Morphology and field performance of thirty one garlic germplasm

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Abstract: The experiment was carried out to observe the morphology and field performance of thirty one garlic germplasm at Bangladesh Agricultural University, Mymensingh during 2009 to 2010. The experiment was conducted in Randomized Complete Block Design (RCBD) with four replications using the selected germplasms as individual treatment. In morphological analysis it was found that yield and yield contributing characters had significant relationship with yield. Among all the germplasm G50 had the highest yield (8.69ton/ha) with highest number of leaves (9), high fresh leaf weight (91.40g), fresh root weight (6.90g/5plants), and dry root weight (1.86g) followed by G49 (7.44ton/ha), G32 (6.86ton/ha) and G30 (6.21ton/ha).
Key words: Garlic, morphology, germplasm, performance

Introduction

Garlic (*Allium sativum* L.) is a member of the family Alliaceae. The total production of garlic in Bangladesh is only 102 thousand metric tons from 66 thousand hectares of land (BBS, 2009). The average yield of garlic in Bangladesh is only 2.93t/ha (FAO) which is very low compared to other countries of the world. In Bangladesh there are many cultivated types of garlic, which are known either by their local or the locality where grown or characteristics of the crop. According to Islam *et al.* (2004) yield and yield contributing characters can affect the yield of any germplasm. For the development of suitable garlic varieties, it is essential to evaluate the characters of the available germplasm and conserve the collected materials for future use. According to Singh (2003) evaluation may consist for nothing more than description of the place of origin and a morphological and phonological description of the places of origin or it may consist of information on physiological, biochemical, genetical, plant pathological or other characteristics.

In Bangladesh with the gradual increase of population the demand of garlic is increasing day by day. It is very difficult to increase the area under cultivation of garlic due to limitation of land. The only way to overcome the problem is to increase per hectare yield of garlic through cultivation of promising varieties means varieties with higher yield. The yield of garlic is dependent on many factors. The most important one is the variety itself. Cultivation of high yielding variety is the main consideration for any crop. To know the potentiality of a variety it is important to know the morphology of the germplasm. Morphological characters largely affect the yield of garlic. Considering the above facts the present study was undertaken to observe the morphological variations in different garlic germplasm and the growth as well as yield of garlic germplasm.

Materials and Methods

The present research work was conducted at the Horticulture farm, Bangladesh Agricultural University, Mymensingh during the period from November 2009 to April 2010. The single factor experiment had thirty one treatments used as germplasm (G3, G5, G8, G10, G13, G15, G19, G20, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38, G39, G40, G41, G42, G43, G44, G45, G46, G47, G49, and G50). Among them 28 germplasam were collected from Bangladesh, one from China and 2 from Vietnam. The experiment was conducted in Randomized Complete Block Design

(RCBD) with 4 replications. The size of each unit plot was 1m × 1m, plant spacing 15×10 cm, total number of plots 124. Data were recorded on yield and yield contributing characters on number of leaves, plant height, length of leaves, fresh weight of leaves, fresh weight of roots, fresh weight of bulbs, dry weight of leaves, dry root weight, dry weight of bulbs, diameter of bulbs, number of cloves, and yield of bulb per hectare.

