IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Preparation Of Organic Fertilizer From Domestic Waste And Its Comparison With Commercial Fertilizer

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***Abstract*:** Homemade fertilizers are prepared using kitchen scraps or waste like grass, dry leaves, neem leaves, onion peel, potato peel, carrot peel, turnip peel, and papaya peel were compared with commercial fertilizers on coriander and fenugreek plants. The plants were kept in small pots and were grown in pot mixing at favorable condition. Seed were studied for germination and growth studies as well as wet and dry weights were compared between commercial fertilizer, homemade fertilizer and tap water treated seeds. There was no significant difference between commercial and homemade fertilizers tested on fenugreek plants. However, there was a significant difference between the homemade and commercial fertilizers on coriander plants.

KEYWORDS: homemade fertilizers, kitchen waste, Pot pourri fertilizer, Coriander seeds, Fenugreek seeds, seed germination, seed vigor

Introduction

A fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply plant nutrients. Historically fertilization came from natural or organic sources: compost, animal manure, human manure, harvested minerals, crop rotations and byproducts of human-nature industries (i.e. fish processing waste, or blood meal from animal slaughter). However, starting in the 19th century, after innovations in plant nutrition, an agricultural industry developed around synthetically created fertilizers. This transition was important in transforming the global food system, allowing for larger-scale industrial agriculture with large crop yields. In particular nitrogen-fixing chemical processes such as the Haber process at the beginning of the 20th century, amplified by production capacity created during World War II led to a boom in using nitrogen fertilizers. In the latter half of the 20th century, increased use of nitrogen fertilizers (800 % increase between1961 and 2019) have been a crucial component of the increased productivity of conventional food systems (more than 30 % per capita) as part of the so called "Green Revolution" (Boller *et al.*, 2004).

Commercial fertilizer: A manufactured chemical mixture prepared for use as fertilizer as distinguished from such natural substances as farm manures. Fertilizer or other substance containing one or more essential available plant nutrients that is distributed for its plant nutrient content and is designed for use and has value in promoting plant growth. "Commercial fertilizer" does not include untreated manures and compost. Organic fertilizers are naturally produced and contain carbon (C). Fertilizers are materials that can be added to soil or plants, in order to provide nutrients and sustain growth. Typical organic fertilizers include mineral sources, all animal waste including meat processing, manure, slurry and guano, plant based fertilizers, such as compost and bio solids. There is also other abiotic non-chemical, fertilizer methods that meet the Principles of Organic Agriculture, which determines whether a fertilizer can be used for commercial organic agriculture (Jadhav and Fan, 2001).

Organic fertilizer work slowly: In order for organic fertilizer to work the soil has to first break them down. This means that both the soil and plants in it get the nutrition they need when they need it. Synthetic fertilizers although speedy, often over feed the plant, do nothing for the soil and can damage plants by burning those (Pettygrove *et al*., 2002). Organic fertilizer improves the soil: Organic materials and fertilizers improve the soil texture, allowing it to hold water longer and increase the bacterial and fungal activity in the soil. So, they not only assist plants and they help the soil. Synthetic fertilizers, on the other hand, deplete the soil of its nutrients, making it unproductive (Bonti and Yiridoe, 2006). Organic fertilizers are safe: organic fertilizers are safe for environment, and animals. Synthetic fertilizers required a significant amount of fossil fuel to produce and process and often run off into nearby water source like streams and lakes. Organic fertilizers are easy to apply: Organics are just easy to apply as their synthetic, non-organic counterparts. Adding them to soil or spraying them on leaves however, they add countless benefits to the garden while providing the same amount of convenience and easy as chemical fertilizers. If homemade fertilizers are as good as commercial fertilizers, then there will be no significant difference in the growth and development of plant being treated (Pettygrove and Dooley, 2004).

