Evaluating the Impact of Plant Spacing to Maximize Onion Yield

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Objective

To assess and compare two different plant spacings to identify the most suitable recommendation in maximizing bulb onion yield.

Materials and Methods

The experiment was conducted at West Nile Learning Farm, Uganda from August to September 2023, using the Prema variety. Seedlings were transplanted 43 days after sowing. The experiment involved a single factor regarding plant spacing: Treatment 1 at 15 x 10 cm and Treatment 2 at 10 x 10 cm. The experiment was laid out in Randomized Complete Block Design (RCBD) with three (3) replications. The field operation followed EWS-KT recommendations such as fertilizer application, insect pest, and disease management. The irrigation was done when needed. The data were recorded on the onion yield. The difference among the means was evaluated by Duncan's multiple range test (DMRT) (Gomez and Gomez, 1984).

Results

The highest recorded yield was 1.9 kg/m^2 with a plant spacing of 10 x 15 cm, reflecting 47.37% increase compared to the yield from 10 x 10 cm spacing. In an area of 500 m^2, the yield for the 10 x 10 cm spacing was 504.95 kg, whereas the 10 x 15 cm spacing produced a significantly higher yield of 986.66 kg. Additionally, the weight of individual bulbs increased with the wider spacing averaging 29.06 gram per bulb, while the closer spacing resulted in smaller bulbs, with an average weight of 10.10 gram per bulb (Table 1).

Table 1. Effect of spacing on bulb weight and yield.

Treatment	Bulb weight (gram)	Yield (kg/500m2)
10 x 15 cm	29.06A	986.66A
10 x 10 cm	10.10B	504.95B
F-Test	*	*
LSD	10.35	239.66

The 10 x 15 cm plant spacing required more space. It used a smaller amount of seeds per unit area, producing larger bulbs and higher yields in a 500 m^2 area. Additionally, other input costs, such as fertilizers and pesticides, remained constant across both spacings. Consequently, this spacing configuration led to greater returns, increased profit margins, and a higher percentage return on investment (%ROI) (Table 2).

Table 2. The return on investment in 500 m^2 (in USD).

Spacing	Cost	Return	Profit	% ROI
10 x 15 cm	78.6	1,147.5	1,068.9	1,359.7
10 x 10 cm	89.5	540.0	450.5	503.6

Conclusions

The action research findings, conducted using the Prema variety, suggest that wider plant spacing likely mitigated interplant competition, facilitating improved access to critical resources such as water, nutrients, and light. Planting at proper plant spacing increases the quality and size of bulbs (Nichols and Hydecker, 1964). By adopting 10 x 15 cm plant spacing, farmers may enhance their crop yields, potentially leading to increased income.

The Effect of Mulching and Fertilizers Application on the Cabbage Yield

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Objective

To find out the effect of mulching and fertilizer application on the growth and yield of cabbage.

Materials and Methods

The experiment was carried out at West Nile Learning Farm, Uganda during July - August 2023. The cabbage Indica F1 (East-West Seed International [Uganda]) variety was used for the experiment. The seedlings were transplanted 25 days after sowing. Three (3) treatments were laid out following a Randomized Complete Block Design (RCBD) with three (3) replications. The treatments consisted of organic mulching x no fertilizer application (Treatment 1), organic mulching x fertilizer application (Treatment 2), and no organic mulching x no fertilizer application (Treatment 3). Dry grass mulch was applied as an organic mulch with 5-10 cm thickness. The irrigation was done when needed. The fertilizer was applied in split doses following the EWS-KT fertilizer recommendation guide. Additionally, before transplanting, a basal application consisting of 15-15-15 fertilizer and cow manure was applied to all treatments, as recommended by KT. The insect pest and disease management also followed the EWS-KT recommendations. Thirty plants were selected randomly from each treatment to collect the data. Data were collected on cabbage head diameter (cm) and head weight (kg). The diameter was measured with a scale as the horizontal distance from one side to another side of the head when it was harvested and then the value was recorded and expressed in centimeters (cm).

Results

The use of organic mulching and fertilizer application in Treatment 2 demonstrated a significant positive effect on plant growth, particularly in terms of head diameter, head weight, and overall yield. Consequently, this treatment also achieved the highest return on investment (ROI), underscoring the economic viability of integrating organic mulching with fertilizer application.

Table 1. Effect of mulching and fertilizers on head diameter and head weight of cabbage.

