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Review on effect of Garlic Clove weight on Yield and Yield Components of Garlic (*Allium sativum* L.)

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Garlic (*Allium sativum* L.) is one of the most important crops in worldwide ranking second after onion in order of importance and cultivation know a day the demand for garlic crop in the worldwide is increasing due to its medicinal value and economic importance. However, the productivity of the crop in many parts of the world is low. A range of factors may contribute to garlic not achieving their potential yield. Among these factors influencing the yield of garlic clove weight is the most relevant one; hence the objective of this review is to review effect of Garlic Clove weight on Yield and Yield Components of Garlic. The result of this review showed that the yield and yield components of the garlic was increased in using medium clove weight (1-2g) to large clove weight (2-3g).Therefore, for increasing yield and yield components of the crop using medium to large clove weight is advisable.

Key words: Clove weight, Garlic (*Allium sativum* L.)

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INTRODUCTION

Garlic (*Allium sativum* L.) belongs to Alliaceae family (Allen, 2009). The origin of garlic is thought to be in Central Asia (India, Afghanistan, West China, Russia) and spread to other parts of the world through trade and colonization (Tindal, 1986). Garlic has been used in China and India for more than 5000 years, and Egypt since 2000 B.C. (Kamenetsky and Rabinowitch, 2006). Garlic is the most important *Allium* crop and ranks second next to onion in the world (Voigt, 2004). With respect to its production and economic value, garlic is one of the main *Allium* vegetable crops in the world and used as a seasoning in many foods throughout the globe. The oil of garlic is volatile and has sulfur combining compounds which is responsible for strong odor, its unique flavor and pungency as well as for healthful benefits (Salomon, 2002).

The demand on garlic crop worldwide is increasing due to its medicinal value and economic importance. The world average yield of garlic is about 10 tons ha 1, but can be increased up to 19 tons ha 1(Kilgori, M.J. et al 2007). The increase in yield and improving bulb quality of garlic is usually dependent on many factors that influence the plant growth throughout the growth (semira.N et al 2017). Several studies in various parts of the world have shown that garlic production can be improved through appropriate cultural practices. The yield potential of garlic plant depends on the extent of vegetative growth attained before the formation of bulb commences (Ahmed, H.G., et al 2007). The productivity of the crop in many parts of the world is low. A range of factors may contribute to

garlic not achieving their potential yield. Among these factors influencing yield of garlic clove weight is the most relevant. No doubt the use of the large sized cloves increases the yield significantly but it also enhances the cost of production by affecting the seed quantity whereas small sized bulbs result into lower yield with lesser cost of production. A number of study are undertake to standardize the weight of garlic cloves used for propagation in order to get cost effective results in garlic production. Therefore the objective of this review is to review effect of clove weight on yield component and yield of garlic.

Effect of garlic clove weight on Days to Emergence

When the size of clove was increased from small (1.0-1.5 g) to medium (1.5-2g) and large (2-3 g), the number of days required for emergence of the plant above the soil surface was significantly and linearly decreased. The longest duration for emergence was required by plants from the small sized cloves whereas the shortest duration was required by plants from large-sized cloves. Earlier emergence of garlic plants from the large-sized cloves than small sized ones could be attributed to availability of higher amounts of stored food (Mustefa Abdulkadir, 2014). The main effect of clove size was significant ($P<0.05$) difference on the number of days required for emergence of the plant above the soil surface .when the weight of clove was increased from small to medium and large the number of days required for emergence of the plant above the soil surface was significantly decreased (Semira.N et al 2017). According to Frederick J. Crowe and Rod Brevig, (2004) Emergence was somewhat lower with small seed, but this was not statistically significant.

Effect of garlic clove weight on Plant Height, Leaf Length and Leaf Number per Plant

Minimum plant height (45.49 cm) was obtained with the clove weight W1 (1.0-1.5 g) whereas maximum plant height (53.55 cm) was observed with the clove weight W5 (3.1-3.5 g). Higher vegetative growth under large clove size might be due to more reserve food material present in the clove in the initial stage of the growth (Nidhish Gautam *et al*, 2014). Plant heights at maturity were significant affected by different clove size. According to Mustefa Abdulkadir, (2014) increasing clove size showed increasing trend in leaf length. This is because large-sized cloves have higher food reserves which might have enabled the plants to produce larger leaves compared to small-sized cloves with relatively smaller reserve food.

Availability of more food reserves in cloves allowed young garlic plants to be more vigorous in their growth and development (Ahmed *et al.,* 2007). Similarly, Danna *et al*. (2000) reported that large sized cloves produced garlic plants which were taller. Leaf is considered as an important functional unit of plant which contributes to yield through its photosynthetic activity. Maximum number of leaves per plant (14.63) and clove weight W1 (1.0-1.5 g) gave the minimum number of leaves per plant 12.56 (Nidhish Gautam *et al*., 2014). Clove size had significant effect on the number of leave per plant at maturity. Large size clove had higher average number than the small sized clove (Ahmed, H.G., et al 2007).