There are many different all natural fertilizers that we can use in your garden or with potting soil. Some of these fertilizers can be made of or collected at home using common items from pantry or backyard (Arnold *et al.,* 2004). Half an inch to an inch of grass clippings make a great weed blocking mulch and it is also rich in nitrogen, which is an essential nutrient for most plants (Pettygrove *et al.,* 2001). Just like grass clippings many of the weeds that we will find in garden are very high in nitrogen and will make an excellent fertilizer. The problem is, once we have pulled the weeds, certainly won't want to put them back in the garden because any seeds will sprout and make new weeds (Silva *et al.,* 2019). Compost releases nutrients slowly, which means a well composted garden can go a year or two without requiring reapplication of fertilizer. Compost also helps the soil retain moisture, which is essential for vegetable garden to thrive during hot, dry summer. Manure comes from verity of sources-cows, horses and chickens. Each type of manure is high in nitrogen and other nutrients, but you need to use it carefully, raw manure is highly acidic and may actually have more nutrients than plants need, so too much can burn your plants. Since it is nutrients dense and acidic you can use more of it to improve your soils water retention without risking your plants. Rather than bagging of fall leaves and putting them on your curb, collect them for gardens instead. Leaves are rich with trace minerals, they attracts earth worms they retain moisture, and they will help make heavy soil lighter (Rafael *et al.,* 2019).

Coffee rounds come with lot of uses but one of them best is as a fertilizer. Lots of plants such as blue berries, roses, rhododendron and tomatoes, thrive best in acidic soil recycle your coffee grounds to help acidify soil. Soak up to six cups of used coffee grounds for up to a week to make garden coffee, then use to water your acid' loving plants (Adams and Shin, 2014). Lime itself is an all-natural fertilizer that you can buy at the garden center, but if you would rather save some money, there is a cheaper way to get the same benefits simply was out the egg shells from your kitchen, save them, and crush them to use in your garden it turns out that egg shells are 93% calcium carbonate, which is scientific name for lime. Bananas are known for their potassium and roses love potassium too simply buries peels in a hole alongside the rose bush so that they can compose naturally as the rose grows, bury the peels into the soil stop layer. Both of these approaches will provide much needed potassium for the plants proper growth (Oliveira *et al.,* 2014).

Homemade solid and liquid fertilizers were made using various ingredients. They were compared with commercial solid and liquid fertilizers on fenugreek/ methi plants and coriander plants. The plants were kept in small parts and were grown in soil or vermiculite. The experiment was conducted in controlled environment.

Materials and Methodology

Making homemade fertilizer is environmentally friendly, cost efficient and consumes less pace. First it will be giving new life to waste materials such as banana peel, orange peel, onion peel, egg shell, and some other healthy vegetable scraps and weeds (dry leaves, dry grass, and old compost for fast fertilizing, mud) and reducing the amount of trash we create. Everything in homemade fertilizers will be hundred per cent (100%) organic (Patidar and Mali, 2002).

Materials:

For the present work we used, kitchen scraps or waste like onion peel, egg shell, banana peel, orange peel, papaya peel, carrot peel beetroot peel, tea waste, dry leaves, dry grass, mud, partially decomposed compost, neem leaves Etc…

This work implies two stages those are:

Making of Pot pourri fertilizer:

Requirements: Big terracotta pot with lid, vegetable scraps or waste, dried leaves, water, partially decomposed composed, Composed (fertilizer) can make by using kitchen waste easily. That terracotta pot used is of depth 10 inches and diameter approx. 12 inches & it contain good drainage hole so that the raw materials inside would not get soggy and added some pebbles at the drainage hole to avoid chocking.

First layer: added first layer as old decomposed composed; thickness of this layer is 1inch. Old composed contains micro organisms which the raw materials decomposes quickly.

Second layer: Added some dry things like dry leaves or grass clippings. This layer provides a substratum for the growth of micro organisms and also keeps the mix approximately moist. This encourages healthy growth of decomposing microbes by providing them favorable environment.

Third layer: Third layer is raw moist things like kitchen waste–onion peel, banana peel, orange peel, eggshell, carrot peel, potato peel, neem leaves, tea waste etc. For a good composting height of dry & wet ingredients almost 2 to 3 inches each. And repeated dry & wet layers for more than 3 to 4 times each alternatively.

