



Grain yield variation models in the wheat ears based on morphological parameters

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Abstract: The aim of the study was to describe the variation of grain weight in the wheat ears in relation to different morphological elements of the wheat plant and ears. The W5028 genotype was considered as the biological material. The parameters considered were: plant height (PH, cm), ear length (EL, cm), spikelets number in the ear (SpkN), ear weight (EW, g), ear grains number (EGN), and ear grains weight (EGW, g). ANOVA Test confirmed the statistical safety of the data, and the presence of variance in the data set ($F > F_{crit}$, $p < 0.001$). The EGW parameter presented negative correlation with PH ($r = -0.435$), and positive correlation with the other parameters, at very strong intensity level with EW ($r = 0.946$), and with EGN ($r = 0.934$), and at medium intensity level with SpkN ($r = 0.556$), and with EL ($r = 0.444$). Regression analysis described the variation of EGW with plant and ear parameters, in different combinations, under statistical safety conditions.

• Introduction

Agronomic characters were studied in wheat genetic resources from the perspectives of biodiversity, genetic variability, and other aspects, in relation to different objectives of breeding programs [4], [1], [30]. The height of wheat plants, as an important element in the architecture of wheat plants and the formation of yields, was analyzed in relation to genetic determinants, in order to characterize genotypes in genotype collections and databases [36], [9], [38]. Grain parameters in the wheat ear (e.g. grain formation, grain weight, etc.) were analyzed to quantify the grain contribution to yield formation [3]. Different methods and models have been promoted for the study of wheat plants, the characteristics of the ears, the dynamics of the wheat crop, in order to estimate the formation of yields in relation to the interaction (genotype x environment x culture technology) [40], [18], [19], [20].

• Material and method

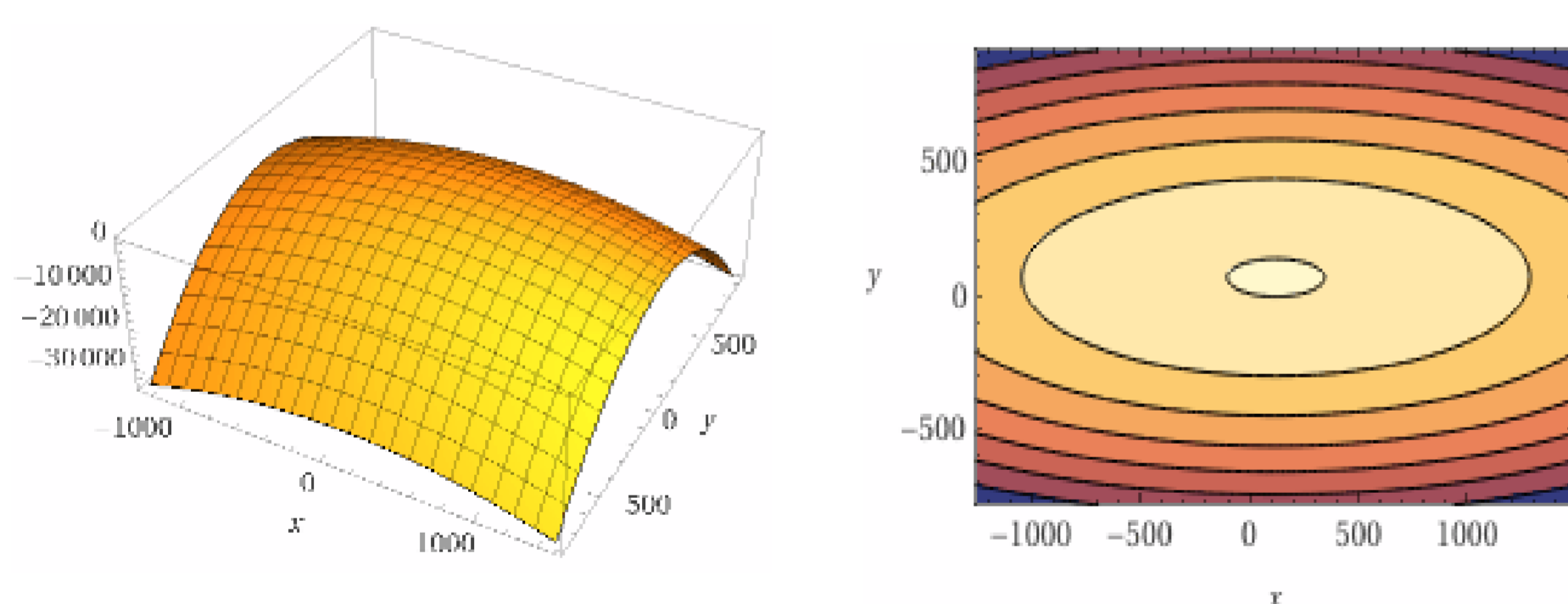
The research was organized within ARDS Lovrin, the Wheat Improvement Laboratory, during the 2023-2024 agricultural year. The biological material was represented by the wheat genotype W5028. The field experiment was carried out in a non-irrigated system, on a land with chernozem type soil. At harvest maturity, BBCH code 9: Senescence [22], plant samples were taken randomly to determine the parameters: plant height (PH, cm), ear length (EL, cm), spikelets number in ear (SpkN), ear weight (EW, g), grains number in ear (EGN), grains weight in ear (EGW, g).