Treatment	Head diameter (cm)	Head weight (kg)	Yield (kg/500 m^2)
1) organic mulching x no fertilizer application	15.93 B	1.97 B	691.36 B
2) organic mulching x fertilizer application	17.03 A	2.70 A	959.26 A
3) no organic mulching x no fertilizer application	15.73 B	1.73 B	611.11 B
F-Test	*	*	*
$LSD_{0.05}$	1.0471	0.2927	189.27

Table 2. The return on investment in 500 m^2 (in USD).

Treatment	Cost	Return	Profit	%ROI
1) organic mulching x no fertilizer application	84.6	340.2	255.6	302.2
2) organic mulching x fertilizer application	133.4	564.3	430.9	323.1
3) no organic mulching x no fertilizer application	128.0	243.0	115.0	89.9

Conclusions

The research findings indicate that farmers can optimize cabbage yield 969.26 kg/500 m^2 by using organic mulch and by applying fertilizers to maximize the yield of cabbage. Organic mulch, such as dry grass, banana leaves, maize stalks, sorghum stalks, rice straw, and dry tree leaves, not only conserves soil moisture and suppresses weeds but also improves soil structure and raises nutrient availability and soil health. Fertilizers also supply essential nutrients crucial for optimal cabbage growth and development. By combining organic mulch with fertilizers, farmers can effectively enhance soil nutrition, promoting healthier cabbage plants and maximizing overall yield.

The Effect of Organic Mulch on the Yield of Tomato

Objective

To evaluate the effect of organic mulch on the yield of tomato.

Materials and Methods

The experiment was conducted in West Nile Learning Farm, Uganda from July to August 2023. The trial consisted of two treatments: mulching and no mulching. Straw mulch, applied at a thickness of 5-10 cm, served as the organic mulch. Irrigation was performed as needed. Other crop production operations such as fertilizer application, and insect pest and disease management were conducted according to the EWS-KT recommendations.

Tomatoes were planted in double rows with a spacing of 50 cm, following EWS-KT recommendations. The Pele F1 variety from East-West Seed International (Uganda) was used in the experiment. At harvest, yields were weighed and recorded.

Results

The production of tomatoes is shown in Figure 1. The application of mulch resulted in a 3.7 tons /kg in 500 m^2 yield, representing an 18.92% increase compared to the treatment without mulch.

Exposed soil in non-mulched fields tends to dry out quickly due to elevated temperatures and rapid moisture loss. Dry soil reduces nutrient availability, as plants struggle to absorb essential nutrients. Nutrients and sugars produced through photosynthesis are dissolved in water and move from areas of higher concentration, such as the roots, to areas of lower concentration, like the blooms, stems, and leaves, to support growth and reproduction. When plants cannot absorb these nutrients effectively, they become weaker and more susceptible to pests and diseases which often require more pesticide use and could not improve yields and reduce profitability.

Mulching addresses these issues by conserving soil moisture and improving nutrient availability. It also suppresses weeds, protects against erosion, and enhances soil aeration and water absorption, promoting healthier, more resilient plant growth.

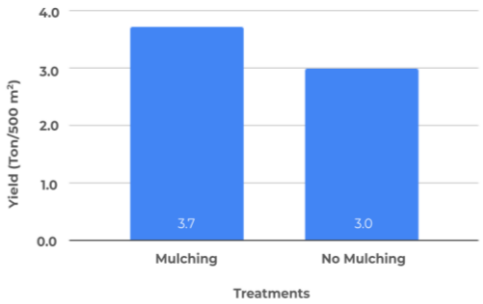

Figure 1. Effect of mulching and no mulching on tomato yield.

Tomatoes grown with mulching increased higher profits and a better return on investment (ROI) compared to those grown without mulching (Table 1). This is because mulching helps reduce production costs by minimizing the need for inputs such as pesticides. Additionally, the improved growing conditions lead to higher yields and greater returns. These combined effects make mulching a more cost-effective and profitable approach to tomato cultivation.

Table 1. The return on investment in 500 m^2 (in USD).

Treatment	Cost	Return	Profit	%ROI
Mulching	546.2	2,003.5	1,457.2	266.8
No Mulching	712.4	1,620.0	907.6	127.4

Conclusions

In this study, it is evident that organic mulching contributes to increased tomato yield. Local organic mulches, like dry grass, banana leaves, maize stalks, sorghum stalks, rice straw, dry tree leaves and among others, present an economically viable option for farmers, utilizing resources readily available in their vicinity. Organic mulch enhances soil moisture retention, regulates soil temperature for optimal crop growth, increases crop yield and improves irrigation water use efficiency in tomato cultivation. Moreover, it is an environmentally friendly technique that supports sustainable agricultural practices.