

ONION *ALLIUM ASCALONICUM* L. PRODUCTION UNDER DIFFERENT IRRIGATION METHODS

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Abstract

The study was conducted to determine the proper irrigation method for onion (*Allium ascalonicum*) production. The research was carried-out in order to evaluate the performance of three irrigation methods: sprinkler, drip and basin irrigation method and its effectiveness with respect to onion production. The data collected were average weekly rate of growth, plant height at maturity, bulb diameter, yield, number of damped onion and amount of water applied. Results showed that the three irrigation methods have no difference in average weekly growth rate, plant height at maturity, bulb diameter, yield, number of clusters, and number of damped onions. However, among the irrigation methods, basin irrigation gave the highest total amount of water applied. Computation of operating cost revealed that the total cost of operation of the three irrigation methods for 1000m² at 10 days interval gives a significant difference. This was affected by the labor and power consumption of the said irrigations. The lowest power consumed and labor cost was obtained using drip irrigation. Operating cost and income for both drip and sprinkler were higher as compared with basin irrigation method.

Keywords: Onion, Production, Drip, Sprinkler, Basin Irrigation Method

INTRODUCTION

Onions are very popular and known as one of the major condiments and used in various cuisine. Different culinary outcomes warrant different onion types, however, they can all be generally described as pungent vegetables (1). The onion bulb is commonly eaten as food and the extract are also used to make medicine (2). Studies also showed that onion has a lot of health benefits (3, 4).

Onion (*allium ascalonicum* L.) is a perennial vegetable species that can be cultivated from lowland to upland areas (5, 6). *Allium ascalonicum* is a form of *A. cepa*, which belongs to the Liliaceae of lily family it is also known as shallot and usually grown during December to March (7).

Onion (*allium ascalonicum* L.) locally known as sibuyas is one of the high-value crops being produced by local farmers and widely adopted vegetable crop. In the Philippines, onion production is one of the major industries in increasing income among onion growers. They are grown both for local and export markets. As cited by Roperos and Donato (1997) the Philippines has a comparative advantage in producing onions for export over temperate countries (8). According to report from the Department of Agriculture, onion production in the country is on an increasing trend with a slight decrease from 2017 to 2018 (9).

Bulb onion grow well in friable and well-drained loam soil with good water holding capacity and pH between 6 and 7 (10-12). Optimum productivity of onion may reach up to 15 tons per ha. (13).

Irrigation water is very important for crop cultivation. Water is needed for seeds to germinate, seedlings to emerge and many plant growth functions (14). Proper irrigation is critical for onion production. Optimal irrigation management leads to steady plant growth, uniform bulb size, maximum yields, and superior bulb quality. Over irrigation increases disease and susceptibility, nutrient leaching, and inefficient water use (15, 16).

Usually, onion production uses gravity type or basin method of irrigation through shallow well which requires too much water and energy. The basin irrigation system that farmers have utilized in years past for onion production are fast becoming impractical. The high cost of pumping and high susceptible to damping produced excess of water from the plants and reduces quality and yield resulted to farmers turned to more efficient and effective methods of irrigation. Economy in the use of water can be observed by providing the proper level of moisture applied at the right time with minimum application losses. Moreover, the traditional way of irrigating crops among Filipino farmers may not be possible in the future as the amount of water from the watershed area and with the limited water supply in some areas, availability of enough water supplies becomes a major concern, with this kind of hindrance a more efficient method becomes necessary.

Sprinkler irrigation is a method of applying irrigation water which is similar to rainfall (17). Low Elevation Spray Application (LESA) systems is one method of sprinkler irrigation. It has no air or canopy water loss since water applications are positioned below the crop canopy (18, 19). Drip irrigation is the slow, even application of low pressure water to soil and plants using plastic tubing placed directly at the plants' root zone. This method allows very little evaporation or runoff, saves water by directing it more precisely, reduces the transmission of pathogens, and produces fewer weeds (16).