• Results and discussions

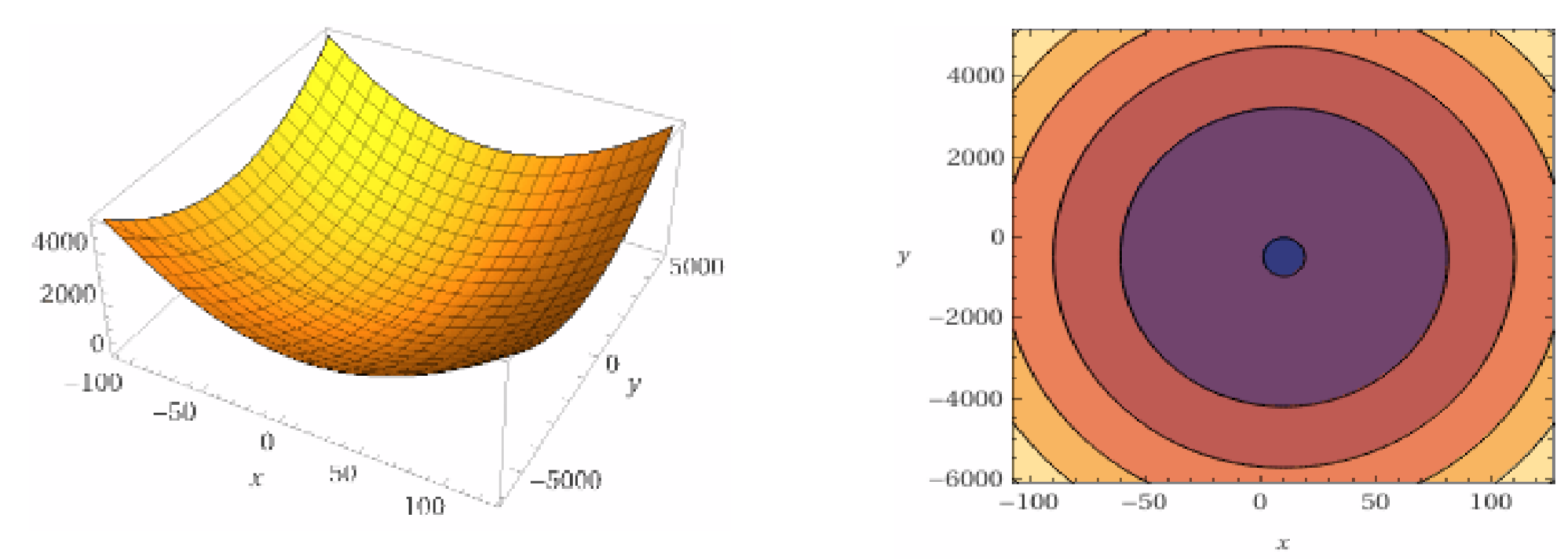
The data recorded for morphological parameters in plants and wheat ears, genotype W5028 were statistically analyzed by Descriptive Statistical Analysis. The height of the plants varied between $PH = 85.00 \pm 1.58$ cm to $PH = 106.00 \pm 1.58$ cm. The spike length presented values between $EL = 9.00 \pm 0.18$ cm to $EL = 11.00 \pm 0.18$ cm. The number of spikelets in the ear presented values from $SpkN = 16.00 \pm 0.38$ to $SpkN = 22.00 \pm 0.38$. For the ear weight, values were recorded between $EW = 2.18 \pm 0.28$ g to $EW = 5.87 \pm 0.28$ g. The number of grains in the ear varied between $EGN = 30.00 \pm 3.58$ to $EGN = 74.00 \pm 3.58$. The weight of the grains in the ear varied between $EGW = 1.47 \pm 0.24$ g to $EGW = 4.30 \pm 0.24$ g.

