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INTERDEPENDENCE RELATIONSHIPS BETWEEN PRODUCTIVITY ELEMENTS IN SOYBEANS

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Abstract: Interdependence relationships between productivity elements in soybeans were analyzed in the present study. The Iris soybean variety was cultivated under the specific conditions of the ARDS Lovrin. Plant samples were taken randomly from 15 plots. Productivity elements were determined in plant samples. The experimental data set showed statistical reliability ($\alpha = 0.05$; $p < 0.001$). Low variability in the case of PH (CV = 5.9611), PL (CV = 3.6785) and Pwdt (CV = 7.0894) parameters. Moderate variability was recorded in the case of the parameters PN (CV = 27.1951), PsW (CV = 28.3441), GW (CV = 27.3812), and respectively PW (CV = 26.1433). Correlation of different levels of intensity and statistical certainty was recorded between the productivity elements. Linear and polynomial equations of the 2nd and 3rd degree described interdependence relationships between the productivity elements considered in the study, under statistical safety conditions ($p < 0.001$).

• Introduction

Soybean is an important source of vegetable protein worldwide. In order to increase the production of vegetable proteins at the level of the European Union, soybean was considered as a valuable resource, due to its yield potential and protein content. The authors studied genotypes from different maturity groups and analyzed influencing factors on soybean yield. The authors obtained models that described grain production and yield per surface unit, under the study conditions.

In order to expand the soybean culture to more northern areas in Europe, the direct and interactional influence of some technological, biological and ecosystem elements on the soybean culture was studied. The authors communicated the variation of some morphological parameters and productivity elements in relation to the date of sowing, the distance between rows, and the inoculation of seeds with bacterial preparations. The interest in the expansion of soybean cultivation in West African conditions led to yield evaluation experiments in relation to climatic conditions, management practices and categories of farmers.

Productivity elements represent a measure of the expression of soybean culture in environmental and technological conditions. The TFP parameter (Total Factor Productivity) in order to evaluate productivity in relation to different categories of factors. The yield and productivity of the soybean crop were analyzed in relation to different sowing densities, in order to optimize the plant density for the study conditions. Symbiotic parameters, productivity elements, yield and profitability in soybeans were studied in relation to sowing methods and different levels of nitrogen. Soybean yield and productivity has been studied in relation to environmental factors. The authors obtained models in the form of regression equations, which described the yield variation in relation to climatic parameters.

In order to increase the yield and quality of soybean culture, different agrotechnical methods and bioregulatory plant growth substances were studied. Soybean productivity and productivity elements were analyzed in relation to influencing factors to understand and explain the stagnation of yields under certain conditions. The authors identified factors, conditions and interactions that favored the increase in productivity in soybean crop. The study analyzed the interdependence between soybean productivity parameters, under non-irrigated culture conditions.

• Material and method

The aim of the study was to evaluate the interdependence relationships between soybean productivity parameters, under non-irrigated culture conditions. The Iris soybean variety was grown under non-irrigated conditions. The researches were carried out within ARDS Lovrin. Adequate culture technology was ensured for soil preparation, sowing, crop maintenance during the growing season. Aspects from the vegetation period of the soybean crop are presented below.



At the physiological maturity of the plants, 99 BBCH code, samples were taken for determination. Fifteen plant samples were taken, randomly. Parameters considered in the study were represented by plant height (PH), pod number (PN), pod length (PL), pod width (Pwdt), pod weight (PW), grain weight (GW), pod shell weight (PSW).

The recorded values for plant productivity parameters represented the experimental database for the analysis. A general descriptive analysis of the data series was made. The experimental safety of the data and the presence of variance in the experimental data set were evaluated. The interdependence of the productivity elements was quantified through correlation analysis and regression analysis. Established statistical safety parameters were used to guarantee the analyzes and the results obtained. The calculation module in EXCEL and the PAST software were used for the analysis and processing of the experimental data, and for the generation of graphic representations.