Results and Discussion

Relation of vegetative and yield contributing characteristics on yield: With the increase of number of leaves, fresh leaf weight, fresh root weight and dry root weight yield increased significantly. Germplasm G50 showed the highest yield (8.69ton/ha) with highest number of leaves (9), fresh leaf weight (91.40g), maximum fresh root weight (6.90g/5plants) and dry root weight (1.86g) (Figs 1-4). If the leaf number is high consequently plant will have higher leaf area indices (Stewart and Dwyer, 1999), highest capture of light and high photosynthetic activity. This was lead to highest yield. In relation analysis germplasm G34, G38, G39, G40, G41, G42, G43, G44, G45, G46 and G47 was not included because they did not produce any cloves.
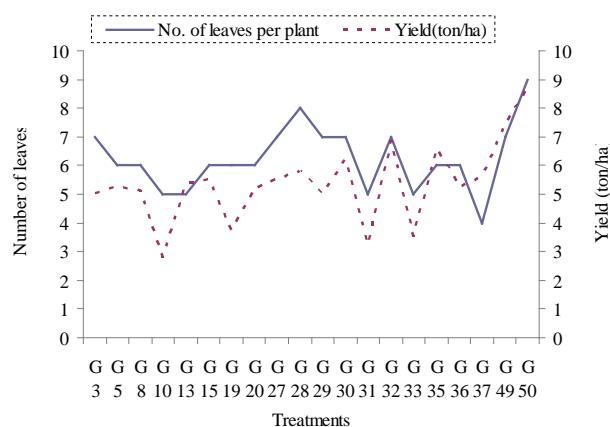

Fig1. Relation between number of leaves and yield

Association of vegetative and yield contributing characters on yield: Multiple regression analysis was conducted to examine the association of vegetative and yield contributing characters on yield. The yield was dependent variable and number of leaves, plant height, leaf length, fresh leaf weight, dry leaf weight, fresh root weight, dry root weight, bulb diameter, dry bulb diameter

and number of cloves were independent variable. All the characters were mainly influenced by environmental factors and management practices. As a whole, there was a significant association present between yield, vegetative and yield contributing characters. That means yield was dependent more or less on all of the characters. Number of leaves contribute to the yield as higher number of leaves represent higher leaf area (Kamenetsky *et al*, 2002). Also leaf length is directly related to leaf area. Also garlic has erect leaves that have high light interception. Root contributes in the translocation of food. So leaves and roots combine other yield contributing characteristics. But when individual association with yield was conducted it was found that only bulb diameter showed significant association with yield (Table 1).

Table 1. Association of individual variable with yield

Name of the variables	Significance
Number of leaves per plant	0.212
Leaf length (cm)	0.367
Plant height (cm)	0.795
Fresh leaf weight (g/5plants)	0.910
Dry leaf weight (g/5plants)	0.306
Fresh root weight (g/5plants)	0.716
Dry root weight (g/5plants)	0.686
Bulb diameter (cm)	0.005**
Dry bulb weight (g/5plants)	0.923
Number of cloves per plant	0.123

Means yield is mainly dependent on bulb diameter (Nourai, 1993). It was also evident in this experiment because the germplasm with highest yield gave the highest (4.40cm) bulb diameter.
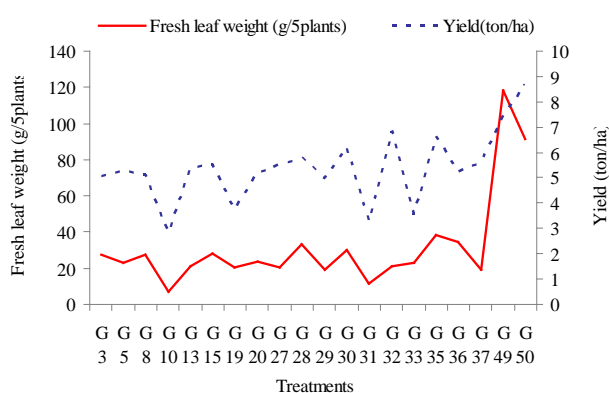

Fig 2. Relation between fresh leaf weight and yield

Yield performance: Analysis of variance test was performed to observe variations among the germplasm. There was significant difference present among the germplasm. The germplasm vary from each other. The maximum yield was obtained from the Vietnam germplasm G50 (8.69 ton/ ha). The lowest yield was obtained from the germplasm G10 (2.81 ton/ha). Also

