination of seeds. The similar trend has been seen with 10% of Chlorpyrifos with vermicompost i.e. an increase of 12.5% after 20 days, 121% after 40 days and 85% after 60 days of germination. Without vermicompost the inhibitory effect of Chlorpyrifos is 46.6% after 20 days, 54.8% after 40 days and 43.6% after 60 days of germination have been reported. These inhibitory effect in case of 15% of Chlorpyrifos with vermicompost have been found remain same after 20 days of germination as there is neither increase nor decrease but an increasing trend has been reported as 121% after 40 days and 77.6% after 60 days of germination. Without vermicompost inhibition of Chlorpyrifos is 37.5% and 33.33% after 40 and 60 days of showing. Hadi *et al.*, (2011) has observed that, the height of *Matricaria chamomomile* plant significantly increased when vermicompost was applied at the rate of 20 t/ha. The increase in height of maize plant was also recorded by Gutierrez - Miceli *et al.*, (2008) when grown in soil mixed with vermicompost. In presence of vermicompost length of inter node of plant has a direct bearing upon the height of the plant in order to assess this parameter of growth and development. The size of the inter node was constantly measured and has been described in Table 3.

Table 3

Effect on the average length of internodes of *Tagetes sps.*

On the review of Table 3 it appears that in presence of vermicompost there has been an increase in the rate of growth in length of internodes of plant to the extent of 87% after 20 days of germination. This value becomes 112.5% after 40 days and 103% after 60 days of germination. The vermicompost also reduces the adverse effects of Chlorpyrifos. In presence of 05% of Chlorpyrifos the rate of increase in length of internodes enhance 84% after 20 days with vermicompost. Whereas without vermicompost a decrease of 23% in length of internodes been reported with same concentration of Chlorpyrifos. Similar kind of adverse effect of Chlorpyrifos has been found as use of vermicompost decreases its adverse effect up to 58% after 40 days and 44% after 60 days of germination of seeds. Whereas without vermicompost there is decrease in rate of growth of length of internodes up to 23% and 22% after 40 days and 60 days respectively of germination of seeds. The similar trend has been seen with 10% of Chlorpyrifos with vermicompost i.e. an increase of 369% after 20 days, 156.6% after 40 days and 129% after 60 days of germination. Without vermicompost the inhibitory effect of Chlorpyrifos has been 78% after 20 days, 53% after 40 days and 48.5% after 60 days of germination. A similar trend has been seen in case of 15% of Chlorpyrifos. The adverse effect of Chlorpyrifos has been reduced up to 96% after 20 days, 83% after 40 days and 81% after 60 days of germination when vermicompost has been used. Without vermicompost inhibition of Chlorpyrifos is 100%, 68.7% and 44% after 20, 40 and 60 days of showing of seeds. Hadi *et al.*, (2011) have observed that, the length of internodes of *Matricaria chamomile* plant significantly increased when vermicompost was applied at the rate of 20 t/ha. The increase in of maize plant was also recorded by Gutierrez - Miceli *et al.*, (2008) when grown in soil mixed with vermicompost. In presence of vermicompost length of inter node of maize plant has a direct bearing upon the height of the plant in order to assess this parameter of growth and development. The size of the inter node was constantly measured and has been described.

Conclusion & acknowledgement

Supplementation of nutrients to a soil is considered as a good practice for agriculture but it should not be deficient in some of the essential scientific parameters.. Therefore it is necessary to arrange complementary resources which can be long acting and minimize the use of chemical fertilizers and pesticides. Present study revealed that by use of vermicompost rate of seed germination has been found to increase. It also increased the length of plant that direct the more surface area for emergence of leaf, flower and pod. This study also indicates

that vermicompost reduces the adverse effects of Chlorpyrifos a pesticide. This finding has been supported by several researchers who noticed that growth and development of plants is due to the presence of humic acids (Arancon *et al.*, 2005).

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Table 1*: Effect of Chlorpyriphos on germination of *Tagetes sps.*

No. of Days Treated	Without Vermicompost				With Vermicompost			
	Without Chlorpyriphos	With Chlorpyriphos			Without Chlorpyriphos	With Chlorpyriphos		
		5%	10%	15%		5%	10%	15%
4	5	4	4	0	8	4	5	1
6	8	6	6	5	9	7	7	7
8	9	7	9	6	10	9	9	9

*Average value of three sets of Experiment

Table 2*: Effect of Vermicompost on plant height of *Tagetes* *sps.* when grown in different concentration of Chlorpyrifos.

No. of Days Treated	Height of plant in c.m. (Without Vermicompost)				Height of plant in c.m. (With Vermicompost)			
	Without Chlorpyrifos	With Chlorpyrifos			Without Chlorpyrifos	With Chlorpyrifos		
		5%	10%	15%		5%	10%	15%
20	3	1.7	1.6	1	4.5	3.5	1.8	1
40	6.2	5.2	2.8	2.5	13	8	6.2	5.7
60	11	10	6.2	5.8	25.2	15.5	11.5	10.3

*Average value of three sets of Experiment

Table 3*: Effect of vermicompost on average length of inter node of *Tagetes* *sps.* when grown on plain soil and under various concentration of Chlorpyrifos.

No. of Days Treated	Height of plant in c.m. (Without Vermicompost)				Height of plant in c.m. (With Vermicompost)			
	Without Chlorpyrifos	With Chlorpyrifos			Without Chlorpyrifos	With Chlorpyrifos		
		5%	10%	15%		5%	10%	15%
20	03	2.3	0.65	00	5.6	4.23	3.05	0.2
40	3.2	2.45	1.5	01	6.8	5.15	3.85	1.1
60	3.4	2.65	1.75	1.9	6.9	5.27	4.02	1.3

*Average value of three sets of Experiment