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RESEARCH ARTICLE

STUDIES ON THE EFFECT OF THREE AGRICHEMICAL ON THE GROWTH OF EISENIA FETIDA IN EARTHEN POTS

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ABSTRACT

To assess the toxic effects of three agrichemicalon earthworm Eisenia fetida to soil supplemented with different concentrations of the examined agrichemicalbased on the recommended agricultural doses. Their commercial formulations are: Glyphosphate [N-(phosphonomethyl)glycine],Kamdhenu paudh vardhak, Cypermethrin {[Cyano-(3-phenoxyphenyl)methyl]3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-1-carboxylate} The test was conducted in earthan pots . All our findings indicated that E. fetida has a higher rate of growth . The effect of high concentration of pesticides effects growth of E. fetida. Results indicated that majority of farmers opted for vermiculture due to environmental consciousness, to save the soil health and for the upliftment of their status.

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INTRODUCTION

India traditionally has an agricultural based economy and it is considered to be the backbone of Indian economy. Agricultural sector employs approximately 55% of the total workforce. The total share of agriculture and allied sectors (including agriculture, livestock, forestry and fishery sub sectors) in terms of percentage of gross domestic product (GDP) is 16.96% and 10% of export earnings. For the 12th five year plan (2012-17), a growth target of 4% has been set for the agriculture sector. Total food grain production in the year 2015-16 was 252 million tonnes. As of today, India supports 18% of world's population on 4.2% of world's water resources and 2.3% of global land. India's per capita availability of resources is about 4 to 6 times less as compared to world average. This will decrease further due to increasing demographic pressure and consequent diversion of the land for non-agricultural uses. The present cropping intensity of 136% has registered an increase of only 25% since independence. Further, rain fed dry lands constitute 65% of the total net sown area. India's arable land area of 159.7 million hectares (394.6 million acres) is the second largest in the world, after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world (Agricultural Situation in India, 2015). India is among the top three global producers of many crops, which includes wheat, rice, pulses, cotton, peanuts, fruits and vegetables. In addition to growth in total output, agriculture in India has shown an increase in average agricultural output per hectare in last 60 years. India's recent accomplishments in crop yields while being impressive, are still just 30% to 60% of the best crop yields achievable in the farms of developed as well as other developing countries

Pesticides use and trends in India: India, second largest populated country of the world, currently supports nearly 17.84% of the world population having 2.4% land resources and 4% of water resources. To meet the demands of growing population, the country needs to raise its agricultural production to provide food as well as nutrition security. Good emerging trends and solutions for sustainable crop protection through use of time tested agrochemicals, seed treatment, agronomy and bio-technological development have raised the quantity and quality of agricultural production. It is important to note that about 15-25% potential crop production is lost due to insect pests, weeds and diseases. India today imports substantial quantities of pulses and oilseeds on a regular basis and sugar as well as other products. Such imports for longer term can not be afforded by our nation. For ensuring farmer's welfare, self reliance and increasing the agricultural production is the need of the hour. Increasing pest attacks in crops is one of the major challenges in enhancing the output in terms of quality and quantity.

At present, per hectare consumption of pesticides in India is amongst the lowest in the world and stands at 0.6 kg/ha against 5-7 kg/ha in the UK and 13 kg/ha in China.

MATERIALS AND METHODS

Earthworms are pivotal to achieve organic farming. They modify soil organic matter both chemically and physically, mix leaf litter with the soil, facilitate the formation and stabilization of soil aggregates and improve soil porosity. They are ideal test organisms for soil risk assessment due to their high biomass in soil and frequently observed sensitivity to relatively low concentrations of environmental toxicants.The vermicompost soil was collected from the vermicompost unit in St. Aloysius college , Jabalpur, Madhya Pradesh.

Test organisms: The earthworms Eisenia fetida (Lumbricidae), were obtained from Krishi Vigyan Kendra, jabalpur. The animals were bred in cattle manure as food. For all tests, worms with clitellum with a fresh weight between 150 to 200 mg were used. Cow dung, free of any chemical contamination, was used to feed the earthworms. Acclimatization of selected worms was done in the selected soil 24 hrs before the onset of the experiment.