The variation of the grain weight in the wheat ear (EGW) was evaluated in relation to the other parameters at the plant level (PH) and at the level of the ears (EL, SpkN, EW, EGN), in different combinations.

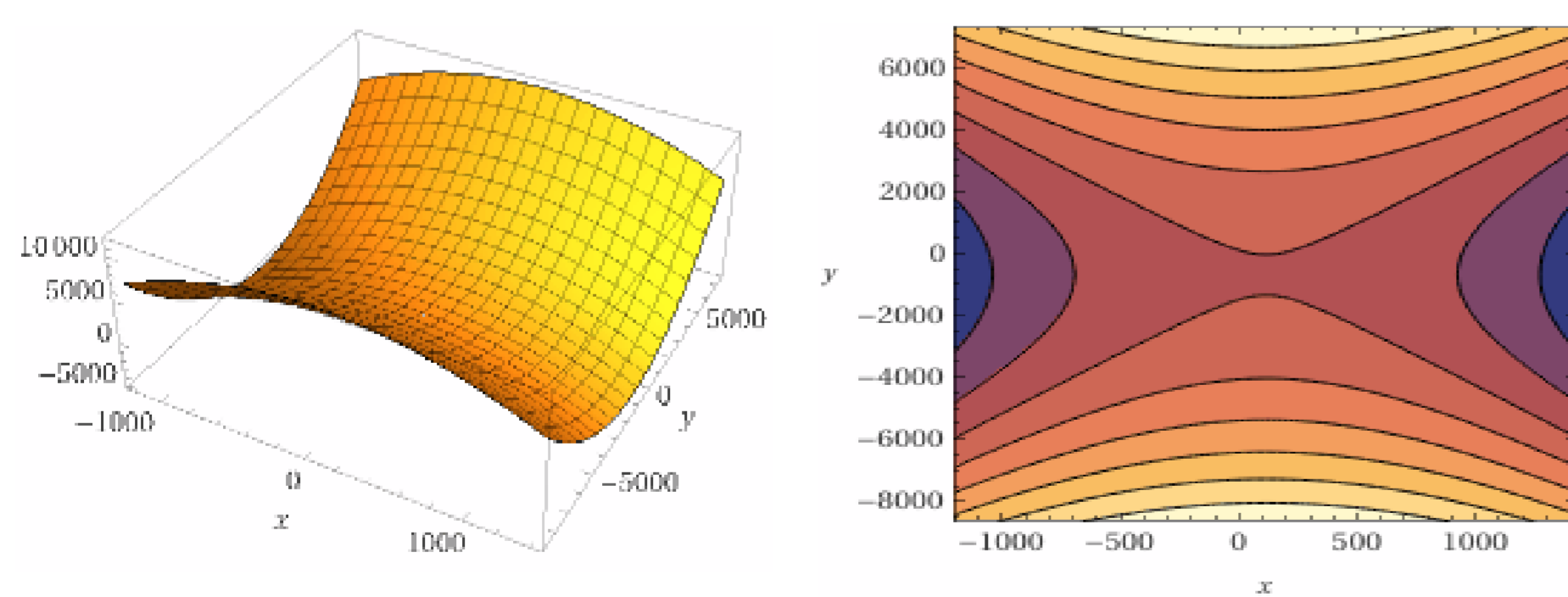
The present study found mathematical and graphic models that described the variation of grain weight in the wheat ear, genotype W5028, in relation to plant parameters and ear components. According to the recorded values, eight models presented statistical safety, and in the case of two models, statistical safety was not recorded ($p > 0.05$). The recorded results show interest and recommend the continuation and development of studies, and the transfer of information in the wheat improvement program.



