Impact of Rainfall Harvesting as a Fertigation Resources Using Autopot on Quality of Melon (*Cucumis melo* L.)

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ABSTRACT

Global climate changes which cause increasing the dry season and impact of decreasing in water resources. Water has an important role in agriculture sector especialy to the process of plant growth and water use efficiency while rainfall harvesting will impact of water quality. Fertigation and using autopot is an alternative of water used efficiency and plant nutrition. Fertigation also will affect the ability of melon (*Cucumis melo* L) to produce quality melon especially water use efficiency, carbohydrate, protein, mineral, vitamin C and sweetness. The methode of the research is descriptive analysis. The results showed that rainfall harvesting quality contained pH 5.6; electronic conductivity (EC) 0.22 mS/cm; TDS 3.075 mg/l; TSS 7.0 mg/l; and turbidity 5.29 NTU; all thing appropriate to the melon needs except EC. Fertigation was significant effect to the yield of melon and average value of water used efficiency was 93.89% and total sweetness 10% brix; carbohydrate 2.65%; protein 1.94%; fat 0.3%; ash 0.89% and vitamine C 26.18%. In conclusion impact of water rainfall harvesting suitable and could applied for fertigation resources and using auto pot.

**Keywords:** fertigation, autopot, rainfall harvesting, global climate change

1. INTRODUCTION

Generally due to climate change will impact of seriously adverse for irrigation and agriculture; which during the dry season water from rainfall decrease by 20-25 percent and in the wet season water from rainfall decrease by 10-15 percent [1]. In the dry seasons demand of water for agriculture sector as a irrigation increased.

Due to global climate change; water crisis especially in the dry season in many parts of the agriculture area applied of irrigation sector use water efficiently. Water use efficiency in agriculture is strongly influenced by main system water management. [2] the scope for existing improved control over water distribution is determined by (1) the availability skill and motivation of operating personal and (2) The physical infrastructure certain combination control structures are inherent more suitable than other; (3) the clarity perecion and flexibility, or otherwise of the operating rules;.

Figure 1 below show that increasing of length of dry season due to climate change. The length of dry season on 1991-2003 start from second week of May to second week of October. But due to climate global change the length of dry season (2004-2011) increased from third week of April to fourth week of October. In conclusion the length of dry season incresed two month during of ten years. The data collect at station climatology at Universitas Padjadjaran’ at campus Jatinangor of West Java Indonesia.

Appropriate technology such as water resources of irrigation should be require. Irrigated agriculture is essential to growth plant and to produce yielding more food. Rainfall harvesting can provide which have been predicted to occur more frequently as the climate change and improved irrigation method and innovation harvesting of rainfall; is an alternative solution to irrigation resources to increases crop production.

The delivery of dissolved fertilizer to the roots of crops in the field using irrigation water is known as fertigation Fertigation which is a mixed of fertilizer and irrigation and applied to the crops. Fertigation for melon plant are basic requirement to increased high yield. Surface irrigation method were historically used to provide water for crop evapotranspiration (ET) requirement [4][6].

Melon needs temperature between 25-35 °C. Figure 2 showed that temperature in the green house during whole growth of melon.
Figure 2 showed that minimum temperature during 10 hours start from 7 am – 5 pm 18.1 °C and maximum temperature at noon 31.17 °C and after noon at 5 pm 26.14 °C. Maximum temperature at noon were solved the problem which is applied water fogging in the green house.

![Figure 1](image1.png)

Figure 1. Rainfall Grafic Decade from 1994 - 2003 and 2004 – 2013 at Jatinangor Climatology Station

![Figure 2](image2.png)

Figure 2. Grafic change Temperature in Green House of Whole Melon Growth.

II. METHOD

A. Problem of Rainfall Harvesting as a Fertigation Resources.

Irrigated agriculture seeks more water to grow more food. However, demand for industrial domestic and environmental uses supply is also increasing rapidly; water is used inefficiently in agriculture. There are large losses in conveyance up to 50% in small field channels and in application up to 60%. Climate change is predicted to increase temperature, reduce regions already experiencing water stress. Water from rainfall harvesting from roof top of green house and supplies for agriculture are some time have a increasing polluted. Water from rainfall containing naturally occurring electronic conductivity (EC) very low around 0.022 mS/cm and pH also low around 5 and not appropriate for melon needs.

Distribution water between farmers on fertigation scheme is generally inequitable, even where water rationing operation. In arid areas effects on soil structure of irrigating with low quality. In many countries the constraints of development of rainfall harvesting especially in humid tropic is they have only two seasons these are dry
Advantages of using Autopot are: (1) runoff there is no pollution to surrounding water systems; (2) on-demand; (3) environmentally friendly; (4) automated and simple, because this system is flexible; the system allows for agriculture to thrive in areas that would normally be seen as non-conducive to cultivation which is independent of soil. Fed with nutrient requirements must be supplied in the irrigation water.

Autopot system is a pot and an efficient and environmentally friendly technology that revolves around the Smart Valve, which feeds plants on demand. The eco-friendly Autopot system allows for sustainable and consistent crop development and (iv). more control application of specific nutrients during stage of crop development and (v). potential to reduced fertilizer losses. Disadvantage of fertigation which are: (i) high initial cost; (ii) higher operating costs and (iii). chemical reactions between some types of fertilizer when mixed potentially causing significant equipment blockages.