• Results and discussions

Biometric parameters in soybean plants, the Iris variety, as well as in soybean pods, were studied during vegetation and at physiological maturity. The data series were analyzed for statistical characterization. The Anova test confirmed the reliability of the data, and the presence of variance in the experimental data set.

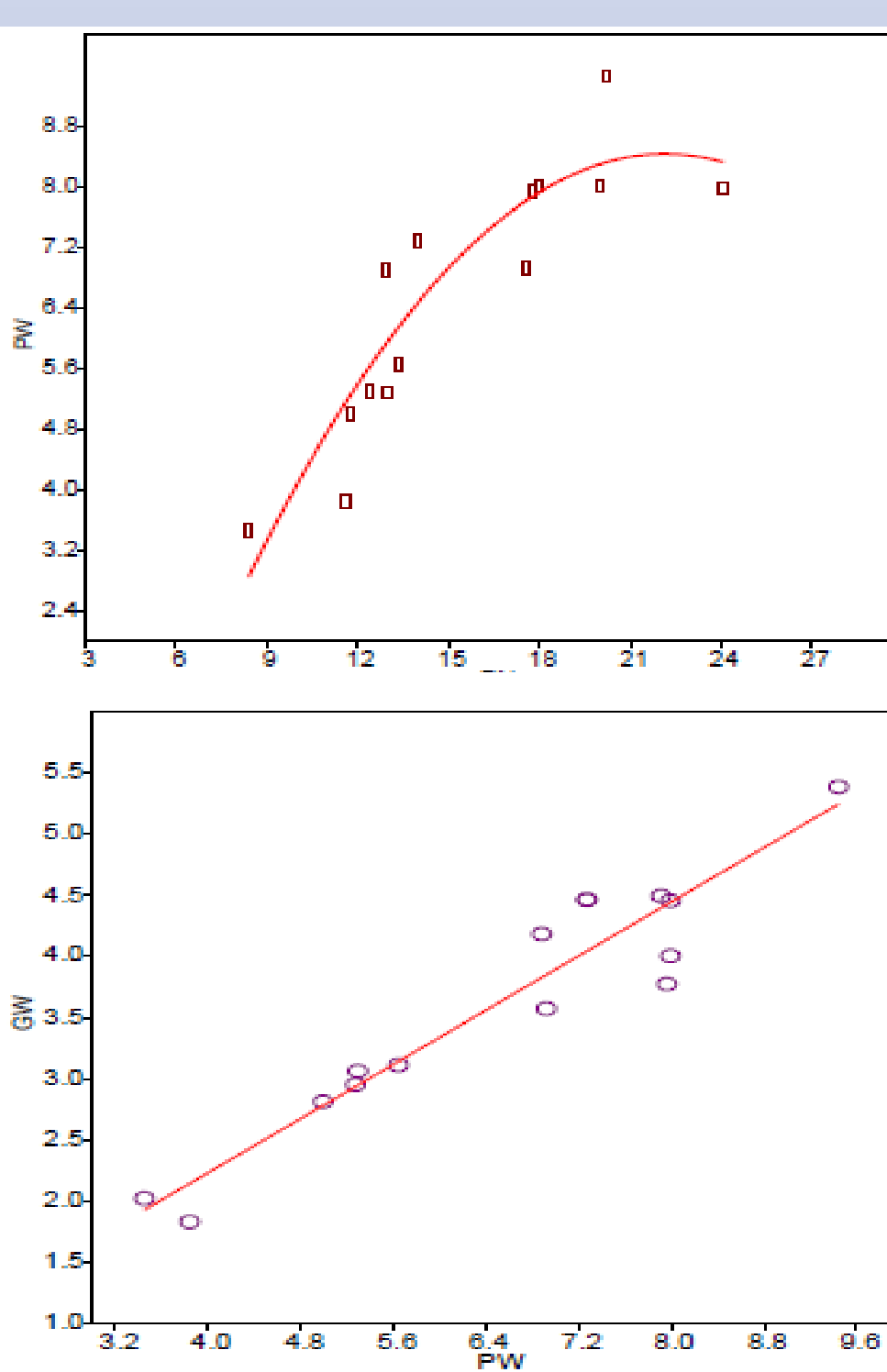
Biometric parameters represent elements that contribute majorly to the formation of yield. Although they have genetic determination, they register variations in relation to environmental and technological conditions. In the study conditions, low variability was recorded in the case of the parameters PH (CV = 5.9611), PL (CV = 3.6785) and Pwdt (CV = 7.0894). Moderate variability was recorded in the case of the parameters PN (CV = 27.1951), PsW (CV = 28.3441), GW (CV = 27.3812), and respectively PW (CV = 26.1433).