After repeating layers for fast composting added a layer of partially formed decomposed compost of 2 inches. After this partially decomposed fertilizer layer added four wet & four dry layers alternatively like earlier. As the material below keeps on decomposing, the volume decreases so it keeps on getting space for more materials. (Adding earth worms for fast decomposing is optional). This pot took fifteens days to fill completely, just kept on making layers as mentioned above. Adding partially decomposed composed layers helped to fasten the fertilizing process & made it odor free, after the last raw materials layer, sprinkled some water to moist the composter.

After the filling process, covered the pot with terracotta lid and placed it in favorable environmental condition at normal temperature. Process of composting is a bit faster in summer months than that of winter months. Covered the pot & placed small rock on the lid to pressurize the composed in terracotta pot. This is because, whenever water added into the pot, excess water will drain out & make things moist.

After thirty days, compost was ready. Composting time completely depends up on the seasons. Preparation of homemade composed or fertilizer took thirty days as it was done in between the months April to May. The ready pots where kept under the sunlight for 24hours to avoid fungal formation by drying & now it is ready to store & for further use (Raut *et al*., 2008).

Comparison of homemade fertilizer and commercial fertilizer on methi and coriander plants:

The experiment conducted on methi or fenugreek and coriander plants, for this has setup two pots for coriander & two pots for fenugreek plants growing. Firstly soaked fenugreek seeds were sow in different pots & soaked coriander was sown in two different pots containing normal garden soil in medium seized pot, to observe the differentiation between growths of each plants already treated with homemade fertilizer and commercial fertilizer.

Study of seed germination and seed vigor

Materials used are seed sample (400 seeds), homemade organic fertilizer, commercial fertilizer and normal tap water, germination paper, forceps etc. Soak seed sample for 3hours, air dried and used for experiment. The brown germination paper is sterilized before use soaked distilled water, over 50-100 seeds are placed/ sterilized paper towel (depending upon size and equidistant on germination paper). Another portion of the paper towel is placed on the first half so that seeds are held in position. The germination paper are rolled and kept directly in trays for germination, Water is maintained in germination tray to avoid decaying of germinated paper, After 7 days of in incubation the germination paper were unrolled and seeds germination is calculated. The seedling vigor is analyzed by measuring seedlings individually for shoot length and root length, experiment is carried out four times with a replicate of 100 seeds each (Islam *et al*., 2014).

Results:

Making of Pot pourri fertilizer:

The fertilizers are prepared using kitchen waste as mentioned in the methodology (Fig. 1-4) and the resultant mixture is applied to plants for recording their growth improvements. Comparison of homemade fertilizer & commercial fertilizer on methi & coriander plants was done by seed germination and growth assessment methods which revealed the following results.

Study of seed germination and seed vigor:

The production of healthy food crops and higher yields in turns of quantity and quality if of great importance for farm house and seed producing incidence is high and more food needed to feed the population (Fig. 5-8).

Germination method:

Percentage of coriander plants treated with organic and commercial Inorganic fertilizer studies showed mean length of coriander plant treated with organic fertilizer was recorded in which shoot length of 66.1cm and Root length of 41.8cm was observed. Mean length of coriander plant treated with commercial inorganic fertilizer was recorded where shoot length was 66.7 cm and root length was 37.6 cm. Total no. Of leaves in Organic fertilizer treated plants was 47.2 and in Inorganic fertilizer treated plants were 45. Therefore, coriander plant treated with commercial inorganic fertilizer showed more yield compared with organic fertilizer treated plants on the basis of analysis (Table 1).