Effect of garlic clove weight on Bulb Length and Bulb Diameter:

The highest bulb length and bulb diameter were obtained when medium weight cloves (1.5-2g) were planted. plots were planted with medium-weight cloves significant difference in bulb length from plots planted with small-weight(1-1.5g) cloves. Likewise, the smaller seed weight severely affected crop yield, bulb length and bulb diameter. On the other hand the main effect of bulb diameter showed non-significant effect on clove weight bulb diameter higher when the largest clove weights were used as compared with the smallest clove weights and the least bulb diameter were achieved by using the small clove weights (Semira et al, 2017).

Planting large-sized cloves (2-3g) resulted in significantly longer cloves compared to planting small sized (1-1.5g) cloves. Moreover, plots planted with medium-sized cloves differed significantly in clove length from plots planted with small-sized cloves. Similarly, clove diameter was significantly affected by the main effect of clove size planted. Planting large-sized cloves produced significantly thicker cloves compared to planting both medium-sized and small-sized cloves, which also differed significantly, with medium-sized cloves producing significantly thicker cloves than small-sized ones. This could be a result of the positive effect of higher vegetative growth which was obtained by planting large clove size, possibly leading to the development of larger clove length and clove diameter (Mustefa Abdulkadir, 2014). Similar findings who indicated that garlic plants which attained higher vegetative growth in early planting possibly had developed larger clove length and clove diameter (Adekpe *et al*.,2007). when the largest clove weights (2-3g) were used as compared with the smallest clove weights (1-1.5g). In 2005/2006, the least bulb diameter and average bulb weight were achieved by using the small clove weights (1-1.51g); however, there were no significant differences between using 1.0-2.0 and 2.1-3 g clove weights (Atif Y. Mahadeen,2011).

Effect of garlic clove weight on Mean Bulb Weight and Total Bulb Yield

The average weight per bulb was reduced by 37% for small seed and total harvest weight was reduced by

about 41% for small seed (Frederick J. Crowe and Rod Brevig, 2004). Average bulb weight, were significantly ($P< 0.05$) higher when the largest clove were used as compared with the smallest clove weights and the least average bulb weight were achieved by using the small clove weights. Conversely, the lowest mean bulb weight was obtained in small clove weigh. There was a positive increase in mean bulb weight at medium and large weight clove (2-3g). Weight might be ascribed to increase food reserved. (Semira et al, 2017).

The study done in Nigeria for two seasons show that clove affect bulb weight significantly in both season and the higher weight was recorded in large sized clove than in small sized clove which had least bulb weight in both season (Ahmed, H.G., et al 2007). According to Burba *et a*l., (1987) plants produced from medium seed cloves gave higher bulb yield than small sized cloves. Higher bulb yield was achieved when large (2-3g) and extra-large cloves (3.1-4g) were used compared with other clove weights. Maximum garlic yield values (19.2 and 18.4 tons ha -1) were achieved by using large clove weights (2-3g) in 2005/2006 and 2006/2007 growing seasons, respectively. This could be a result of the positive effect of higher vegetative growth which was obtained by planting large clove weight, possibly lending to the development of larger bulbs and higher yield (Ahmed *et al*., 2007; Stahlschmidt *et al*., 1997).

Effect of garlic clove weight on Marketable Bulb (>2g) and Unmarketable Bulb (<1g)

Increasing marketable cloves size was observed in response to increasing the size of cloves planted. Thus, the thickest cloves (with the largest width) were obtained from plots planted with Large-sized cloves. On the other hand, planting small-sized cloves resulted in the production of small-sized cloves. This means that the failure of the small-sized seed cloves to develop into marketable cloves size due to higher competition for resources as compared to large sized seed cloves. This might be due to the presence of higher amount of initial reserved food material in the large sized cloves which enhanced more cell division and cell elongation resulting in vigorous plants that yielded larger bulbs than the medium and smaller ones (Mustefa Abdulkadir, 2014). In similar finding Azad (2002) and Halim (2000) who stated that using larger cloves for planting produced marketable clove size and increased top dry weights. Increasing marketable bulb size was observed in response to increasing the weight of cloves planted. Thus, the thickest cloves (with the largest width) were obtained from plots planted with medium weight cloves. Planting small-weight cloves resulted in the production of small-size cloves (Semira.N et al, 2017).

The highest weight of unmarketable cloves per bulb (0.9 g) was obtained when large clove size was used, while the lowest weight of unmarketable cloves per bulb (0.7 g) was obtained from using small-sized cloves. This indicated that the failure of the small-sized seed cloves to develop into less unmarketable cloves size due to higher competition for resources as compared to large sized seed cloves. The failure of the small-sized seed cloves to develop into less unmarketable cloves size might be due to the presence of higher amount of initial reserved food material in the propagating unit (Mustefa Abdulkadir, 2014).

CONCLUSION

This review shown that using clove weight of medium (1-2g) to large weight (2-3g) resulted in the production of higher Plant Height, Leaf Length and Leaf Number per Plant and also Mean Bulb Weight, Total Bulb Yield and marketable bulb yields. Therefore, it is better to use medium to large clove weights for producing higher bulb yield and yield component of garlic.

Conflicts of Interest

The authors declare no conflicts of interest.

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