PERFORMANCE OF ONION (*Allium cepa* L.) UNDER DIFFERENT GROWING METHODS

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ABSTRACT

An experiment was conducted at the Agronomy Farm of the Eastern University, Sri Lanka, during the *'Yala'* 2007 to evaluate the performance of onion (*Allium cepa* L.) cv. Vethalam under different growing methods. The experiment was layed out in the Randomized Complete Block Design (RCBD) with four treatments and five replications. Four different growing methods were practiced; they were raised seed bed, seed bed with ridges and furrows, sunken bed without polyethylene sheet and sunken bed with polyethylene sheet. Performance of onion was assessed in terms of plant height, number of leaves per plant, yield and yield components such as bulb diameter and number of bulbs per plant. The maximum number of leaves per plant was recorded in the sunken bed with polyethylene sheet method and the plant height was high in the sunken bed with polyethylene sheet and raised seed bed methods on the 8th week after planting. The highest number of bulbs per plant was obtained in the sunken bed with polyethylene sheet method. The plants which were raised in the raised seed bed method showed the maximum bulb diameter. However it was not significantly different from the bulb diameter recorded in the sunken bed with polyethylene sheet method. Sunken bed with polyethylene sheet method gave the highest yield compared to the other growing methods. This may be because polyethylene sheets would have enhanced the retention of moisture and nutrients available for the plants, which would have resulted in the production of highest yield.

Key words: Onion, Growing methods, Performance, Yield

INTRIDUCTION

Onion (*Allium cepa*) is a popular vegetable crop grown for its pungent bulbs and flavorful leaves. The bulb is composed of concentric, fleshy, enlarged leaf bases or scales. Most of the rain fed onion is cultivated during the *'Maha'* season whereas, the irrigated onion is cultivated mostly during the *'Yala'* season. During the *'Yala'* season, the crop production is affected by water scarcity in the Batticaloa district. The major

constrains in obtaining high yield during the '*Yala*' season are insufficient water and inadequate nutrients. Onion is a heavy feeder of mineral elements. It was reported that a crop of 35 tonnes of onion removes approximately 120 Kg of N, 50 Kg of P_2O_5 and 160 Kg of K_2O ha^{-1} (Tandon, 1987). Raised seed bed method, seed bed with ridges and furrows, sunken bed without polyethylene sheet and sunken bed with polyethylene sheet are the possible growing methods. Farmers in the Batticaloa district, follow raised seed bed method for onion cultivation. Leaching of nutrients and seapage of water are some of the problems faced in this method. This experiment was conducted to find out which of this/these method/s could be adopted to optimize the yield of onion in the Battticaloa district during the *'Yala'* season.

MATERIALS AND METHODS

This experiment was conducted at the Agronomy Farm of the Eastern University, Sri Lanka, which is situated at 100 m above mean sea level. The climate is warm (28°C - 32°C) with an annual rainfall ranging from 1800 mm to 2100 mm. Most of the rain is received during the month of October to January.

The field was well prepared with 20 plots each having a dimension of 1.2 m x 0.9 m. Beds were raised for the raised seed bed method to a height of 15 cm. Sunken bed was made to a depth of 0.5 m and polyethylene sheets were spread at the bottom and along sides. Sterilized (sun dried) soil was added into the pits to the ground level. Organic manure was incorporated for all the plots (500 g/bed). Plots were constructed at 1 m apart. The experiment was layed out in the Randomized Complete Block Design with four treatments and five replications. The treatments were T_1-Raised seed bed (served as control), T_2-Seed bed with ridges and furrows, T_3-sunken bed with out polyethylene sheet and T_4-sunken bed with polyethylene sheet.

Healthy and undamaged bulbs were selected and were treated with Homai (2g lit^{-1}). The bulbs were planted in the plots at a spacing of 10 cm x 10 cm for all the treatments. They were planted at a depth of 2.5 cm and so that the tips were able to be seen above the soil surface. The experiment was managed in accordance with the recommended cultural practices (Technoguide, 2005).The growth parameters such as plant height and number of leaves per plant were recorded at two weeks interval. The initial reading was taken four weeks after planting. Number

of bulbs per plant, bulb diameter and bulb weight were recorded. The yield in each experimental plot was also determined.

RESULTS AND DICUSSION

Number of leaves per plant

It was observed that there were significant differences ($P<0.05$) between treatments in the number of leaves per plant on the 4th, 6th and 8th Week After Planting (WAP) (Table1).

Table 1.The effects of different growing methods on the number of leaves per plant at different time intervals

Treatments	Number of leaves per plant		
	Time interval		
	4th WAP	6th WAP	8th WAP
T_1	5.88^a	7.44^a	7.99^b
T_2	4.52^b	5.76^b	7.13^c
T_3	3.32^c	4.04^c	5.53^d
T_4	5.72^a	7.36^a	8.67^a

*Values in the same column followed by the same letter do not differ significantly ($P<0.05$).

*Values are the means of 15 plants in 5 replications.

Sunken bed with polyethylene sheet (T_4) showed the highest number of leaves per plant on the 8th WAP. The lowest number was seen in the T_3 treatment. The highest number may be due to better availability of moisture and nutrients for the plants. In this treatment, polyethylene sheet would have enhanced to retain sufficient amount of moisture and nutrients and minimized the leaching losses. As stated by Govindan and Purushottam (1984), higher number of leaves per plant is due to higher metabolic activity from higher N supply resulting in higher production of carbohydrates and phytohormones which were manifested in the form of enhanced growth. In contrast, lower number of leaves per plant in the T_3 treatment may be due to the shortage of water and nutrients. According to Kramer (1983), leaf enlargement is often reduced or stopped as a consequence of water shortage, new leaves developed more slowly and old leaves senesce more rapidly. Tindal (1968) stated that adequate reserves of the major elements particularly nitrogen and potash should be available throughout the growing period and phosphate is required to promote early leaf development.