Fenugreek seeds show cent percent result in both media, coriander seeds which is treated with inorganic fertilizer shows minimum germination compared to tap water treated seeds. Percentage of fenugreek plants treated with homemade organic and commercial inorganic fertilizer was studied. Mean length of fenugreek plant treated with organic fertilizer showed shoot length of 105.7cm and root length of 40.9cm. Mean length of fenugreek plant treated with commercial inorganic fertilizer showed shoot length of 102.5 cm and root length of 28.7cm as well as total no. of leaves in organic fertilizer treated plants was 91.2 cm and inorganic fertilizer treated plants was 99 cm. Therefore, fenugreek plant treated with commercial inorganic fertilizer showed more yield compared with organic fertilizer treated plants and it shows flowering and fruiting stages earlier compared to plant treated with organic fertilizer on the basis of analysis (Table 2).

Wet and dry weight of coriander and fenugreek plants treated with organic and commercial inorganic fertilizer was studied. The results showed dry and wet weight variations in noncommercial and commercial fertilizer treated plants shows minimum weight, compared to plants which are treated with organic fertilizer (Table 3). Percentage of seed germination in liquid organic fertilizer and compared with normal tap water was recorded. The data with respect to germination percentage is influenced by number of seeds and numbers of germination paper are presented in Table 4. Results indicate that organic fertilizer treated seeds showed percentage of seed germination in coriander seeds is 62% and in fenugreek seeds is 100%. Whereas tap water treated seeds showed percentage of seed germination in coriander seeds is 57% and fenugreek seeds is 100%.

Summary

Organic fertilizer refers to materials used as fertilizer that occur regularly in nature, usually as a byproduct or end product of a naturally occurring process. Organic fertilizers such as manure have been used in agriculture for thousands of years; ancient farmers did not understand the chemistry involved, but they did recognize the benefit of providing their crops with organic material. Interest in organic farming is growing worldwide as sustainable agricultural practice nowadays. Organic fertilizers are sustained sources of nutrients due to slow release during decomposition. By increasing soil organic matter, organic farming can reinstate the natural fertility of the damaged soil, which will improve the crop productivity to feed the growing population. Organic fertilizers enhance the natural soil processes, which have long-term effects on soil fertility. Here Food wastes are composed of organic matters which can be used for composting to make fertilizer.

Composting is the natural process of decomposition and recycling of organic material into a humus-rich soil amendment known as compost. Food waste is composed of organic matter which can be used for composting to make fertilizer. It is an effective and eco- friendly way of disposing of food waste in your kitchen. By using leftovers and other food waste, you can convert these smelly items from the kitchen waste into a highly organic product rich in nutrients that you can use to grow vegetables or flowers with it. Here when we grow plants in applying fertilizer, the seeds which are grown in the commercial fertilizer have shown higher percentage of yield compared with homemade organic fertilizer. In the Seed germination method has also shown the seeds which are germinated in the organic liquid fertilizer water and normal tap water shows slight significant difference. Using the analysis of variance, I found out there was no significant difference between commercial and homemade fertilizers tested on fenugreek plants. However, there was a significant difference between the homemade and commercial fertilizers on coriander plants. Since homemade fertilizers are equivalent to commercial ones, why go out and buy expensive commercial fertilizers. Instead, household items can be used to make a fertilizer that is as good as the store bought ones.

FIGURES

Fig. 1: Images showing A. whole pot, B. depth of a pot, C. well drainage hole, D. drainage hole from inside the pot.

Fig. 2: Images showing the raw materials using for fertilizer making. A. grass, B. dry leaves, C. neem leaves, D. onion peel, potato peel, carrot peel, turnip peel, papaya peel.

