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CONSERVATION OF WATER THROUGH HYDROPONICAL TECHNIQUE

Dr. P. Shakila[1]*, Dr. N. Saraswathi[2] and Dr. B. Rajalakshmi[3]

[1]Dept. of Botany, Arignar Anna Arts College, Villupuram.
[2]Dept. of Botany, Government Arts College C- Mutlur, Chidambaram.
[3]Dept. of Botany, H. H. The Rajah's College, Pudukkottai.

***Corresponding Author: Dr. P. Shakila**
Dept. of Botany, Arignar Anna Arts College, Villupuram.

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ABSTRACT
Attaining sustainable agriculture is a key goal in many parts of the world. Due to rapid urbanization and industrialization as well as an obvious impact of global warming, arable land under cultivation is further going to decrease. The increased environmental awareness and the ongoing attempts to execute agricultural practices that are economically feasible and environmentally safe, promote the use of hydroponic cultivation. Six different plants were selected for hydroponic techniques Wheat grass and Onion (*Thinopyrum intermedium, Allium cepa)* of Monoctyledons, Karpooravalli (*Coleus aromaticus),* Chrysanths *(Chrysanthemum morifolium)* Fenugreek (*Trigonella foenum – graecum*) and Arakkeerai (*Amaranthes sp.*) of Dicotyledons . Six growing tubes were fixed and each tube possesses five grow cups. Tubes are connected with overhead tank and rain water harvesting tube. The excess water from tubes are collected in a tank and then reused to hydroponic set up / irrigated to garden. Coco peat is used as seed holding material. Vermicompost milk is used as nutrient because it possesses all the micro and macro nutrients which is necessary for plant growth. The same plants were grown in soil for comparative analysis. Growth parameters such as germination percentage, seedling growth, length of root and shoot, fresh and dry weight of seedlings and bio – chemical analysis were carried out in both soil and water grew plants. There is a visible differences existed between this two medium grew plants. This is because of regular water supply, direct supply of nutrients, using of organic liquid fertilizers (vermicompost milk) and using of organic biopesticides and insecticides (2% neem oil and 2% of GGC extracts) .

KEYWORDS: Water conservation, Rain water harvesting, Hydroponic, Reuse of waste water, organic method of cultivation.

INTRODUCTION
Soil fertility status has attained a saturation level, and productivity is not increasing further with increased level of fertilizer application. Frequent drought conditions, rise in temperature, river pollution, poor water management and wastage of huge amount of water, decline in ground water level, etc. are threatening food production under conventional soil-based agriculture. A rapid growth of industrialization and population and their high demand per capita for water are problematic in India with regard to the limited water resources available. some places like metropolitan areas, soil is not available for crop growing at all, or in some areas, we find scarcity of fertile cultivable arable lands due to their unfavorable geographical or topographical conditions (Beibel, J.P., 1960). Of late, another serious problem experienced since is the difficulty to hire labour for conventional open field agriculture (Butler, J.D. and Oebker, N.F., 2006).

We need a new and emerging technology which can improve continuously the productivity, profitability, equality of our major farming systems. Under such circumstances, soil-less culture can be introduced successfully (Butler, J.D. and Oebker, N.F., 2006).These can be achieved by alternative new and latest technology of farming such as **hydroponics.** Hydroponics is the technique of growing plants in soil-less condition with their roots immersed in nutrient solution Maharana, L. and Koul, D.N., (2011). Crops grow two times faster in hydroponic gardening. It provides controlled environment, and yield is doubled leading to more production from same amount of space. It's simple to get complete control over nutrient balance by using VM solutions. Plants grown through this technique are healthy and have better nutritional value. It has been proved that vitamin content is 50% more in hydroponically grown plants as compared to conventional ones. (Ms. Mamta D.Sardare et al.,2013).

The aim of this research is to design and construct a hydroponic system which is fully automated that can be integrated into the agricultural curriculum while introducing business skill and also conserve excess overflow water from tank.

MATERIALS AND METHODS

1. Collection of excess water

Hydroponics culture requires minimum quantities of water. Overflow Tube is connected with hydroponical set up for save the excess of water from tank for cultivation of veggies and greens in hydroponical system.

2. Rain water harvesting

During rainy season, rain water is collected and used to hydroponic set up for plant growth. Rain water in terrace were collected in a tank and then it is used for hydroponics.

3. Hydroponical set up

Continuous flow solution culture was applied Ms. Mamta D.Sardare et al.,(2013).Three 10 inch PVC pipes were selected and fixed in a stand. All the pipes were connected with tubes for irrigation . The tubes should be exposed for proper lighting. Each tube possesses five holes to hold a growing cups. The growing cup has holes on base for rooting. The base tube has an outlet tube to collect the used water and use. Coco peat were used as seed holding material in each growing cup.