The low values of the variability of the dimensional parameters (PH, PL, and Pwdt) showed that the plants had relatively good conditions for vegetative growth. The moderate values of the variability of the parameters that represented the number of pods, and their weight, respectively of the grains, showed that the productivity of the plants was influenced during the vegetation period.

The correlation analysis led to the correlation diagram.

Very strong correlation was recorded between PsW and PN ($r = 0.975^{***}$), between PW and PsW ($r = 0.929^{***}$), and respectively between PW and GW ($r = 0.951^{***}$). Strong correlation was recorded between PW and PN ($r = 0.842^{***}$). Moderate correlation was recorded between GW and PsW ($r = 0.769^{***}$). Weak correlation was recorded between PN and PH ($r = 0.603^*$), between GW and PN ($r = 0.641^*$), and respectively between PsW and PH ($r = 0.575^*$).

	PH	PN	PL	Pwdt	PsW	GW	PW
PH		0.603*	-0.151	0.28	0.575*	0.233	0.413
PN	0.603*		-0.094	0.43	0.975***	0.641*	0.842***
PL	-0.151	-0.094		-0.08	-0.147	-0.313	-0.251
Pwdt	0.28	0.43	-0.08		0.411	0.325	0.387
PsW	0.575*	0.975***	-0.147	0.411		0.769***	0.929***
GW	0.233	0.641*	-0.313	0.325	0.769***		0.951***
PW	0.413	0.842***	-0.251	0.387	0.929***	0.951***	



The variation of the PW parameter in relation to PN was described by equation (1), under conditions of $R^2 = 0.816$, $p < 0.001$. The graphic representation of the variation of PW in relation to PN and the expression of equation (1) is given below.

$$PW = -0.02954 \cdot PN^2 + 1.309 \cdot PN - 6.078 \quad (1)$$

The variation of GW in relation to PW was described by equation (2) under conditions of $R^2 = 0.905$, $p < 0.001$. The graphic representation of the variation of PW in relation to PN and the expression of equation (1) is presented.

$$GW = 0.5529 \cdot PW + 0.01393 \quad (2)$$

The variation of PsW in relation to PN was described by equation (3), under conditions of $R^2 = 0.973$, $p < 0.001$. The variation of PsW in relation to PW was described by equation (4), under conditions of $R^2 = 0.867$, $p < 0.001$.

$$PsW = -0.006503 \cdot PN^2 + 0.4055 \cdot PN - 1.661 \quad (3)$$

$$PsW = -0.007968 \cdot PW^2 + 0.1671 \cdot PW^2 - 0.6631 \cdot PW + 2.286 \quad (4)$$

• Conclusions

The productivity elements analyzed in the Iris soybean variety recorded differentiated variability, as a specific response to the crop conditions in a non-irrigated system. PH, PL, Pwdt parameters showed low variability. Moderate variability was recorded in the case of PN, PsW, GW, and PW parameters. It can be appreciated that these parameters showed a stronger dependence on environmental conditions. Correlation of different levels of intensity was recorded between the analyzed productivity elements, under statistical safety conditions. The regression analysis led to models in the form of linear and polynomial equations that described the interdependence between the studied productivity elements.

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