some local germplasm showed good yield G32 (6.86 ton/ha) and G30 (6.21 t/ha) (Fig 5). The germplasm from Vietnam showed good performance because the climatic condition of Vietnam is very similar to Bangladesh. The average temperature of Vietnam is 25 to 30 °C.
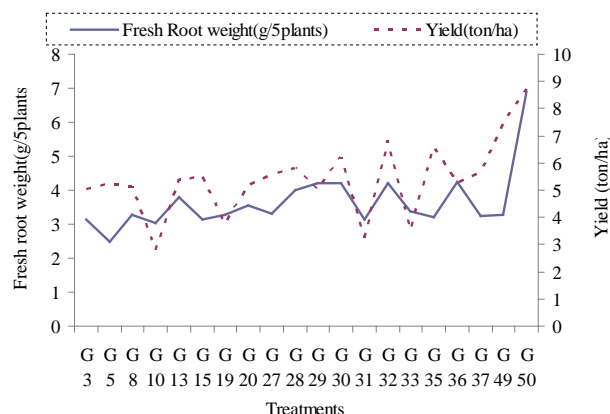
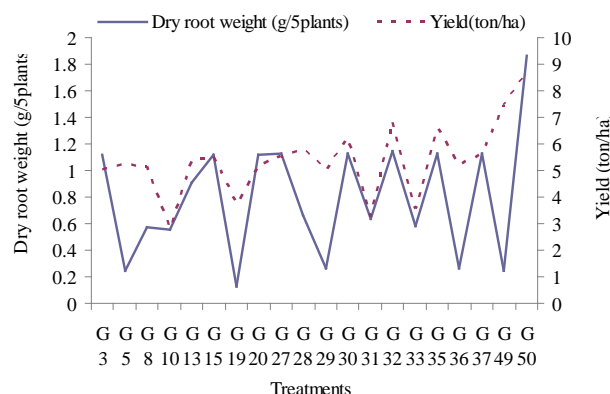

Fig 3. Relation between fresh root weight and yield

Fig 4. Relation between dry root weight and yield

Cluster analysis: G50 germplasm was well separated as a single cluster while G49 and G39 were clustered together. Other than those four were obvious clusters can be seen (which are encircled in blue colour). G40 was different from other members G27, G3, G30, G15, G20 and G35 in that sister cluster while G37 was also quite different from G34 and G46 sister clusters (Fig 6). As morphological characters like number of leaves, fresh leaf weight, fresh root weight and dry root weight which significantly correlated are used for the construction of dendrogram, which come together to form a cluster showing similar morphology while others are distant. G50 which origin in Vietnam shows very different morphological characters such as relatively higher number of leaves and lengthy leaves, highest root weight confirming its parental line can be different compared to other varieties. Moreover, G49 which also has Vietnam origin closely clustered with G50. The varieties G37 and G29 have same cluster distance collected from Pirgong in Bangladesh. On the contrary G27, G28, G35 and G36 have clustered in differently and possibly due the disparities of their

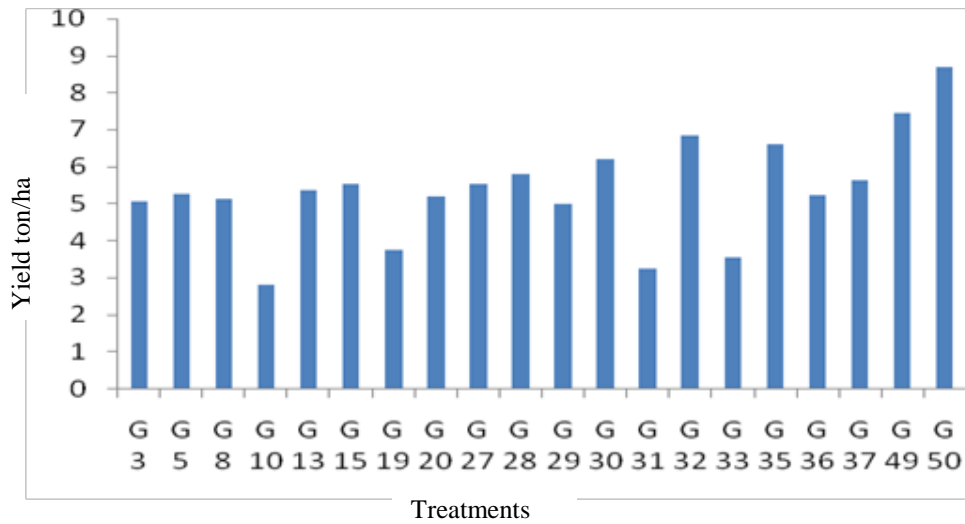parental lines though they come from same place called   Palashbari in Bangladesh.