4. Nutrient solution:

Hydroponics culture requires minimum quantities essential nutrients to optimize plant production. Vermicompost milk (VM) is used as nutrient solution for this system because VM contains all micro and macro nutrients for plants growth. (Table No.1).

5. Plants for hydroponical culture

Different edible, medicinal and ornamental plants were selected for hydroponical culture . one and second row of (five cups) growing tube possess greens (Fenugreek greens – *Trigonella foenum-graecum* and Arakkeerai (Amaranthes sp.)), third row possess cereals (wheat grass – *Triticum vulgare*) and forth row possess herbs (Karpooravalli – *Coleus aromaticus)* and fifth row has Onion (*Allium cepa*) and sixth row contains Chrysanthemum. These plants were selected for its quality of fast growing, need less nutrients, its nutritive, medicinal qualities thereupatic and aesthetic values.

6. Natural organic pesticides and insecticides

Neem oil is an excellent natural organic pesticides. 5% Neem oil solution is mixed with water in hydroponical system, it kills the pests and microbes and protect the roots from microbial infection. 2% GGC solution (Ginger, Garlic and Chilly) also mixed in which possess fungicidal, nematicidal and bactericidal activity.

7. Collection and reuse of excess water from setup:

The used excess water was collected in tank and then again used for the hydroponical set up because it possesses minor quantities of nutrients to conserve water.

8. Growth parameters

Various growth parameters were recorded for both soil and water culture plants. Growth parameters such as seed germination percentage, seedling growth, shoot length, root length, fresh and dry weight of seedlings were measured and tabulated.

i. **Seed germination percentage (%)**

Seed germination percentage is calculated on 7^{th} day from sowing of seeds. This is calculated by using the following formula.

$$\text{Seed germination percentage} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds sowed}} \times 100$$

ii. Root and Shoot length(cm)

Root and shoot length is measured from 25^{th} day from seed sowed. Root length is measured from radical to tip of the tap root / fibrous root. Shoot length is measured from plumule to tip of the shoot. Both are expressed in centimeters (cm).

iii. Seedling Fresh and Dry weight (mg)

The fresh weight of the seedlings plant was recorded immediately after collecting from the experimental sites. After taking the fresh weight the same seedlings were kept separately in labeled packets. Then the samples were kept in an oven maintained at 85 ± 2°C for 24 hours. The weight of dried seedlings plants was recorded and means dry weight of seedlings was calculated and expressed in milligrams / gram. All the results were tabulated in Table – 2.

BIOCHEMICAL ANALYSIS

The fresh leaf material of seedlings were used for the estimation of total chlorophyll pigments, reducing sugar, total sugar and protein contents on 25^{th} days old seedlings carried out in leaves of test crops seedlings per plant. Estimation of chlorophyll (Arnon 1949), Estimation of sugar (Nelson 1944) and estimation of protein (Lowry et al., 1951). All the results were tabulated in Table – 3.

OBERVATION

Organic Nutrient

Daily kitchen wastes were collected in vermicompost bins and from which vermicompost milk was collected. This VM used as nutrient solution for growing plants in hydroponical system. It is pure organic, and reduces dumping of waste and prevent land and water pollution.

Plants growth

All the plants showed a very good growth result in hydroponical system. The growth parameters such as

germination percentage, root length and shoot length and fresh and dry weights of seedlings were recorded in table –3.

Table 1: Micro and Macro Nutrients on vermicompost Milk

Sl.No	Parameters	Values
1	N%	5.72
2	P (%)	4.02
3	K (%)	0.96
4	Mg (ppm)	3285
5	Fe (ppm)	246.05
6	Mn (ppm)	76.50
7	Zn (ppm)	46.50
8	Cu (ppm)	36.75
9	B (ppm)	0.57

Table 2: Comparative study of growth parameters of six plants grown at different ways (soil and hydroponic culture)

S. No.	Plant Name	Seed germination (%)		Root length (cm)		Shoot length (cm)		Fresh weight (mg)		Dry weight (mg)	
		S.C.	H. C.	S. C.	H. C.	S. C.	H. C.	S. C.	H. C.	S. C.	H. C.
1.	Wheat grass	95	98	8.5	9.6	11.2	14.2	26.0	30.0	8.7	9.8
2.	Onion	94	100	7.4	8.2	10.5	14.2	32.5	35.50	9.5	12.8
3.	Coleus	96	98	5.9	6.5	9.7	15.6	19.5	25.5	6.5	8.8
4.	Amaranthes	95	99	7.2	9.4	12.4	14.9	21.5	26.8	8.6	14.5
5.	Fenugreek	96	97	8.8	9.9	15.9	18.5	24.5	29.5	9.8	15.5
6.	Chrysanthemum	92	97	6.8	8.7	13.3	17.9	31.0	35.5	12.0	18.4

Table No – 3: Comparative study of Bio - chemical parameters of three plants grown at different ways (soil and hydroponic culture).