OBJECTIVES OF THE STUDY

The general objective of the study is to evaluate the performance of three irrigation methods, the sprinkler, drip and basin irrigation method with respect to onion production (shallot variety). It aimed to determine the proper irrigation method for onion production in terms of vegetative growth, yield, bulbing characteristics and susceptibility to damping and determine the cost of operation of the respective irrigation methods.

MATERIALS AND METHODS

The study was focused on the comparison of evaluation of the sprinkler, drip and surface irrigation method and its cost of effectiveness with respect to onion production. Data gathering will only start right after transplanting of seedlings.

Materials and equipment

The following materials and equipment were used in the conduct of the study: Onion; Sprinkler (Low Elevation Spray Application); Drip; Water pump and hose; Fertilizer; Sprayer; Measuring tape; Soil Auger; Soil oven; Cans; Weighing balance; Pressure gauge; Stop watch; Vernier calliper. Variety used was Onion (*Allium ascalonicum*), commonly known as "Shallot"

or “Tanduyong” or “Lasona”. This variety was one of the recommended varieties in onion production. One ha production area requires 500 kg of bulbs with a potential yield of 10,000kg/ha in 85-90 days.

Onion Description

These onions like plants produce a cluster of bulbs. They are narrowly oval. The leaves are round and hollow. This is genuinely perennial form of *Allium cepa*, the bulb grows deeper in the soil and divides to produce a number of underground bulbs each year in much the same way as shallots. Large bulbs divide to form 5-15 bulb whilst smaller bulbs grow into one large bulb (20).

Site Description

An area of 544 square meter at the Water Resources Management Center Techno Demo Farm from Central Luzon State University, Science City of Munoz was used in the conduct of the study. From the Land Mapping Unit 4 (LMU) as studied by Mactal (1998) soil type is clay with physical properties of 1.48 g/cc bulk density, 28.34% field capacity and 16.77% wilting point (21).

Land Preparation

Prior to planting, herbicide application was done to kill the unwanted plants in the area. The area was then divided into nine (9) blocks measuring 5 x 10 meters with a spacing of 1 m apart. Rice straw of 3 inch was spread on top of the plots to prevent the early growth of weeds, excessive evaporation and soil erosion (22).

Planting Method

Straight line method was used during transplanting with one seedling per hill and a depth of 1 cm from the ground surface with a spacing of 15 x 15 cm.

Experimental Layout and Design

Each plot was treated with three different irrigation methods such as: treatment #1- use of drip irrigation method; treatment #2- use of Low elevation spray application (LESA) and treatment #3- basin irrigation (traditional method).

Irrigation Application

Irrigation was applied when available moisture content reached 22.6% (50% management allowed deficit) for all irrigation methods. The LESA irrigation system (Figure 1) was manually moved across the plot during irrigation at 50% over lapping between sprinkler settings. Two persons were needed to move the LESA system. One of them monitored the time of irrigation per station using stopwatch. The sprinkler irrigates the area at 0.5 m per station. In drip irrigation, water tank with a capacity of 1000 li and was elevated 4m high. Lateral pipes used were 12 mm diameter with a discharge of 0.33 Li/hr. Built in drip irrigation system was used the study. Drip lines were installed every other hill with a length of 10 meters. In basin irrigation method, a 2-inch flexible hose was used manually in traditional irrigation treatment.

Irrigation was applied up to field capacity or until water front reached the longest distance of the plot and the time to moisten the soil was recorded.

Fertilizer application was done based on the recommendation for onion per hectare, the kind, rate, time and method (7). Hand-weeding was done whenever necessary and when the soil was soft to lessen the damage on the growth of the plants. Harvesting was done when majority of the bulbs were mature or 85 to 90 days after transplanting. Harvesting was done manually by pulling the leaves.



