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ResearchArticle

PESTICIDE ACTIVITY OF CALENDULA / MARIGOLD THROUGH VERMICOMPOSTING

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ABSTRACT

Objective: The objective pesticide activity of Calendula/ marigold was investigated through vermi composting technique. **Methods:** Marigold waste and vegetable waste were collected from koyembedu market. The waste was degraded by Eisenia fetida (Lumbricidae) earthworms. After 60 days NPK levels were checked by FCO method. Marigold fertilizer showed antimicrobial activity against plant pathogenic bacteria(Pseudomonas syringae, Erwinia carotovora, Xanthomonas citri).Spinach seeds were sowed in the soil containing vermicompost(vegetable fertilizer and marigold fertilizer).**Results:** NPK levels were found to be increased by 60% and 75% respectively. A zone of inhibition was formed by marigold fertilizer on Pseudomonas syringae and Erwinia carotovora. During the period of study, data were collected on reproductive strategies of earthworms and the number of earthworms was found to be increased. Spinach grows well without any disease using marigold fertilizer, which shows marigold may be having pesticide activity.**Conclusion:** From the results we concluded that marigold waste after degradation has the ability to control plant pathogens as well as a good fertilizer with low cost and protect the environment.

Keywords: Antibacterial activity ,Calendula officinalis, Eisenia fetida, Pseudomonas syringae, Erwinia carotovora, Xanthomonas citri.

INTRODUCTION

Earthworms belonging to Phylum Annelida, Class Clitellata, and Order Haplotaxida occupy a unique position in animal kingdom. They are the first group of multicellular, eucoelomate invertebrates who have succeeded to inhabit terrestrial environment. They form major soil macrofauna. Their species richness, abundance, and distribution pattern reflect on edaphic and climatic factors of the geographical zone. They serve as bio indicators to understand the physicochemical characteristics of their habitat. Distinctive habitat, food niches, and adaptive mechanisms of earthworms have opened up new fields for investigations on their role in organic waste management. One of the advantageous factors in this field is the use of earthworms to minimize the degradable organic matter and to use the same as bio resource for organic manure production. Eisenia earthworms are used for producing the organic manure, "vermicompost" [1] The manure produced serves as good source of soil amendment. The ecologically distinguished Eisenia earthworms are used for producing the organic manure, "vermicompost" This has gained attention of garden lovers, agriculturists, and agro industries to convert organic matter generated at different levels into rich, odourless, free flowing compost to support sustainable agriculture. Earthworms form one of the major macro fauna among soil biota to maintain dynamic equilibrium and regulate soil fertility[2]. Their existence depends on adequate moisture, soil texture, pH, electrolyte concentration, and food source in the given ecosystem. Calendula officinalis, commonly known as pot marigold, is an annual herb and belongs to Asteraceae family.. Alpha-therthienyl is recognized as one of the most toxic. This sulfur containing compound is abundant in marigold tissues, including roots . It has nematicidal , insecticidal, fungicidal, antiviral & cyto toxic activities [3].The leaves, blossoms and buds are used to make a homeopathic remedy. It is used internally in order to speed the healing of wounds. Only the common deep orange flowered variety is considered to be of medicinal value. The whole plant, but especially the flowers and the leaves, is antiphlogistic, antiseptic, antispasmodic, aperients , astringent, cholagogue , diaphoretic, emmenagogue, skin, stimulant and vulneary. Antibacterial properties of marigold flowers and mother homeopathictinctures of C. officinalis and Calendula arvensia have been evaluated [5] The sap of different organs of Calendula sp. has been studied for antimicrobial activity [6]various vermicompost samples for their fungal communities that can inhibit soil borne pathogenic bacteria, or even for production of various secondary metabolites. Generally, gardeners plant marigold in their vegetable gardens to protect vegetables from the pests(fig.1). Marigold plant produce a number of potentially bioactive compounds, among which Insect repelling properties of marigold are not scientifically proven yet. Spinach is one of the vegetable which comes under "Dirty Dozen". That proves, spinach can't grow without any disease absence of using any pesticide. The spinach grows well without any disease using marigold fertilizer. That shows marigold may be having a pesticide activity. Companion planting is standard recommendation for growing vegetables. One of the most commonly recommended plants for this is the marigold, which is supposed to be good for preventing various pests from eating the vegetables [4]

Fig 1: Marigold plant around the garden.

