



RESEARCH ARTICLE

# Performance of Garlic Genotypes Under Polyhouse and Open Field Conditions of Kodaikanal Hills

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## ABSTRACT

An experiment was conducted at Horticultural Research Station, Kodaikanal to find out the suitable variety or genotype for cultivation under protected structure. The treatment consists of 7 garlic genotypes collected from different institutions and local types viz., Ooty 1 Garlic, Agrifound Parvathi, Yamuna Safed-4, Yamuna Safed-5, KKL-1 (Poombarai local (Pink)), KKL-2 (Kodaikanal local (White)), KKL-3 (Kodaikanal local (Single bulb)). The variety Yamuna Safed-4 registered the highest yield both under open field (11.21 t ha<sup>-1</sup>) and polyhouse condition (11.04 t ha<sup>-1</sup>). The TSS content was 37.33° Brix under open field conditions and 35.21° Brix under polyhouse condition. During 90 days of storage the physiological loss in weight was 38.80 per cent and 37.42 per cent respectively in open field and polyhouse condition. Hence it is concluded that Yamuna Safed-4 can be cultivated both under open field and polyhouse condition of Kodaikanal with higher yield and quality.

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## INTRODUCTION

Garlic (*Allium sativum* L.) belongs to the family Alliaceae is being used in the traditional medical systems of India. Allicin, the biologically active compound has been found to prevent the risk of cardiovascular diseases and cancer (Banerjee and Maulik, 2002). In India it is cultivated largely in Madhya Pradesh, Rajasthan, Gujarat, Uttar Pradesh and Assam. As per the data available in Horticultural statistics at a glance 2018, the area under cultivation is 3,17,000 hectares with production of 16.11 lakh tonnes. Garlic is also exported to the tune of 31,222 tonnes valued for rupees 13,266 lakh (Anonymous, 2018). In Tamil Nadu, garlic is grown in Ooty and Kodaikanal hills. Geographical Indication is used to identify agricultural, natural and manufactured goods originating in said area. It should have a special quality of characteristics unique to the Geographical Indication. GI tagging has been given for the garlic grown in Kodaikanal hills owing to the reason that it has peculiar characteristic with abundant medicinal properties. Generally, garlic varieties cannot tolerate extreme cold or hot climatic conditions. But Kodaikanal garlic grows well in cool climate between 11 to 20°C. The performance of genotypes varies with region, season and other growing conditions. Hence the present investigation was formulated to assess the performance of garlic genotypes under polyhouse and open field conditions of Kodaikanal hills.

## MATERIAL AND METHODS

An experiment was conducted at Horticultural Research Station, Kodaikanal to find out the suitable variety or genotype for cultivation under protected structure. The treatment consists of 7 garlic genotypes collected from different institutions and local types viz., Agrifound Parvathi, Yamuna Safed-4, Yamuna Safed-5, Ooty 1, Poombarai local (Pink) KKL-1, Kodaikanal local (White) KKL-2 and Kodaikanal local (Single bulb) KKL-3. The seven genotypes were grown in open field and Polyhouse conditions (Low-cost poly house without environment control). The experiment was laid out in Randomized Complete Block Design (RCBD) with two replications. The cloves were sown in beds of 2.0 m × 10 m area at a spacing of 15 cm × 10 cm in the last week of April 2017 and 2018. Recommended cultural practices were followed for raising good crop. Five plants from each treatment were tagged and observations were recorded on vegetative growth and yield characters such as, plant height, No. of Leaves/plant, No. of cloves/bulb, clove weight, bulb weight, dry matter content (per cent), TSS (oBrix), yield plant<sup>-1</sup> (g), yield plot<sup>-1</sup> (kg m<sup>-2</sup>), yield hectare<sup>-1</sup> (t ha<sup>-1</sup>) and physiological weight loss during storage. The genotypes were stored under ambient condition for three months and the data was recorded at 30 days interval on PLW. The cloves of ten randomly selected garlic bulbs were crushed and the paste was used to find the total soluble solids in samples (Nieuwhof *et al.*, 1973) and the total soluble

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solids values were recorded with the help of digital refractometer and expressed in degree Brix. The recorded data were statistically analyzed at 5 per cent level of significance by following the standard process as stated by Panse and Sukhatme (1978).

