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HYDROPONIC FARMING: A STRATEGY FOR FOOD STRATEGY AT THE HOUSEHOLD SCALE IN LUBUK MINTURUN, KOTO TANGAH SUB-DISTRICT, PADANG

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ABSTRACT: The low consumption of vegetables is the leading cause of health problems ranging from obesity, cancer, stroke, chronic kidney disease, and diabetes mellitus to hypertension. The Indonesian population's consumption of vegetables and fruits is still below the recommended levels. Lubuk Minturun Village is one of the areas with an increasing population every year, with residential areas surrounding the vicinity. The high demand for horticultural plants in the community has led to utilizing the household environment to cultivate horticultural plants to meet daily needs. One effort can be made by using hydroponic systems so that the community and homemakers do not need to have large plots of land to cultivate horticultural plants; instead, they can utilize the environment or the yard of the house to cultivate these plants. Several approaches offered to support the realization of this community service program include training and demonstrations, including (1) Case Studies, (2) Practice/demonstration, especially in hydroponic cultivation, (3) Brainstorming/idea gathering from the community, (4) Question and answer sessions between homemakers and speakers or relevant government agencies, (5) Lectures containing core materials and plans for further activities that provide solutions to the problems faced by homemakers. This activity is very beneficial and has resulted in (1) Increased knowledge of homemakers in utilizing yards with hydroponic systems, (2) Increased knowledge and skills of homemakers in utilizing recycled materials as media for hydroponic cultivation, (3) Increased knowledge and skills of homemakers in hydroponic cultivation and maintenance.

Keywords: Hydroponics, Food security

1. INTRODUCTION

Food security is the cornerstone of development in other sectors. This is considered strategic because no country can build its economy without first addressing its food needs. Specifically for Indonesia, the agricultural sector is a determinant of the welfare level of most of its population. Vegetables and fruits are one of the food groups classified by the FAO, known as Desirable Dietary Pattern (Pola Pangan Harapan/PPH). This food group is a source of vitamins and minerals, so the lack of consumption negatively affects nutritional status.

The low consumption of vegetables is also a significant cause of health issues such as obesity, cancer, stroke, chronic kidney disease, diabetes mellitus, and hypertension. The consumption of fruits and vegetables by the Indonesian population, according to BPS 2017 data, reaches 173 grams per day, which is smaller than the World Health Organization's (WHO) recommended 400 grams per day. Consuming fruits and vegetables is acknowledged by doctors, including vegan doctors, as a disciplined key to maintaining the body's resistance to diseases. The vegetable formula on the plate is straightforward: 1/3 vegetables, 1/3 rice, 1/6 fruit, and 1/6 side dish [1]. The main issue faced in the consumption of vegetables and fruits is that nationally, the Indonesian population's consumption of vegetables and fruits still falls below the recommended levels [2].

The high population growth results in an increase in the conversion of agricultural land into settlements, especially in urban areas. This condition continues until today, with agricultural land percentages decreasing significantly. The amount of agricultural land, especially in urban areas, is diminishing. Land conversion is changing the function of a type of land into another function. Various types of land can be converted into various other functions that can provide different benefits and costs from using that land. One type of land often converted is agricultural land, especially paddy fields. Usually, farmers also cultivate vegetables [3]. Paddy fields are turned into dense

housing with narrow yards, so no land is available for vegetable cultivation.

Hydroponics is a farming method that does not use soil as a medium, making it an activity carried out using water to replace soil. Therefore, hydroponic farming systems can utilize narrow land. Farming using hydroponic systems does not require ample land for implementation, but it is only feasible in hydroponic farming businesses [4]. Hydroponic plant maintenance is also easier because the cultivation location is relatively clean, the planting media is sterile, pest and disease attacks are relatively small, and the plants are healthier and more productive [5]. Containers that can be used for hydroponic farming can be made from used plastic bottles acting as plant pots. Apart from used plastic bottles, we can use easily found containers that come from unused items around us, such as gutters, used cans, and pipes [6].

