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Parameter and yield variation in cabbage in relation to some technology elements

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Abstract: The study evaluated morphological parameters and yield of autumn cabbage in relation to technology elements. Two cabbage genotypes ('Carusoe F1' and 'Autumn King F1') were studied in relation to two fertilizer products (Gospodaru - poultry manure, Complex Linzer 20-20+8SO_3+Zn), and two irrigation systems (sprinkler irrigation, drum irrigation). Eight experimental variants resulted (V1 to V8, generated by combining each hybrid, with fertilizers and irrigation). The following parameters of cabbage heads and yield were evaluated: (cabbage head diameter – CHD; cabbage head height – CHH; shape index - SI; central stem height – CSH; central stem leaf number – CSLN; leaves number per unit stem length – LNUSL; cabbage head weight – CHW; yield/ha – Y/ha). Based on SI values, cabbage hybrids presented a flattened head shape (SI<1.00). In relation to the values of the parameters CSH, CSLA, and LNUSL, the cabbage heads were very dense. For the CHW parameter, values of CHW = 1.29±0.01 kg to CHW = 1.41±0.01 kg were recorded.

• Introduction

Cabbage (*Brassica oleracea* L. var. *capitata*), family *Cruciferae*, is one of the most cultivated vegetable plants in the world [19], [22]. Cabbage was studied in relation to technology elements, for the purpose of adequate technological management and optimization of yields [9]. Technological inputs are important for optimizing yields and have been studied in relation to cabbage cultivation in relation to energy-efficient agricultural practices [11], [21]. The water factor is important for cabbage crops [18], [10]. Morphological and agronomic parameters of cabbage heads have been studied in response to different cultivation techniques [14]. Developmental dynamics of cabbages have been studied, and how tissue growth mechanisms influence leaves in cabbage heads has been evaluated [24].

• Material and method

Two genotypes, hybrid forms, of autumn cabbage were cultivated, 'Karusoe F1' (V1 to V4) and 'Autumn King F1' (V5 to V8). Fertilization was done with organic fertilizer (Gospodarul – fermented poultry manure; V1, V2, V5, V6), and complex fertilizer (Linzer 20:20+8SO_3+Zn; V3, V4, V7, V8). Water supply was done by irrigation, sprinkler irrigation (V1, V3, V5, V7), and drum irrigation (V2, V4, V6, V8). An appropriate cultivation technology was provided, specific for industrial autumn cabbage crops. At the technical maturity of harvesting, head samples (10 heads) were taken, randomly on the experimental variants, and the following parameters were determined: cabbage head diameter (CHD, cm), cabbage head height (CHH, cm), shape index (SI); central stem height (CSH, cm); central stem leaf number (CSLN, no); leaves number per unit stem length (LNUSL, no); cabbage head weight (CHW, kg); yield/ha – Y/ha, t/ha).

• Results and discussions

The values recorded for the parameters considered in the study of plants on the experimental variants of autumn cabbage are presented in Table 1. In the case of cabbage head diameter, values were recorded CHD = 15.90±0.11 cm (V5), up to CHD = 16.80±0.11 cm (V4). In the case of cabbage head height, values were recorded CHH = 13.50±0.11 cm (V5, V6), up to CHH = 14.30±0.11 cm (V2, V4). The shape index parameter presented values from SI = 0.84±0.004 (V6) to SI = 0.88±0.004 (V8). In the case of central stem height the values varied between CSH = 8.30±0.07 cm (V5), up to CSH = 8.90±0.07 cm (V8). In the case of central stem leaf number values were recorded from CSLN = 11.00±0.08 (V5), up to CSLN = 11.60±0.08 (V8). For leaves number per unit stem length, values from LNUSL = 1.30±0.01 (V8) to LNUSL = 1.40±0.01 (V2) were recorded. Cabbage head weight presented values from CHW = 1.29±0.01 kg (V5, V7), to CHW = 1.41±0.01 kg (V2). The yield showed values from Y/ha = 64.35±0.76 t/ha (V5), to Y/ha = 70.55±0.76 t/ha (V2). The correlation analysis showed the level of interdependence between cabbage head parameters, based on the values recorded under experimental conditions, Figure 2. Multivariate analysis revealed variant V2, followed by variant V4, in relation to CSLN and CHW parameters, parameters considered important in relation to yield and utilization through processing into finished products for autumn cabbage, Fig. 3. Based on the same parameters, Cluster analysis was applied, which generated the dendrogram with the similarity-based grouping of variants (Coph.corr. = 0.830), Fig. 4. The variants were positioned in a balanced manner in the cluster dendrogram, in relation to the parameter values and the level of similarity.