Fig 1: Low Elevation Spray Application



Fig 2: Drip Irrigation Setup

Data gathered and Statistical Tool

The data gathered were as follows: (a) Rate of growth (cm)- plant from each treatment was selected randomly for the measurement of rate of growth; (b) plant height (cm)- average height of 10 sample plants per plot measured from the ground level to the tip of the tallest leaf. Measurement was done just before harvesting; (c) bulb diameter (cm)- the average diameter of 10 sample per plot was measured using vernier caliper; (d) yield (kg/plot)- the weight of onions harvested from one square meter per plot was done to determine the yield; (e) Number of clusters produced- average number of cluster bulbs using 20 samples per plot was recorded; (f) number of damped onion- the number of damped onions from one square meter per plot was counted. All data that were collected were statistically analyzed using Randomized Completely Block Design and the comparison among means was done using Duncan Multiple Range Test (DMRT). Simple cost analysis was done to determine the economic viability of each method. Simple cost analysis was done on each method to determine the most economical method in onion production.

RESULTS AND DISCUSSION

Irrigation was applied before moisture content reached the management allowed deficit for all irrigation methods. Analysis of variance revealed that weekly growth rate, plant height at maturity, diameter of onion, average yield, average number of cluster, average number of damped onion there were no significant difference as affected by the three irrigation methods. This means that irrigating onions using drip, sprinkler (LESA) and basin have no effect in the weekly growth rate, plant height at maturity, diameter of onion, average yield, average number of cluster, average number of damped onion. However, analysis of variance reveals that there was a high significant difference on the amount of water applied. Amount of water applied using basin irrigation gave the highest total volume applied with mean of 30.87m^3 which was far from the other treatments. This was followed by sprinkler method with a mean of 7.59m^3 and the lowest amount of water applied of 7.33m^3 was obtained by drip irrigation method.

On the other hand, water productivity with the highest obtained by drip irrigation followed by sprinkler method and basin irrigation method as the lowest water productivity. Study revealed that water per cubic meter of drip has been maximized due to the highest computed water productivity. This is due to the fact that drip irrigation reduces water losses such as excessive infiltration, deep percolation and run-off. Cost and return analysis revealed that onion that was irrigated by drip irrigation had projected net income of Php18, 414 with a payback period of 2.06 years and break even yield of 1, 465.47 kg. The rate of return using drip is 1.05%. While LESA had a net income of Php18, 918.00, payback period and breakeven yield of 0.43 and 1423.54 kg respectively. The rate of return is 1.11%. Basin irrigation method got the highest net income of Php23, 095. This is due to the labor and electricity consumed by the drip and sprinkler methods. Some other observation such as the occurrence of weeds was observed during the first month of growing season. The weeds were controlled by manual pulling. Plants were observed as healthy in the three irrigation methods. The penetration of water into the soil was delayed because of the interception of the mulching materials. Another observation was that the clearance of the nozzle and soil surface was not appropriate for onion because the onion leaves block the nozzles while irrigating.

CONCLUSIONS

This study was conducted to determine the proper irrigation method for onion production. Specifically it aimed to evaluate the performance of three irrigation methods: drip, sprinkler (LESA) and basin irrigation for onion production in terms of vegetative growth, yield, bulbing characteristics and susceptibility to damping; and determine the cost of operation of the respective irrigation methods

Results showed that there is no significant difference in the rate of growth, average plant height, average diameter, yield, number of cluster and damped onion. These means that adopting the three irrigation methods have no relatively increase or decrease on the rate of growth, average plant height, average diameter, yield, number of cluster and damped onion. However, the average amount of water applied was resulted to a highly significant difference among three

methods of irrigation. This was given by the average amount of water applied in basin of 30.87m³ which is far from the sprinkler and drip with mean of 7.60 and 7.33m³ respectively.

On the other hand, the operating cost gives a significant difference among the irrigation methods. This was affected by the labor cost and power consumption of the said irrigations. Drip irrigation method obtained both the lowest power consumption and labor cost while sprinkler got the highest labor cost. Finally, basin irrigation obtained the lowest operating cost and highest net profit.

Based on the result, it is recommended that drip and sprinkler irrigation in onion production is feasible where water scarcity is a problem due to its low power consumption and labor cost.

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