Koto Tangah District is one of the districts where its population is heavily involved in horticultural plant farming, especially chili, eggplant, cucumber, water spinach, spinach, and others. Based on data from the Padang City Central Bureau of Statistics, the average production of horticultural crops has declined. If in 2009, the average chili production was 203 tons/ha, in 2013, it was recorded that the average chili production was 99 tons/ha. In 2009, the average water spinach production was 222 tons/ha; in 2013, it was recorded that the average water spinach production was 798 tons/ha. Meanwhile, spinach production in 2009 averaged 183 tons/ha; in 2013, it was recorded that the average spinach production was 27 tons/ha. In 2018, the average vegetable production for Koto Tangah District was 16.08 tons/ha. This horticultural crop production still cannot meet the increasing demand yearly in line with the increasing population.

2. METHODS

The purpose of this nagari development activity is to assist housewives in cultivating hydroponics using recycled bottles or plastic. The advantages of hydroponics compared to soil-based farming include easier maintenance and cultivation because the hydroponic environment is relatively clean, the planting media is free from dirt, and plants are protected from rain exposure, with relatively fewer pest and disease attacks. Hydroponic plants are healthier, more vigorous, have higher productivity, produce high-quality and durable yields, and fetch higher prices.

Several approaches offered to support the realization of this community service program include training and demonstrations, including: (1) Case Studies, reviewing issues that arise within the community related to hydroponic cultivation, (2) Practice/demonstration, especially in hydroponic cultivation for growing vegetables, (3) Brainstorming/gathering ideas from housewives, (4) Question and answer sessions between participating housewives and speakers or relevant government agencies, (5) Lectures containing core materials and plans for further activities that provide solutions to the problems faced by housewives in hydroponic cultivation.

3. RESULT AND DISCUSSION

This research activity aimed at hydroponic cultivation for household food security has resulted in several outcomes, including:

Increased knowledge of housewives in utilizing yards with hydroponic systems

Based on the development of the Desirable Dietary Pattern (PPH) scores, to achieve ideal food diversity and meet the Recommended Nutrient Intake (AKG) for recommended availability, the availability of animal-based food groups, as well as vegetables and fruits, needs to be increased. This is the basis for the Ministry of Agriculture, through the Directorate General of Horticulture, to implement several programs, including increasing horticultural production and cultivation and providing technical guidance for women's groups in yard utilization, promoting the consumption of vegetables and fruits, and providing support for vegetable and fruit seeds for women's groups in yard utilization.

Figure 1. The research was attended by mothers from the Lubuk Minturun Village

Hydroponic material was chosen because hydroponics is a solution for communities to cultivate vegetables and fruits without requiring any soil as a planting medium, and it can be developed on narrow land or even indoors. The advantages of hydroponic cultivation are that it can be done throughout the year regardless of the season. The types of commodities planted are also not limited to specific plants only. Hydroponics is used as a means of education and training in modern agriculture from children to adults, beautifying the environment with a clean and healthy agricultural impression and rural agribusiness without polluting the environment.

The availability of yard land in big cities is inversely proportional to rural areas, which still have vast land for vegetable cultivation. Vertical gardening can be a solution in agriculture with limited land because the farming system is vertically or in layers. Hydroponics uses planting media such as rocks or coconut husks, given a mixture of primary, secondary, and micronutrient solutions. Aeroponics is a high-level hydroponic system. The plant roots hang and are in a closed space, then given nutrients by spraying a nutrient solution in mist periodically, usually every 2-3 minutes, to keep the roots moist and the nutrients soluble in the air.

There is very limited land and limited buildings, so homeowners try to develop the houses to look bigger and wider, resulting in very narrow, neglected yards or even houses that no longer have yards. The potential of narrow yards in housing like this will be empowered so that vegetables, which are food needs for local communities, can be fulfilled from these narrow yards.

Hydroponic maintenance is straightforward because plants or vegetables can grow easily without using soil, only with water troughs and unused packaging bottles, and also can utilize items that are no longer needed, such as buckets, basins, and so on. Hydroponics can sharpen creativity to process and create new media for farming. By planting using hydroponic methods, the harvest will be faster, and existing items for planting and used items such as used bottles will be utilized. This community service invites homemakers so mothers can better understand how to operate their yards for hydroponic cultivation even though their yards are limited to narrow land.