Test chemicals: Based on the data provided by the local farmers as well as shopkeepers, one chemical was selected to study their effect on growth of earthworms. The objective of the research work was to observe the effect of herbicide used for crop on earthworms.

Chemical used

Glyphosphate [N-(phosphonomethyl)glycine] is spectrum systematic herbicide and crop desiccant. It is an organophosphorus compound, specifically a phosphonate, which acts by inhibiting the plant enzyme 5-enolpyruvylshikimate-3-phosphate synthase. It is used to kill weeds, especially annual broadleaf weeds and grasses that compete with crops.

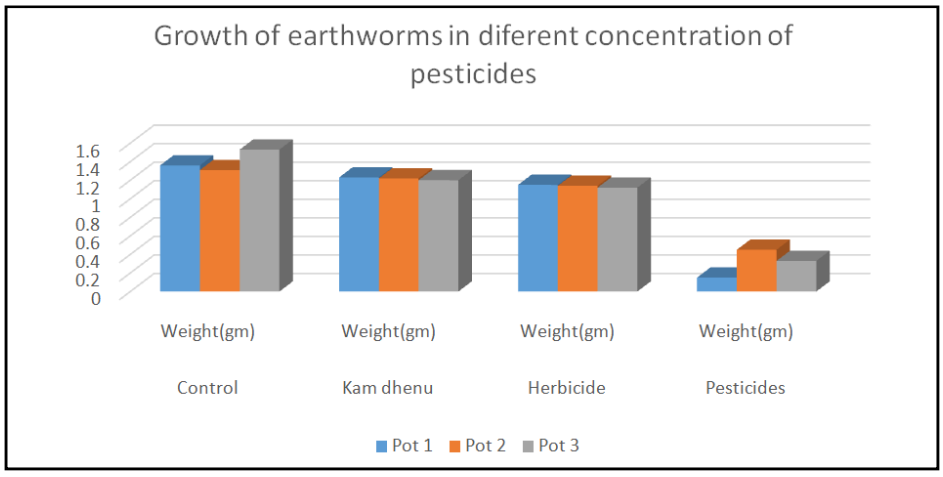
Kamdhenu paudh vardhak: Cow urine + neem oil in equal amount. Spraying of cow urine eliminates fungal infection, insect attack as well as parasites such as nematodes. Cow urine has Urea, minerals and enzymes required for the enrichment for the soil. Cow urine can also be mixed with neem oil to get even better results.

Cypermethrin {[Cyano-(3-phenoxyphenyl)methyl]3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-1-carboxylate} is a synthetic pyrethroid used as an insecticide in large – scale commercial agricultural applications as well as in consumer products for domestic purposes. It behaves as a fast – acting neurotoxin in insects. It is easily degraded in soil and plants but can be effective for weeks when applied to indoor inert surfaces .Exposure to sunlight, water and oxygenwill accelerate its decomposition. Cypermethrin is highly toxic to fish,bees and aquatic insects , according to the National Pesticides Telecommunications Network (NPTN) .

Earthworm growth test: Three earthen pots with vermicompost soil were prepared to evaluate the growth of earthworms. For experimentation, raw cow dung was procured from dairy farm. Earthworms were sorted out from the culture and acclimatized for 24 hrs in test soil. Before which they were washed with fresh water and measured their weight on electronic balance. Five earthworms having weight between 900 mg to 1 gm were selected and left over on the soil surface of each pot. They immediately buried themselves into the soil. The soil was artificially contaminated by adding different concentrations ofherbicide (ammonium salt of glyphosphate)to each of the pots. Close watch was kept on moisture content of the soil by checking it daily and maintaining it by adding water, as required. For growth rate observation, experiment lasted for 10 days. Biomass growth rate is calculated by mean.

RESULT AND DISCUSSION

The data presented in Table 1 clearly show that earthworm weight was significantly reduced by exposure to the three pesticides and, after 10 days exposure earthworm weight differed from the control in all treatments.