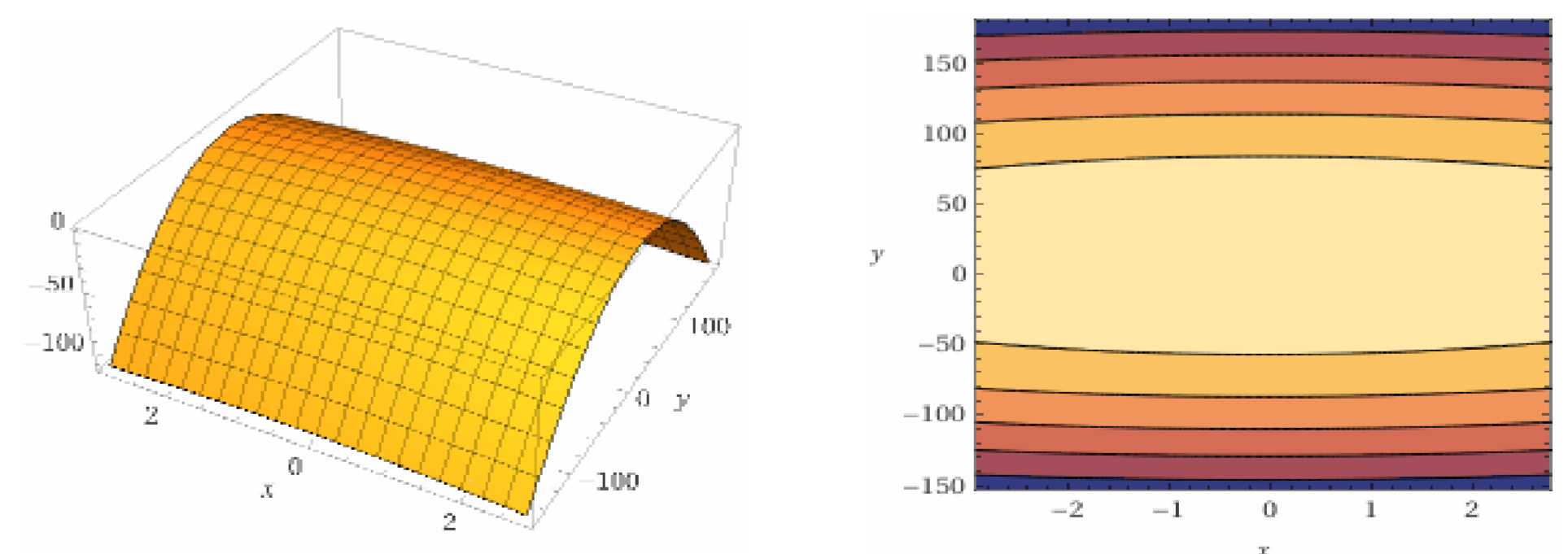
Graphical distribution of EGW values in relation to PH and SpkN



Graphical distribution of EGW values in relation to EL and EGN



Graphical distribution of EGW values in relation to PH and EGN



Graphical distribution of EGW values in relation to SpkN and EGN

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• Conclusions

The regression analysis led to mathematical and graphical models that describe the variation of grain weight in the ear (EGW) in relation to plant parameters and the components of the wheat ear. Ten models resulted, of which eight models presented statistical reliability; seven models at the $p < 0.001$ level (PH, SpkN; PH, EGN; EL, SpkN; EL, EGN; SpkN, EW; SpkN, EGN; EW, EGN); a model at $p < 0.01$ level (PH, EW). In the case of two models, statistical certainty was not recorded, $p > 0.05$ (PH, EL; EL, EW). According to the values of the coefficients of the equations obtained, and of the graphic models (3D, isoquants), the convergent action of some parameters (as variables of the equations) was recorded when forming the EGW values (e.g. PH with SpkN; EL with SpkN; EL with EW; EL with EGN; SpkN with EGN), and divergent action in the case of other combinations of parameters (e.g. PH with EL; PH with EW; PH with EGN; SpkN with EW; EW with EGN).