Coaching housewives in hydroponic cultivation, especially in utilizing recycled materials as media for hydroponic cultivation

Be obtained from this system. This system can benefit from the quality and quantity of its agricultural products and maximize existing agrarian land because it does not require a lot of land. Some common types of hydroponics used include: (1) Wick System. This system is the simplest hydroponic model, using a wick that connects the plant pot with the nutrient solution medium, (2) Nutrient Film Technique. The nutrient solution continuously flows over the plant roots using PVC pipes with recirculation pump techniques, (3) Deep Water Culture (DWC). Plants are made to float on the nutrient solution to constantly submerge the plant roots. The pump is only used to produce oxygen

in the nutrient solution, (4) Drip System. This system uses two containers. The upper container is for plants, and the lower one is for the nutrient solution. The nutrient solution is pumped up and poured onto the plant stem, and the remaining solution flows down to the lower container after passing through the planting media and plant roots, (5) Ebb and Flow Systems (Flood and Drain System). Nutrient delivery to plants is done with a tidal system, which alternately fills the upper container with nutrient solution and then emptys it back into the lower container.

The hydroponic cultivation practiced here includes the Wick System, the simplest hydroponic method. This system can utilize recycled materials such as bottles or beverage glasses as nutrient containers. Plants receive nutrients absorbed through wicks or flannel cloth. The system is similar to a kerosene stove. Participants from this community service activity can be seen in Figure 2.

Figure 2. Participants in the research conducted outreach to the community about hydroponic cultivation

Benefits of Hydroponic Systems

Hydroponics has several advantages, including (1) Increased assurance of plant growth and production success. (2) More practical maintenance and better pest control. (3) More efficient fertilizer usage. (4) Dead plants can be easily replaced with new ones. (5) There is less need for manual labor due to more efficient working methods and standardization. (6) Faster and cleaner plant growth. (7) Continuous and higher production compared to soil cultivation. (8) Hydroponic products fetch higher prices than non-hydroponic ones. (9) Some plant types can be cultivated off-season. (10) No risk of flooding, erosion, drought, or dependence on natural conditions. (11) Hydroponic plants can be grown in limited spaces, such as rooftops, kitchens, or garages.

Disadvantages of Hydroponic Systems Hydroponic cultivation has some drawbacks, including (1) High initial investment costs. (2) Requires specialized skills to measure and mix chemicals. (3) Availability and maintenance of hydroponic devices can be challenging. Efforts should be made to utilize every inch of available yard space for plant cultivation to increase yard productivity and produce healthy food for the family. The utilization of recycled materials for this community service includes used plastic bottles and Styrofoam, as seen in Figure 3.

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Figure 3. Utilization of recycled materials as hydroponic media

Hydroponic cultivation requires working steps and equipment such as: (1) Equipment Used The equipment needed for this cultivation includes: (a) Used Bottles or Plastic Mineral Water Glasses, (b) Used Plastic Jerrycans for Cooking Oil, (c) Cloth as Wick (used cloth), (d) Hydroponic Nutrients, (e) Planting Media (Coconut Husk, broken bricks, sand), (f) Bucket and Stirrer; (2) Materials Used. The materials used for hydroponic cultivation are: (a) 100g Urea Fertilizer, (b) 100g KCL Fertilizer, (c) 100g NPK Fertilizer, (d) 50g Gandrasil Fertilizer, (e) Well water, river water, (f) PDAM water settled for 7-10 days, (3) Growing Media The growing media that can be used here are: (a) Coconut husk powder, (b) Rockwool media, (c) Sand.