Pseudomonas:

Pseudomonas syringae is a rod shaped bacteria and gram negative with polar flagella, as a plant pathogen.It causes bacterial leaf spot in leafy greens.

Erwinia carotovora

It is a rod shaped bacteria.It causes bacterial spot rot in leafy greens..

Xanthomonas citri

It is a rod shaped bacteria.It causes citrus canker.

Methods: Earth worms *Eisenia fetida* were collected from a river bank.The marigold wastes and vegetable wastes were collected from

koyambedu market.The ideal temperature for the worm bin is 50 to 75 degrees Fahrenheit, or 12.8 to 23.9 degrees Celsius. vermin sheds were prepared using plastic trays (15*10*10 cm) with lids.Put the spores in the base of the tray and the lid to eliminate excess amount of water and for air flow. Shred up newspaper for bedding. Soak the bedding with water. Sprinkle soil in the plastic trays, which introduce artificial microorganisms. Gritty soil particles also aid the worms' digestive process. Put an even layer of marigold waste on the top of the soil. Close the lid and wait for 10 days. Allow the materials to compost after ten days introduced the worms into the bin. Ten Earthworms were introduced into each tray. (fig.2)

Fig. 2: Earthworms introduced into the tray.

The bedding was kept moisture throughout the experiment by regular watering.The experiment was terminated on the 60th day and the vermicompost produced by the worms are harvested. [7].The parameters such as pH, the nutrients were analyzed. Comparison between T1 & T2.

Anti-microbial activity

The antimicrobial activity of the sample was evaluated by agar well diffusion method[8]. Bacteria were grown in Muller Hinton broth to match the turbidity of 0.5 McFarland standards to be inoculated on Muller-Hinton agar. After inoculation, plates were dried for 15min, and the wells were punched using sterile cork borers. Once wells were formed, they were filled with 100 µL of compost extract and blanks . Commercially available gentamycin (10 µg) discs were used as a positive control in this study. Plates were incubated for 24 h at 37 °C to allow leaf extracts to diffuse through the agar media to form zones of inhibition. The diameters of the zone of inhibition for different leaf extracts against different bacteria were measured in millimetre for further analysis. An agar well (6 mm) showing no zone of inhibition was considered as no antimicrobial activity.

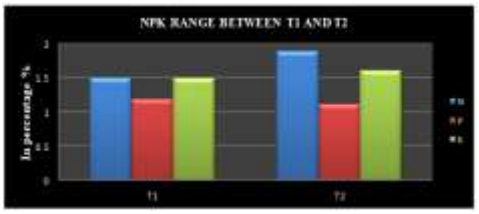
RESULTS

Vermicomposting is the Biodegradation system.[9]The parameters were analyzed for T1 & T2. T1 consist of vegetable wastes. Its gives a 60% NPK range. T2 consist of marigold wastes. Its gives a 75% NPK range. The number of earthworms and the weight of the earthworms are calculated.

Table 1 : Macro And micronutrients of the vermicompost.

S.NO	PARAMETERS	UNITS	T1	T2	SPECIFICATION
1	Moisture	%	18.93	18.23	15.0-25.0
2	Colour	-	Black colour	Black colour	Dark brown to black
3	Odour	-	Absence of foul odour	Absence of foul odour	Absence of foul odour
4	Bulk density	G/cm2	0.82	0.79	0.7-0.9
5	Total organic carbon	%	18.6	21	Minimum 16.0
6	Total nitrogen(as N)	%	1.5	1.9	Minimum 0.5
7	Total phosphorus(as P)	%	1.2	1.1	Minimum 0.5
8	Total potash(as k2o)	%	1.5	1.6	Minimum 1.0
9	C:N ratio	-	18:01	18:01	20:1 or less
10	pH	-	6.54	6.78	6.5-7.5
11	Conductivity	Dsm-1	3.8	2.7	Not more than 4.0
Heavy metals					
12	Zinc as zn	Mg/kg	242	264	Max 1000.00
13	Lead as pb	Mg/kg	69.12	67.5	Max 100.00
14	Chromium as cr	Mg/kg	21	20.79	Max 50.00
15	Copper as cu	Mg/kg	155.43	153.76	Max 300.00

Graph 1: NPK range between T1and T2 (T2 has a high level of NPK).