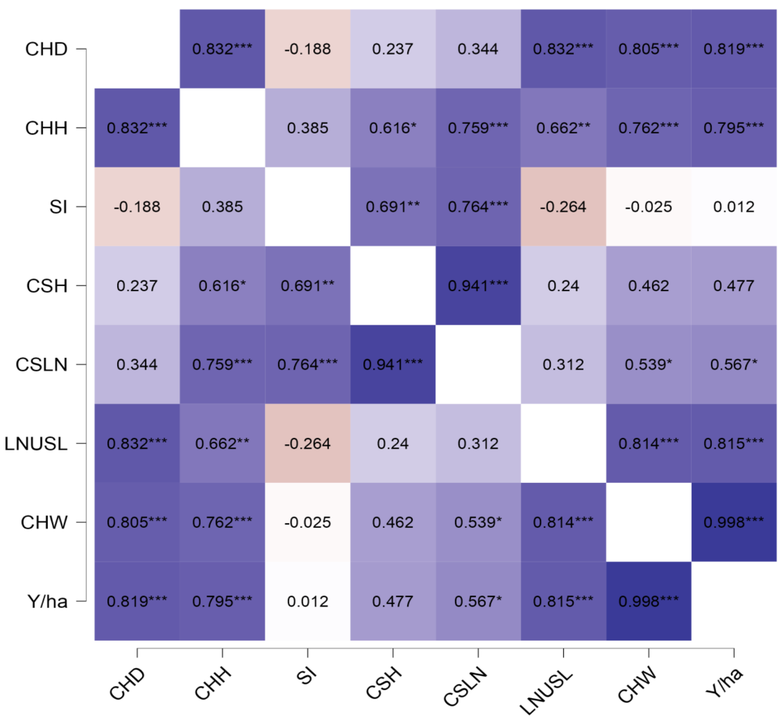

Figure 2. Correlation matrix between cabbage head parameters (p<0.05, *; p<0.01, **; p<0.001, ***)

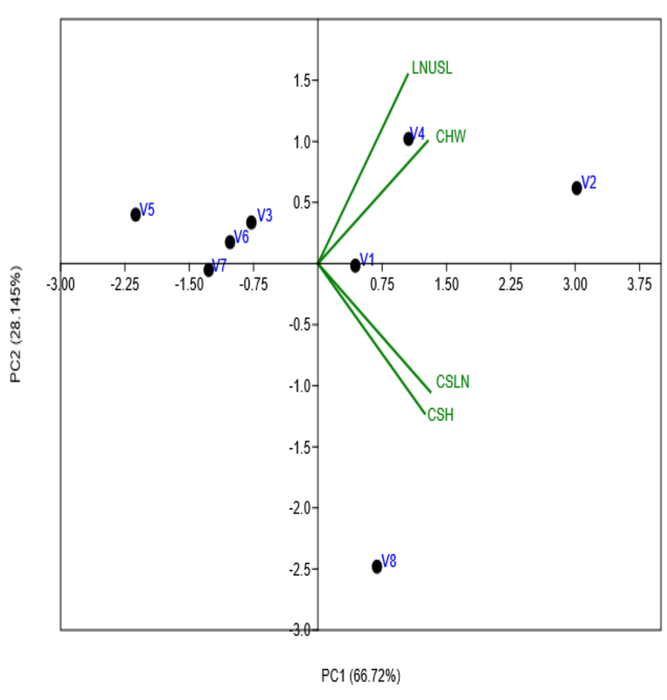

Figure 3. PCA diagram in terms of the variants and parameters considered for autumn cabbage

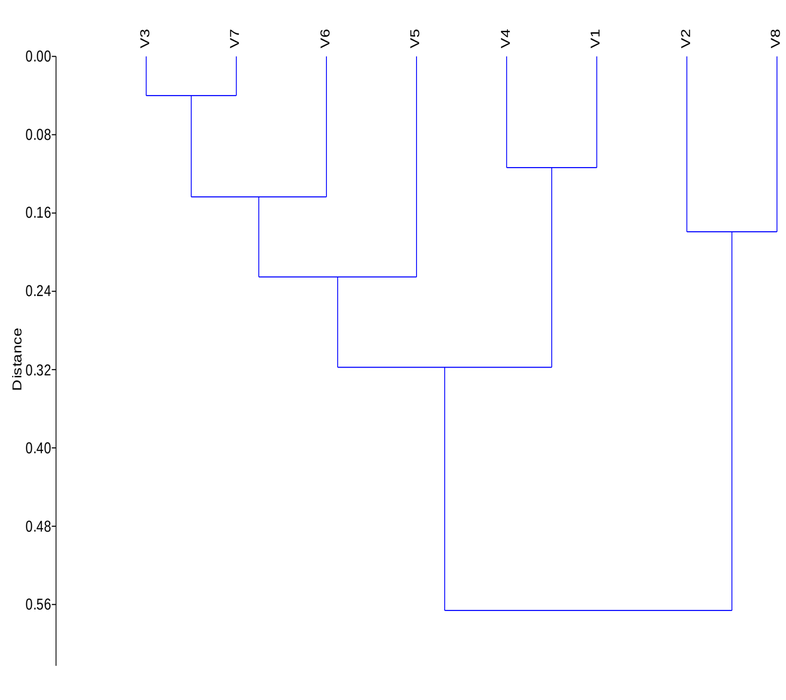

Figure 4. Cluster dendrogram of experimental variants in autumn cabbage

• Conclusions

A positive correlation of different intensity levels was recorded, in conditions of statistical safety (p<0.05, p<0.01, p<0.001) between agronomic parameters of cabbage heads. The correlation recorded between cabbage head weight (CHW) and morphological and dimensional parameters of the heads were of great interest. The multivariate analysis explained the loading values of the factors (cabbage head parameters) in the principal components, and the score of the experimental variants in the principal components, which made it possible to understand more clearly the interdependence of the variants with parameters, through the tabular matrix and PCA diagram. Regression analysis generated mathematical models in the form of polynomial equations, and graphical models (3D, isoquants) that described the variation in cabbage head weight (CHW) in relation to different morphological and agronomic parameters of the head, under conditions of statistical safety.

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