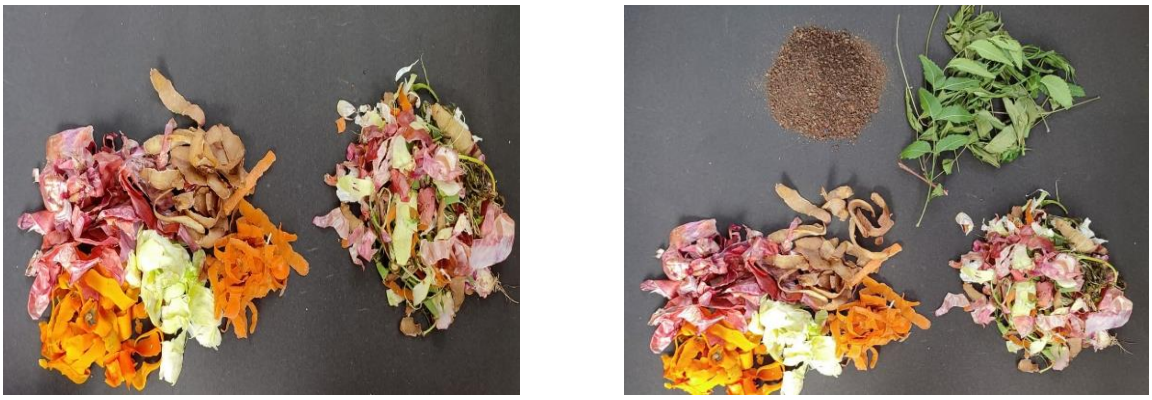

Fig.3: image showing collection of kitchen scraps and the basic raw organic materials in making of homemade fertilizer.

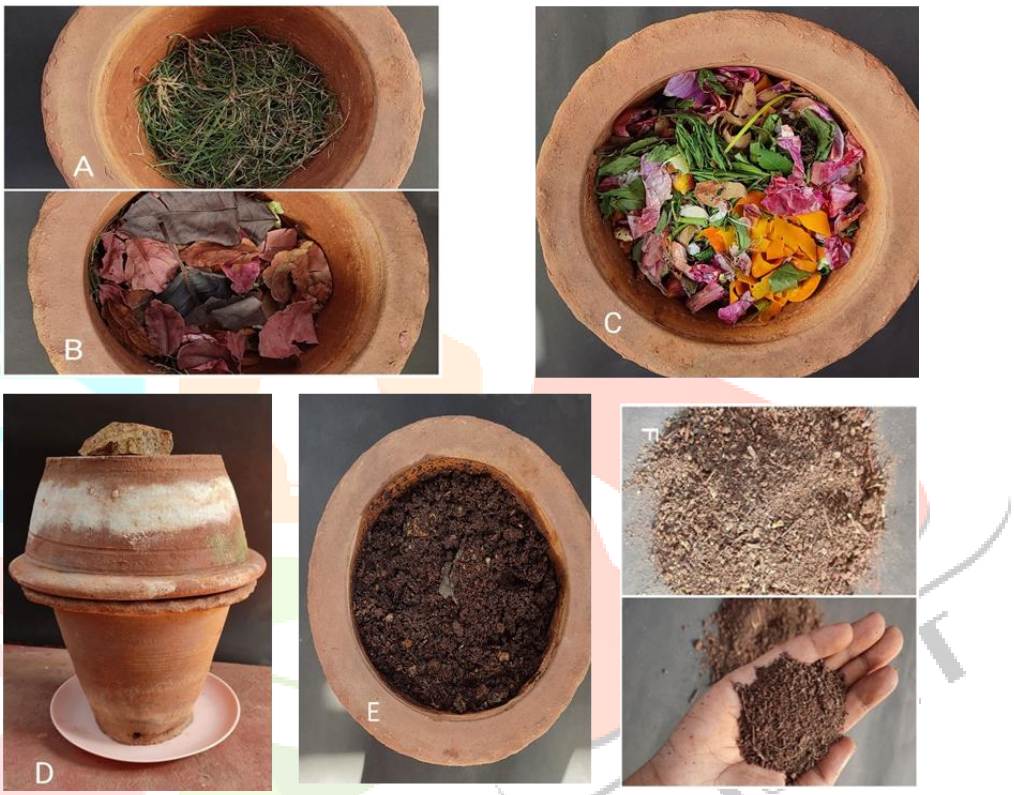

Fig. 4: Image showing A. layer of grass, B. layer of dried leaves. C. layer of healthy, raw kitchen scraps. D. the whole set up for preparing, E. 32 days result, homemade fertilizer, and homemade potpourri solid fertilizer. F. potpourri fertilizer after dried under sun shade and ready for further use.