## RESULTS AND DISCUSSION

### Pooled analysis of growth and yield parameters of garlic genotypes grown under open field and polyhouse conditions

Growth parameters were significantly influenced by genotypes and growing environment. In Agrifound Parvathi and KKL 2, significant reduction in plant height was recorded in polyhouse condition. However in Yamuna Safed-4 marked increase in plant height (66.50 cm) was registered under polyhouse condition. Tiwari et al. (2002), Futane et al. (2006) and Mishra and Vikram (2017) also observed difference among garlic genotypes for plant height. The number of leaves also influenced by genotypes and growing environment. Among the genotypes and growing environment Yamuna Safed-4 grown under polyhouse condition registered the highest number of leaves (14.08) (Fig. 1).

#### Yield parameters

Number of cloves/bulb ranged between 1.15 and 15.35 under open field condition and it was between 1.05 and 13.31 in polyhouse condition. The significant difference in number of cloves/bulbs among genotypes was observed by Aslam et al. (2016). When compared to open field condition, reduced number of cloves/bulbs was observed under polyhouse condition in Agrifound Parvathi. Yamuna Safed-4, Yamuna Safed-5, Ooty-1, KKL-2 recorded less number of cloves under polyhouse compared to open field condition. Only the genotype KKL-1 registered more number of cloves under polyhouse condition. However, in KKL-3, the single cloved bulb did not show any change in number of cloves despite variation in growing environment.

Individual clove weight ranged between 1.12 to 4.6 g under open field condition and 1.45 to 4.44 g in polyhouse condition. KKL-3 recorded the highest single clove weight under both environmental conditions. Yamuna Safed 4 registered marked improvement in clove weight in polyhouse condition compared to open field condition. Bulb weight also significantly influenced by growing environment and genotypes. Agrifound Parvathi registered considerable bulb weight reduction under polyhouse conditions whereas Yamuna Safed 4 recorded highest bulb weight (32.09 g) under polyhouse conditions (Fig. 2).

The yield plot<sup>1</sup> was significantly influenced by genotypes. Growing environment did not have influence on plot yield of Agrifound Parvathi, Yamuna Safeda – 4, Yamuna Safeda – 5, Ooty – 1,

KKL – 1, KKL -2 and KKL – 3. Among the genotypes, Yamuna Safeda – 4 registered the highest plot yield in open field and polyhouse conditions. The similar trend was observed for yield ha-1 also. The highest recorded in Yamuna Safed- 4 can be attributed to more number of leaves which might have physiological capacity to mobilize and translocate photosynthates to bulbs (Fig. 3). Besides Yamuna Safed- 4 had registered significantly highest individual clove number. These results are in agreement with the findings of Umamaheswarappa et al. (2014) and Nandini et al. (2018).

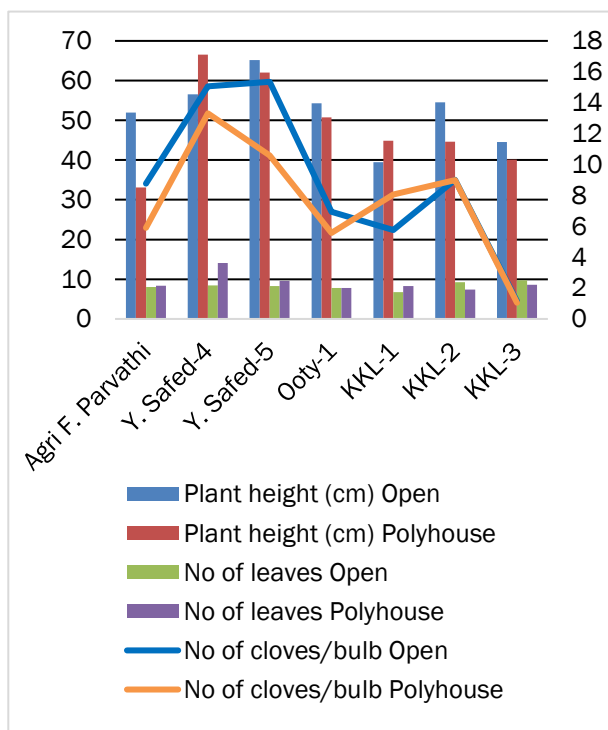


Figure 1. Pooled analysis of Growth and yield parameters of garlic grown under open and polyhouse condition