B. Fertigation and Autopot

1. Fertigation

The use of fertigation is gaining popularity because of its efficiencies in nutrient management, time and labour and potentially a greater control over crops performance. This is a technology which widely practised in the production of high value annual vegetable crops under protective structures and is sometime referred to as nutrient film technique or NFT. In soilless solution culture all the plants’ mineral nutrient requirement must be supplied in the irrigation water.

Fertigation represent as a natural extension of the hydroponics concept, and is now widely practiced in horticultural industries particularly permanent planting of crops such as citrus, olives and almonds. Fertigation is most successful when combined with drip irrigation [3].

The advantages of supplying mineral nutrients to crop roots using fertigation include: (i). reduced delivery cost of fertilizer and low labor requirement; (ii). greater control of nutrients are delivered to greater fertilizer; (iii). more control application of specific nutrient during stage of crop development and (iv). potential to reduced fertilizer losses. Disadvantage of fertigation which are: (i) high initial cost; (ii) higher operating costs and (iii). chemical reactions between some types of fertilizer when mixed potentially causing significant equipment blockages.

2. Autopot System

Autopot system is a pot and an efficient and environmentally friendly technology that revolves around the Smart Valve, which feeds plants on demand. The eco-friendly Autopot system allows for sustainable and consistent crop cultivation which is independent of soil. Fed with nutrient rich water, crops are protected from soil borne diseases and are kept healthy without the use of harmful chemical.

Advantage of using of autopot are: (1). resource efficiency. There is no water wastage or nutrient run-off as plants feed on demand; (2) environmentally friendly; without nutrient run-off there is no pollution to surrounding water systems; (3). flexibility; the system allow for agriculture to thrive in areas that would normally be seen as non-conductive to farming such as non productive or marginal land, or even rooftop; (4) automated and simple, because this system is fully automated, farming on a commercial scale becomes easier and less laborious and (5) crop yield quantity and quality are consistent. Figure 2 below show that Autopot with Smart Valve [5].

Figure 3. Smart valve in side Autopot (Source: Nurpilihan et al., 2016)

Figure 4. Autopot (Source: Nurpilihan et al., 2016)

III. RESULTS AND DISCUSSION

3.1. Water Rainfall Harvesting Quality

Water quality problem affecting of water use in agriculture and should be included in one or other category. Water rainfall harvesting from the roof top supplies are being increasingly polluted by agricultural, domestic urban and industrial use. Quality of water rainfall harvesting depend on the system of harvested in catchment area. The research use of water rainfall harvesting from the roof of the greenhouse. Table 2 below show quality of rainfall harvesting.

Table 1. Quality of Water Rainfall Harvesting

| No | Parameter | Unit | Analysis Sample |
|----|-----------|------|-----------------|
| 1  | EC        | mS/cm| 0.22            |
| 2  | PH        | -    | 5.56            |
| 3  | TDS       | mg/L | 3.075           |
| 4  | TSS       | mg/L | 7.0             |
| 5  | Turbidity | NTU  | 5.29            |

Water rainfall harvesting from Table 1 showed that appreciate and suitable for irrigation resources for crops (FAO., 1985). But for melon the quality of fertigation should be increasing especially electronic conductivity (EC) which are melon needs EC 0.25 mS/cm for initial stage; 1.0 for mid season stage and 2.0 for late season. Melon also needs pH 6 to 7; Total dissolved solids (TDS) 11 mg/l; total suspended solids (TSS) 5 to 6 mg/l and turbidity 5-6 NTU. Quality of water rainfall harvesting...
(Table 2) not significant impact on melon quality except EC. To solved this problem solution of the nutrient should be more add such as nirate; fosfate and kalium

3.2. Quality of Melon (Cucumis melo L)

The results of quality on melon yield were assested on water content; corbohydrate ;protein; ash; vitamin C and sweetnees. Table 2 show the quality of melon

| Table 2. Quality of Melon by Using Fertigation From Water Rainfall Harvesting |
|---|---|---|
| Parameter | Unit | Quality analysis of melon |
| Water | % | 94.265 |
| Fat | % | 0.3 |
| Ash | % | 0.89 |
| Protein | % | 1.948 |
| Carbohydrate | % | 2.65 |
| Vitamin C | mg/100grm | 26.18 |
| Sweetness | % brix | 10 |

In general Table 2 showed that quality content of melon by using fertigation from water rainfall harvesting was good. Tjahyadi (1987) noted that good melon fruit content of ash 0.3 -0.4 %; protein 0.6%; carbohydrate 4-6% ; vitamin C 25% and sweetnees 10% brix.

3.3. Total Water Use of Melon Using Auto Pot

Applied of water use as a fertigation using auto pot show on Table 3 below

| Table 3. Total Water use of Melon Using Auto Pot (litre) |
|---|---|---|
| Water Use | Number of Plant | Water Use whole life of Plant |
| 817.78 | 144 | 54.29 |

Table 3 showed that water requirement for melon very efficient only 0.6 litre/crop/day. Comparing with 1.3 litre/crop/day/ (FAO 1987). The efficiently due to all plants growth in the auto pot and there is no water wastage or nutrients run off as plants feed on demand.

IV. CONCLUSION

1. Impact of water rainfall harvesting from the green house of roof top not significant effected with quality of melon and suitable for fertigaton.
2. Quality content of melon were ash 0.89%; protein 0.1,94%; carbohydrate 2,65%; and vitamin C 26,8%; fat 0,3% and sweetnees 10% brix.
3. Total water requirement fertigation by using auto pot were 54.19 litre/plant whole life of melon and 0.61 litre/plant/day.
4. Water rainfall harvesting could applied and suitable for fertigation by using auto pot.

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