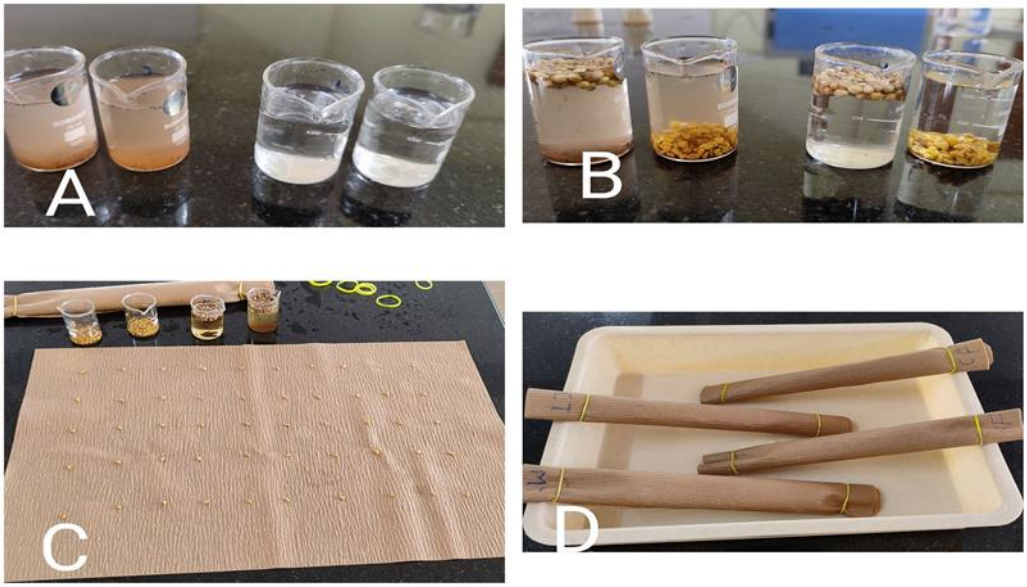

Fig.5: image showing the preparation for germination method. A. Beaker containing Liquid fertilizer and normal tap water. B. Soaking of seeds in prepared liquids. C. Alignment of seeds based on seed size. D. Rolled paper towel and ready for germination.

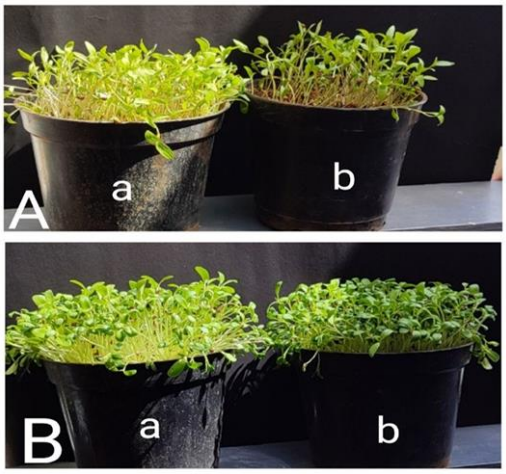

Fig. 6: image showing 30 days result of plant growth which is treated with organic and commercial inorganic fertilizer.
A. Pot **(a)** Coriander plants treated with homemade organic fertilizer. Pot (**b**) coriander plants treated with commercial inorganic fertilizer. **B.** Pot **(a)** fenugreek plants treated with homemade organic fertilizer. Pot (**b**) fenugreek plants treated with commercial inorganic fertilizer.

Fig.7: Analysis of fertilizer treated plants. A. Comparing root and shoot length between fertilizers treated plants. B. Taking net weight of the plants using weighing machine.