Hydroponic Making Procedure

The practical procedure for making hydroponic media using mineral water bottles that are no longer in use is as follows:

1. Prepare a 1500 ml used mineral water bottle, then cut it into two parts using a knife or cutter. Cut a piece of flannel cloth with a length of 10 cm and a width of 2 cm. Cut rock wool or foam into cubes with sides of 2 cm. After all the equipment is prepared, proceed to the top part of the mineral water bottle that has been cut into two parts, then make incisions using a knife to form holes for placing the flannel cloth and for putting the rock wool or foam. The upper part of the mineral bottle that has been cut is then joined with the inverted upper end and assembled to form a tube.
2. Make the nutrient solution by dissolving fertilizers A and B into the mineral water bottle according to the dosage and instructions on the fertilizer. Each 5 ml of fertilizer A and B solution is stirred into 1 liter of water.
3. Plant vegetable or fruit seeds by taking one seed and placing it on the Rockwool or foam on the prepared media, then filling the prepared media

with the prepared solution as well. Let it sit for a few days until the plants grow well.

4. Increasing the knowledge and skills of homemakers in hydroponic cultivation and maintenance

Hydroponics is a method of cultivation using growing media other than soil, such as pumice, gravel, sand, coconut husk, wood chips, or foam. This is done because the function of soil as a support for plant roots and as a medium for a nutrient solution can be replaced by flowing or adding nutrients, water, and oxygen through the press. Hydroponics is a form of agricultural cultivation that does not use soil as a medium, making it a farming activity that uses place soil.

Procedure for Hydroponic Planting

Hydroponic cultivation requires several steps to be performed from seedling to maintenance, including: (a) Seed Selection. Choose quality seeds to ensure optimal fruit or vegetable yield, (b) Seedling. The hydroponic system can use wooden or plastic trays. The tray contains a mixture of finely sifted sand, burnt rice husks, compost, and manure in a ratio 1:1:1:1. Plant the seeds with a spacing of 1 x 1.5 cm. Cover with damp tissue/sack/cloth to maintain moisture. Then, water only when the planting medium starts to dry out. Afterward, remove the cover once the seeds have germinated. Then, transfer to a larger planting area when the seedlings have grown at least two leaves, (c) Preparation of Growing Media. Peat, coconut coir, burnt rice husks, and rock wool (mineral wool) are suitable growing media. Then, fill plastic bags, polybags, plastic pots, or plastic containers with the prepared growing media, (d) Greenhouse Construction. Hydroponic cultivation requires a greenhouse. The greenhouse can be made of iron, bamboo, or wooden frames, (e) Fertilization. The growing media in the hydroponic system only serves as a root anchor and a medium for the nutrient solution. To meet the needs of macro and micronutrients, fertilization in the form of a solution, which is poured into the growing media, is necessary, (f) Plant Maintenance. Maintenance in hydroponic systems such as pruning, weed removal, foliar and leaf fertilization spraying, and other tasks.

Maintenance of Hydroponics

High humidity (> 80%) triggers the development of pathogenic fungi that attack plants. Maintaining aeration and sanitation in the hydroponic environment is also crucial for optimal plant growth. Things to consider include:

1. pH and Nutrient Measurement

   pH is essential to regulate the absorption of plant nutrients to prevent deficiencies. Nutrient levels in the solution can be measured with TDS (Total Dissolved Solids) or PPM (Parts Per Million).

2. Pest and Disease Control

   Pests commonly attacking hydroponic plants include whiteflies, aphids, snails, leaf miners, and ants. Diseases in hydroponic plants are generally similar to those cultivated in soil.

3. Thinning

   The plants can be thinning 15 days after planting.

4. Installation Control

   Malfunctioning pumps and hoses/pipes will significantly affect plant growth.

5. Harvesting and Post-harvest

   Each commodity has different harvesting periods and post-harvest treatments. Proper harvesting and post-harvest handling are essential for business scale.

4. CONCLUSIONS

The conclusion is that low vegetable and fruit consumption can lead to various health problems, such as obesity, cancer, stroke, and others. This consumption is still below the recommended standard, especially in areas like Kelurahan Lubuk Minturun, where the population continues to grow. To address this issue, utilizing the home environment to cultivate horticultural plants using hydroponic systems becomes an attractive solution. Various approaches, such as case studies, practice sessions, brainstorming, Q&A sessions, and lectures, can support this community service program. The results of these activities include increasing homemakers' knowledge and skills in utilizing their yards with hydroponic systems and using recycled materials as media for hydroponic cultivation. Thus, this program provides direct benefits in increasing local food availability and enhances the community's knowledge and skills in sustainable farming practices.

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