#### Quality parameters

Dry matter content ranged between 27.1 to 34.93 per cent in the open field conditions. The genotype KKL- 3 registered the highest dry matter content of 34.93 per cent. Under polyhouse conditions it ranged between 27.24 and 34.12 per cent (Fig. 4). The genotype KKL- 2 registered the highest dry matter of 34.12 per cent which was on par with KKL- 3 (33.69 per cent), the results are in line with Khar et al. (2011) who estimated the dry matter content of different garlic genotypes it was in the range of 33.3 and 44.0per cent.

The T.S.S °Brix (total soluble solid) content was significantly influence by different genotypes. However, the growing conditions did not influence much on the total soluble solid content. The genotype KKL- 1 registered the highest T.S.S content both under open field and polyhouse conditions. The results indicate that the T.S.S content is influenced by genetic character. The same view is opined by Sharma et al. (2015) and Abedi et al. (2013).

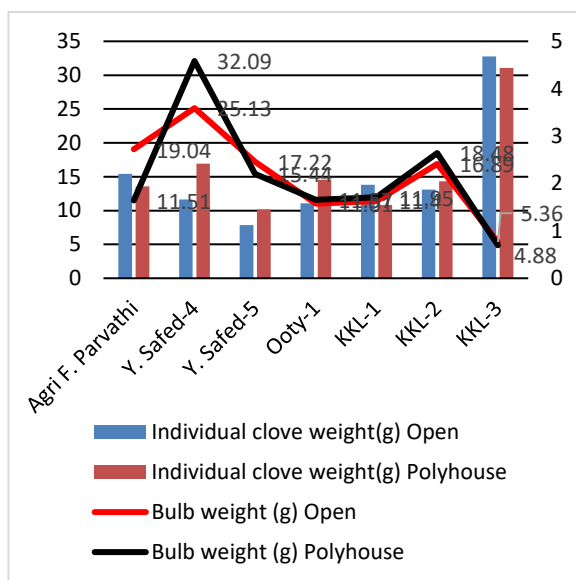


Figure 2. Individual clove weight and bulb weight of garlic grown under open and polyhouse condition

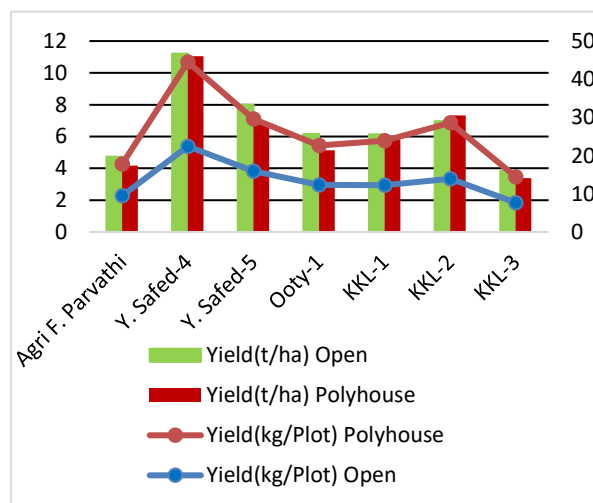


Figure 3. Yield plot<sup>-1</sup> and yield ha<sup>-1</sup> of garlic grown under open and polyhouse condition

**Physiological Loss on Weight (per cent)**

The physiological loss in weight was observed for garlic genotypes grown under polyhouse and open field conditions. The loss in weight was assessed at 30, 60 and 90 days of storage. At 30 days of storage the maximum physiological loss in weight was observed in Yamuna Safed-5 grown under polyhouse conditions and same genotype registered highest physiological loss in weight

under open condition also (17.3 per cent). At 60 days of storage Agrifound Parvathi registered the highest loss in weight of 55.04 and 54.62 per cent under open field and polyhouse conditions respectively. At 90 days of storage Agrifound Parvathi registered the highest physiological loss in weight both under open field (72.5 per cent) and polyhouse condition (71.74 per cent), which was followed by Yamuna Safed-5 (40.74 and 41.05 per cent). The lowest value was registered in KKL-3 grown under open field condition (31.29 per cent) and polyhouse condition (32.67 per cent) (Fig. 5).