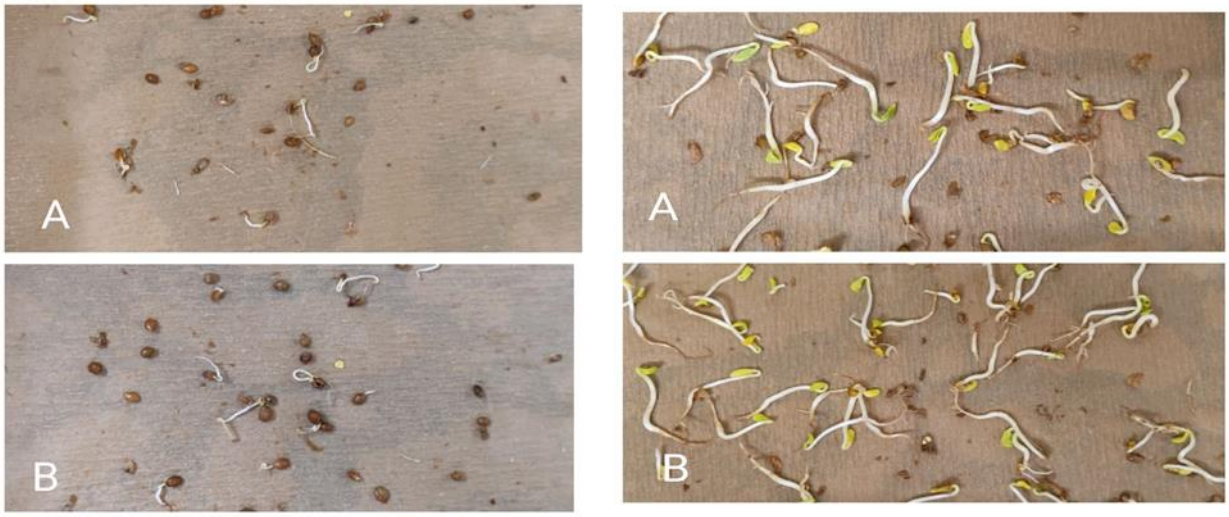

Fig.8: Paper towel containing germinating seeds of coriander which is treated with liquid organic fertilizer and normal tap water. Image showing germination after 7-10 days and there were some seeds which were not germinated.

TABLES

Table1: Percentage of coriander plants treated with organic and commercial Inorganic fertilizer.

Sl. no.	Coriander plants treated with organic fertilizer			Coriander plant treated with commercial inorganic fertilizer		
	Shoot length	Root length	No. of leaves	Shoot length	Root length	No. of leaves
1	19.9	9.4	11	17.8	10.3	14
2	14.6	9.7	10	15.4	8.6	10
3	17.1	11.9	12	18.2	9.1	9
4	14.5	10.8	14	15.3	9.6	12
Total	66.1	41.8	47	66.7	37.6	45

Table 2: Percentage of fenugreek plants treated with homemade organic and commercial inorganic fertilizer.

Sl. no.	Fenugreek plants treated with organic fertilizer			Fenugreek plant treated with commercial inorganic fertilizer		
	Shoot length	Root length	No. of leaves	Shoot length	Root length	No. of leaves
1	24.6	11	18	22.3	8.1	22+1fruit
2	22.2	7.3	17	24.4	7.1	26+1flower
3	29.6	11.2	19	27.5	6.6	24+1flower
4	29.3	11.4	31	28.3	6.9	27
Total	105.7	40.9	91	102.5	28.7	99

Table 3: Wet and Dry weight of coriander and fenugreek plants treated with organic and commercial inorganic fertilizer.

Sl. no.		Coriander plant		Fenugreek plant	
		Organic fertilizer	Commercial fertilizer	Organic fertilizer	Commercial fertilizer
1	Wet weight	1.22	1.54	2.22	2.54
2	Dry weight	0.2189	0.1656	0.2876	0.3649

Table 4: Percentage of seed germination in liquid organic fertilizer and compared with normal tap water.

Sl.no.	Types of seeds	Observation Time (days)	Total no. of seeds	No. of seed germinated in LF	% of seed germinated (LF)	No. of seed germinated in TW	% of seed germinated (TW)
1	Coriander seeds	7	50	31	62%	29	58%
2	Fenugreek seeds	7	50	50	100%	50	100%

LF= liquid fertilizer.TW= tap water.

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