S. No.	Plant Name	Total chlorophyll		Reducing Sugar		Total Sugar		Protein	
		S. C.	H. C.	S. C.	H. C.	S. C.	H. C.	S. C.	H. C.
1.	Wheat grass	1.67	2.76	2.74	3.44	8.76	10.31	3.52	4.59
2.	Onion	1.23	2.19	2.23	2.51	8.13	9.45	2.89	3.98
3.	Coleus	1.36	2.40	2.41	2.88	8.22	9.14	2.98	4.12
4.	Amaranthes	1.73	2.91	2.98	3.69	8.85	9.86	3.65	4.64
5.	Fenugreek	1.87	2.98	3.14	3.98	9.45	10.66	3.97	4.73
6.	Chrysanthemum	1.45	2.55	2.71	3.07	8.65	9.15	3.16	4.25

DATA ANALYSIS AND INTERPRETATION

Plants were grown in two different environment such as land soil growth and hydroponical setup. Plants have grown in hydroponical system showed great variation in growth parameters such as seed germination percentage, seedling root length and shoot length. Seed germination percentage is more in plants grown in hydroponical setup when compared with soil grown. The same results were obtained in both length of root and shoot of seedlings. Bio chemical parameters such as total chlorophyll, reducing sugar, total sugar and protein deferred significantly with treatment. Plants have grown hydroponics system exert a progressive effect on all experimental plants

Hydroponically growing Plants showed better growth and growth parameters. This is because of the required enough nutrients are supplied directly to the root. This will enhance the growth of plants very fast and health. Direct supply of nutrients in hydroponical plants promotes all the metabolic reactions such photosynthesis, respiration, cell divisions such as mitosis and meiosis (Bradley and Marulanda, 2000). When compared with soilless culture, the soil cultured plants showed less values in all growth parameters. This is because of plants in soil have faced many environmental struggles, so the metabolic reaction rate is low, all enhance the reduction in healthy growth of plants.

The maximum value of growth parameters were recorded in plants growing in hydroponic system when compared with soil growing plants Ramarayalu Reddy, 2017. He also stated that hydroponic technology is a gift for farmers, gardeners and home – makers. For terrace

gardening, hydroponic system is good and suitable technique (Chandrasekara and kottacharya 2018). Venkataramaiah (2018) recommended hydroponic technology is apt for people who are living in apartments of metropolitan cities.

RESULTS AND CONCLUSION

There are numerous benefits of hydroponic gardening. Its practice can yield excellent results in short span of time with proper knowledge and techniques. Various environmental concerns, reduction in arable land, and scarcity of water can be easily conquered with the use of hydroponics. It is extremely beneficial for commercial farmers and home gardeners alike. All the results obtained from this investigation indicated that the hydroponics system of cultivation is eco – friendly, mind relaxed and well gain giving and less expense technology for growing of veggies, grasses, medicinal herbs, horticulture plants and ornamental plants. The results obtained from this research work recommended to the growers for attaining better germination, growth and yield.

Hydroponics as a growing method can be greatly improved. If the hydroponic system of growing plants could be facilitated for the average person, then it could be widely implemented throughout the world. This alternate method of growing plant has not being perfected yet, however when it is perfected people around the would greatly benefit from it, especially those nations that do not have access to reliable and nutrient soil. Although, the hydroponic system is a great method for growing plants and can germinate plants at the same rate and even faster than soil plants. It is not as easy as soil gardening. For the average backyard gardener, soil grown plants would be easier. However, for professional gardeners, less land holders with wide knowledge about organic cultivation, hydroponic would be an excellent choice.

Future Scope of Hydroponics

Hydroponics farming can have a great future in India only if its value is known or understood by the Indians. Hydroponic is a method of growing plants using mineral nutrient solutions in water, without soil.

In coming years India really needs such farming methods as

- It produces higher yields than the traditional soil based agriculture.
- Growing mediums can be re-used and recycled.
- Hydroponic plants have a higher pest resistance which eliminates the higher use of pesticides.
- These products tastes superior and are much healthier than soil based.
- This method allows food to be grown in areas that cannot support crops in the soil.
- It is environment friendly as it reduces soil erosion as well as air and water pollution.

This method of food production is much needed to support our growing population. We all have to spread the awareness regarding this method as many of us don't know about this. Then only it will work out. This technique fulfill our necessary needs.

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