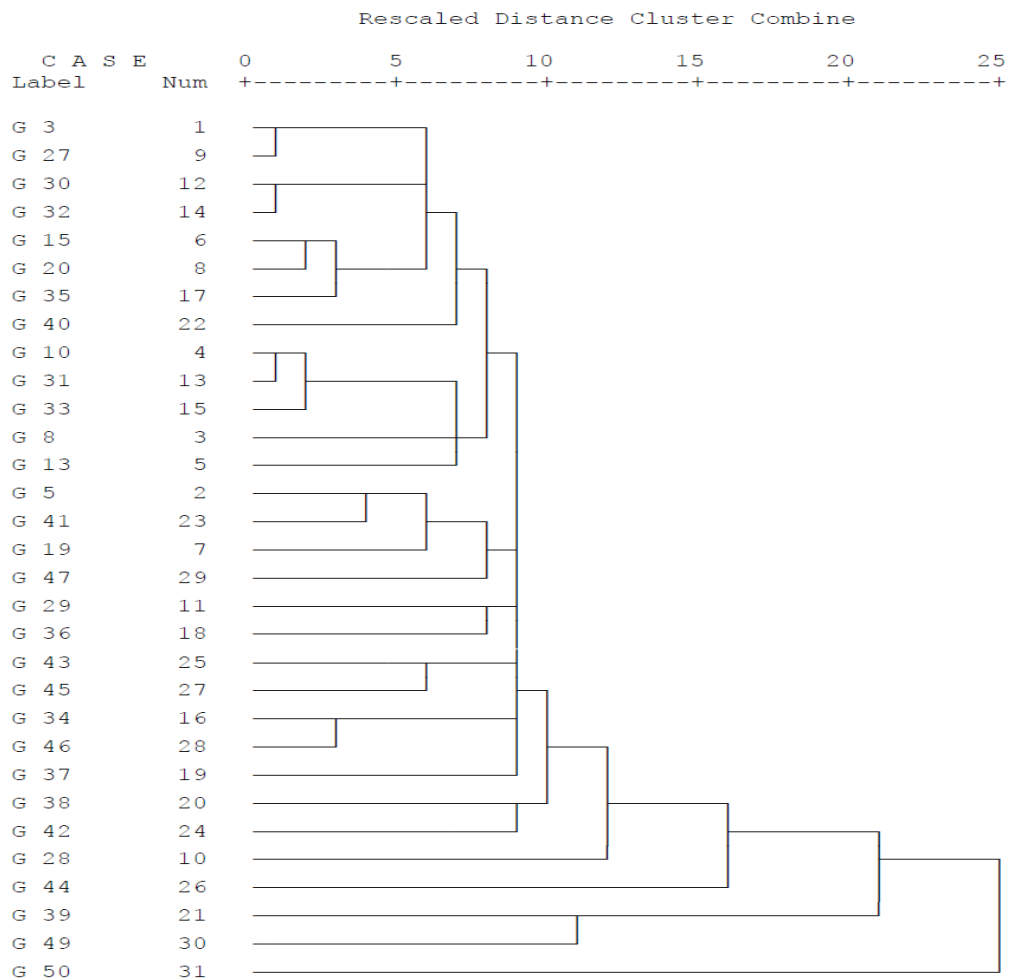**Fig. 5.** Yield Performance of different treatments

Fig. 6. Dendogram showing hierarchical clustering of thirty one garlic germplasm

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