Graph 1. Showing Growth of earthworms in different concentration of pesticides

Table 1. Showing mean Growth of earthworms in different concentration of pesticides

	Control Weight gm	Kam dhenu Weight(gm)	Herbicide Weight(gm)	Cypermethrin Weight(gm
Pot 1	1.36	1.23	1.15	0.15
Pot 2	1.31	1.22	1.14	0.45
Pot 3	1.53	1.20	1.12	0.33

The animals showed progressive signs and symptoms of toxicity ranging from visibly undetectable marks to coiling, curling, extrusion of coelomic fluid, segmental constriction and swelling. In several animals the swollen portion burst causing bloody lesions, limp and ultimately death. During the period of the test the results showed highest growth in kamdhenu exposure and lowest growth in Cypermethrin.Many investigators have reported a high toxicity of Chlorpyrifos and Cypermethrin insecticides on many species of earthworms in different countries, the effects ranging between moderate mortality to Perionyx exacavtus (Chakravorty and Kaviraj 2010) and decrease in body weight of Eisenia Sherwan Taeeb Ahmed the impact of four pesticides on the earthworm lumbricus terrestris (annelida; oligochaeta) int j cur res rev, nov 2013/ vol 05 (21) page 3 fetido (yasamin and dsouza 2010). booth et al. 2000 observed loss of weight of aporrectodea caliginosa when treated with organophosphate pesticides in field and laboratory also.

(Faheem and Farhanullah Khan 2010) reported that predictable signs and symptoms of Imidacloprid poisoning on Pheretima posthuma including tiredness, twitching, cramps, and muscle weakness also including the muscles essential for breathing. Data presented in the study by Farrukh and Ali 2011 clearly showed that dichlorovos caused a decrease in the weight of all groups of earthworms, when they were exposed to different concentrations of dichlorovos fumigant insecticide. This study showed that there was a significant decrease in sperm numbers of animals treated with the four pesticides, Sophie et al. (1995) showed that dieldrin at relatively low concentrations caused structural damage, especially to the nucleus of the sperm which may cause several changes in morphology, motility, and sperm density. A significant decrease in sperm numbers were found at 15 and 30 days in the dose of 600 mg of malathion for kg of soil (Espinoza and Bustos 2004). This decrease of the sperm count indicates that the insecticide has been degraded to its active metabolites malaoxon and isomalathion, which could also alter spermatogenesis (ATSDR 2000). In another study when three different concentrations of benomyl were applied for one week there were abnormalities in the ultrastructure of the spermatogonia, spermatids, and spermatozoa of the earthworm Eisenia fetid (Sorour and Larink 2001).

Conclusion

All our findings indicated that E. fetida has a higher rate of growth . The effect of high concentration of pesticides effects growth of E. fetida. The data clearly showed that earthworm weight was significantly reduced by exposure to the three pesticides and, after 10 days exposure earthworm weight differed from the control in all treatments. The animals showed progressive signs and symptoms of toxicity ranging from visibly undetectable marks to coiling, curling, extrusion of coelomic fluid, segmental constriction and swelling. In several animals the swollen portion burst causing bloody lesions, limp and ultimately death. During the period of the test the results showed highest growth in kamdhenu exposure and lowest growth in Cypermethrin. Results indicated that majority of farmers opted for vermiculture due to environmental consciousness, to save the soil health and for the upliftment of their status. The major problems which were faced by the farmers were lack of training, high cost of production and non availability of literature. Most of the farmers (73.3%) indicated vermiculture is of laborious nature. Farmers had knowledge about the amount of vermicompost required for per acre of land, time required for its certification and recommended time for vermicompost. Thus it can be concluded that practice of vermiculture has revived among farmers as they are know aware of environmental consciousness, to save soil health but the government has to play a role in promoting vermiculture as segment of organic farming by fixing price for organically grown products so that the crop could fetch a good remuneration in the market. And low amount of use of herbicides

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