Plant height

It was observed that there were significant differences ($P<0.05$) between treatments in the height of onion plant on the 4th, 6th and 8th WAP (Table 2).

Table 2: The effects of different growing methods on the height of onion plant at different time intervals

Treatments	Plant height (cm)		
	Time interval		
	4th WAP	6th WAP	8th WAP
T_1	21.11^a	22.44^a	**24.72^a**
T_2	17.72^b	19.30^b	20.48^b
T_3	15.90^c	17.30^c	18.48^c
T_4	21.32^a	23.20^a	**24.56^a**

*Values in the same column followed by the same letter do not differ significantly ($P<0.05$).

*Values are the means of 15 plants in 5 replications.

It was observed that the height of onion plants increased with the age. Highest value was observed in the T_1 treatment on the 8th WAP. However, it was not significantly different from the T_4 treatment. Polyethylene sheets helped to conserve moisture and nutrients. As a result, the roots would have absorbed sufficient amounts of water and nutrients for their growth. In the raised seed bed method (T_1), raised beds with loosened soil would have facilitated the roots for better penetration and better plant growth.

Number of bulbs per plant and bulb diameter

It was found that there were significant differences between treatments ($p<0.05$) in the number of bulbs per plant and bulb diameter (Table 3).

Table 3: The effects of different growing methods on the number of bulbs per plant and bulb diameter

Treatments	No. of bulbs per plant	Bulb diameter (cm)
T_1	8.11^b	**2.22^a**
T_2	7.13^c	1.86^b
T_3	5.53^d	1.79^c
T_4	**8.67^a**	**2.19^a**

*Values in the same column followed by the same letter do not differ significantly ($P<0.05$).

*Values are the means of 15 plants in 5 replications.

The highest number of bulbs per plant was obtained in the T_4 treatment. The plants which were grown on the raised seed bed (T_1) had the maximum bulb diameter. However, it was not significantly different from the bulb diameter recorded by plants grown in the sunken bed with polyethylene sheet. The lowest value was obtained in the T_3 treatment. In the sunken bed with polyethylene sheet, soil worming would have occurred and this would have enhanced the formation of bulbs. As pointed out by Purseglove (1975), temperature plays an important role in bulbing and bulbing takes place more quickly at warm than cool temperature. This may be the reason for the highest number of bulbs per plant in the T_4 treatment. In the T_1 and T_4 treatments, soil particles would have loosened and soil compaction would have been low compared to the other treatments. This would have resulted in better formation of bulbs in these treatments.

Yield

It was observed that there were significant differences between treatments ($P<0.05$) in the yield of onion (Figure1).

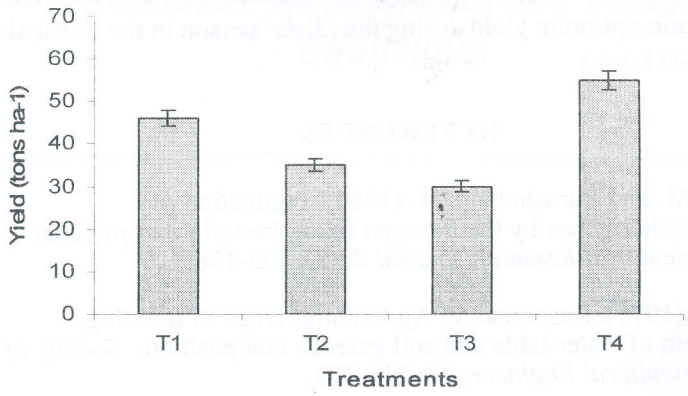

Figure 1: The effects of different growing methods on the yield of onion cv. Vethalam

The highest weight of bulbs was obtained in the T_4 treatment. This was attributed to maximum plant height, more number of leaves per plant, greater number of bulbs and bulb diameter recorded in this treatment compared to the other treatments. Polyethylene sheets would have trapped most of the nutrients and conserved water which would have facilitated better absorption by these plants. As a result, bulb growth would have increased because of more translocation of photosynthates to the bulbs.

The second highest yield was obtained in the control treatment. In this method the raised bed facilitated the bulb formation. The lowest yield was obtained in the T_3 treatment. In this treatment, soil particles would not have loosened and leached the nutrients and water. This would have lead to the lowest yield. Onion requires uniform moisture throughout the growing season. Low yield has been reported in some crops which were mostly affected by loss of nutrients (Hudson, 1971).

CONCLUSIONS

The performance of onion under different growing methods was studied. Highest yield and better performance of the parameters were observed in the sunken bed with polyethylene sheet method compared to the other methods. Plant height and bulb diameter were greater in the raised seed bed method. Seed bed with ridges and furrows method showed the intermediate yield compared to the sunken bed with polyethylene sheet and raised bed method. The yield was lowest and the performance was poor in the sunken bed without polyethylene sheet. Hence, out of all methods tested, sunken bed with polyethylene sheet could be adaoted in order to obtain optimum yield during the *'Yala'* season in the Batticaloa district of Sri Lanka.

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