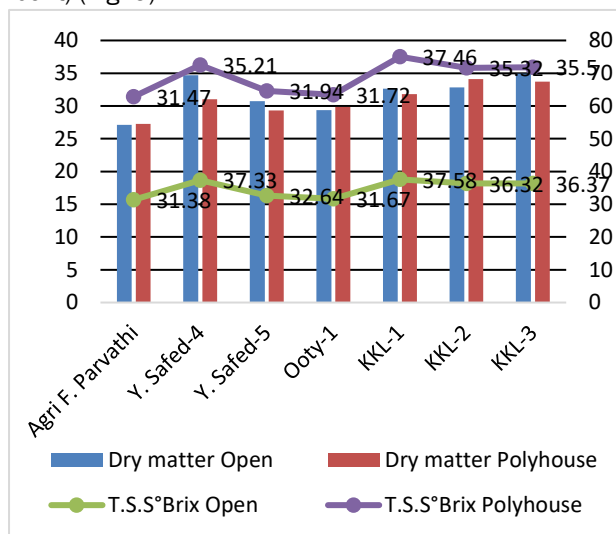


Figure 4. Pooled analysis of quality parameters of garlic grown under open and polyhouse condition

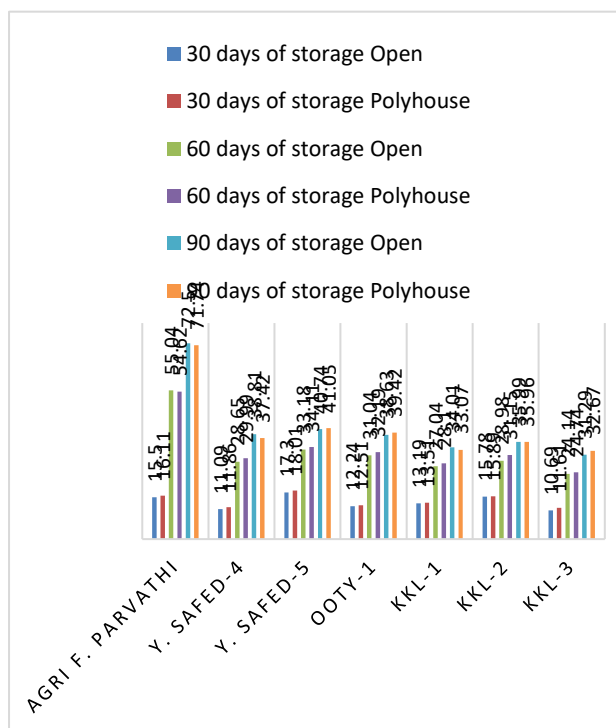


Figure 5. Physiological loss in weight (per cent) of garlic grown under open and polyhouse condition

## CONCLUSION

The treatment consists of 7 garlic genotypes collected from different institutions and local types viz., Ooty 1 Garlic, Agrifound Parvathi, Yamuna Safed-4, Yamuna Safed-5, KKL-1 (Poombarai local (Pink)), KKL-2 (Kodaikanal local (White)), KKL-3 (Kodaikanal local (Single bulb)). The variety Yamuna Safed-4 registered the highest yield both under open field (11.21 t ha<sup>-1</sup>) and polyhouse condition (11.04 t ha<sup>-1</sup>). The TSS content was 37.33° Brix under open field conditions and 35.21° Brix under polyhouse condition. The allicin content was 10.05 mg g<sup>-1</sup> and 9.10 mg g<sup>-1</sup> in open field and polyhouse condition respectively. During 90 days of storage the physiological loss in weight was 38.80 and 37.42 per cent in open field and polyhouse condition respectively. Hence it is concluded that Yamuna Safed-4 can be cultivated under both open field and polyhouse conditions of Kodaikanal with higher yield and quality.

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