Graph 2 . Range of heavy metals (T2 has a normal level of heavy metals than T1).

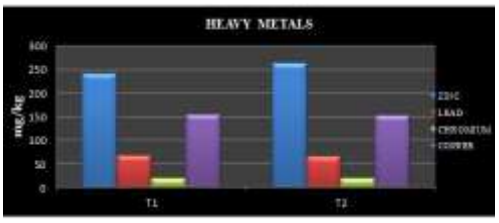
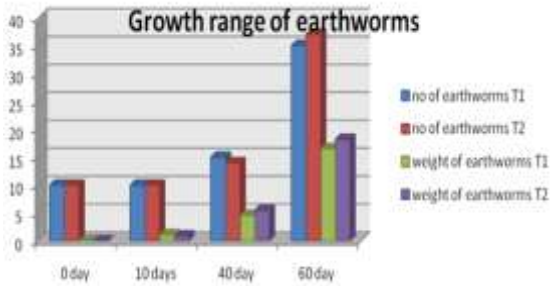


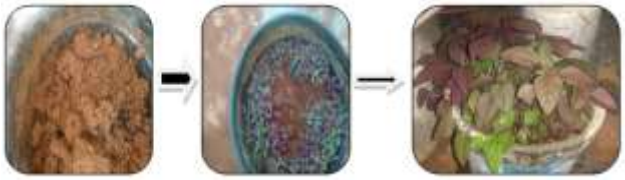
Table 3: Growth range of Earthworms

Duration	No Of Earthworms		Weight Of Earthworms (Gm)	
	T1	T2	T1	T2
0 day	10	10	0.9-11	0.9-11
After 10 days	10	10	1.1	0.9
After 40 days	15	14	4.6	5.5
After 60 days	35	37	16.5	18.2

Graph 3: Growth range of Earthworms (number and weight of the earthworms were gradually increased in T2).



Growth of spinach

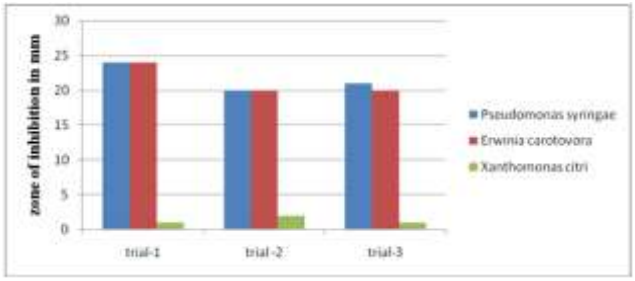


Antimicrobial activity

Table4: zone of inhibition formed by marigold fertilizer on different test bacteria

		Zone of inhibition in mm		
S.no	**Culture**	**Trial-1 mm**	**Trial-2 mm**	**Trial-3 mm**
1	*Pseudomonas syringae*	24	20	21
2	*Erwinia carotovora*	24	20	20
3	*Xanthomonas citri*	1	2	1

Graph 4: zone of inhibition formed by marigold fertilizer on different test bacteria



DISCUSSION

NPK range of the two vermicomposts is equally same. Marigold compost has a high NPK range when compared to vegetable compost. We have planted spinach in one pot using marigold compost and another pot using vegetable compost. Spinach is one of the vegetables which comes under "Dirty Dozen", that proves, spinach can't grow without any disease absence of using any pesticide. In the present study, spinach grows well without any disease using marigold fertilizer. [10] That shows marigold may be having a pesticide activity. We analyzed the antimicrobial activity of the marigold of the plant pathogenic bacteria. That shows the antimicrobial activity against plant pathogenic bacteria.

CONCLUSION

This study offers a simple and economical alternative through vermicomposting to resolve the management of marigold waste [10] .For this project, we got a good fertilizer through vermicomposting as well as a good pesticide.

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