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# RESULTS REGARDING THE IMPACT OF CROP ROTATION AND FERTILISATION ON THE GRAIN YIELD AND SOME PLANT TRAITS AT MAIZE CULTIVATED ON SANDY SOILS IN SOUTH ROMANIA

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***Abstract***

*The reduced production capacity of sandy soils is due to their low natural fertility, but it is determined also by the way the plants are cultivated, respectively the crop technology.*
*Fertilization according to the results of the soil analysis without considering the crop needs and the crop rotation does not represent a specific way to increase soil fertility. Under the same natural conditions, any crop - for the maximum yielding potential - requires different fertilization conditions, designated via the previous crop (precursory or pre-precursory).*
*Substituting the positive effects of the crop rotation through increasing the rates of fertilizers does not represent a reliable way to ensure the sustainability of the agricultural system. This is due to the fact that the yielding potential of the cultivated plants is conditioned by a variety of environmental factors among which the crop rotation is one of the most important. This influence is ever more significant under the less favorable growing conditions of the sandy soils. Under these circumstances, maize requires a specific crop technology, within which an important role is played by the crop rotation as well as the efficient use of fertilizers.*
*The conducted researches, through the obtained results have shown that on the improved sandy soils from the Southern Romanian region Oltenia, the grain yield of maize cultivated in crop rotations is higher that the grain yield obtained in conditions of monoculture. Also, using nitrogen and phosphorus chemical fertilizers on the improved sandy soils represents a reliable measure to increase maize yield. The combined influence of the studied factors (crop rotation x fertilizers) has determined an even increased yield. For the exploitation of the improved sandy soils, it is essential to have a crop rotation with plants that improve soil fertility, such as annual leguminous and green fertilizers, as well as a crop rotation that makes the maximum use of chemical fertilizers.*

***Key words****: sandy soils, maize, previous crop, nitrogen rate, grain yield, plant traits.*

## INTRODUCTION

Sandy soils are characterized by their grain size, typically having low clay content and being dominated by coarse particles, and they have lower physical, chemical and biological fertility (Unkovich, 2014). Sandy soils are low in nutrient content and water holding capacity leading to frequent application of both nutrients and water to meet crop requirements (Alshankiti and Gill, 2016). Practically, the main problems of sandy soil are moisture holding capacity and nutrients deficiency (Saleh and Kiyoshi, 2006).
Crop plant is very likely to perform better under poor sandy-soil condition if management requirements are provided (Usman et al., 2013). It is clear that on sandy soils with a reduced content of humus, applying mineral fertilizers within the crop rotations represents a certain agro technical measure to increase the yields (Gheorghe, 1997; Ştefan and Gheorghe, 2016).
Many researches pointed out the importance of the crop rotation on sands and sandy soils (Antal, 1966; Duley et al., 1953; Gheorghe, 1997; Lombin, 1981; Stratula et al., 1980; Ştefan and Gheorghe, 2016). All these researches show that the yields on sandy soils does not depend only on well applying the agro technical rules, but also on the crop rotation and efficient use of fertilizers.
Maize (*Zea mays* L.) is one of the most important cereal crops in the world agriculturally and economically both as food for human beings, feed for animals and other industrial raw materials (Mazen et al., 2015). Grain maize is an important cash crop for farms without livestock (Finke et al., 1999).

Crop rotation and nitrogen application are among the management methods that can increase maize grain yields (Stanger and Lauer, 2008). The preceding crop is an important crop technology measure with a significant influence upon the yield (Ion et al., 2015). The issue of placing the maize into the crop rotation or for how long the maize should be cultivated after itself has represented and continues to do so, the object of many researches performed under different soil and climatic conditions.

The role of leguminous plants as previous crops on increasing the maize production as well as on improving the soil fertility is pointed out by the researches carried out by Lombin (1981), according to which the maize cultivated after a 7-years monoculture of peanut, known also as groundnut (*Arachis hypogea*) achieved an extra difference of more than 910 kg/ha compared to the maize cultivated after a 7-years monoculture of cotton and an extra difference of more than 1,980 kg/ha compared to the maize cultivated after sorghum monoculture.

Nitrogen is a major nutrient-element and it is needed in large amount to increase growth and yield of maize (EL-Guibali et al., 2015). Nitrogen fertilizer is universally accepted as a key component to high maize grain yield and optimum economic return (Gehl et al., 2005).

The positioning of maize in rational crop rotations after favorable previous crops and establishing the optimum rates of fertilizers represent technological measures which are extremely important within the crop technology on the improved sandy soils from the Southern Romanian region Oltenia. In this respect, the objective of this study was to establish the impact of crop rotation and fertilization on the grain yield and some plant traits at maize cultivated on the improved sandy soils in South Romania.

## MATERIALS AND METHODS

A field experiment of long duration was implemented in order to solve the main aspects concerning the influence of crop rotation and mineral fertilization on maize cultivated on the sandy and irrigated soils from Southern Romanian region Oltenia, within Research and Development Station for Crops on Sandy Soils Dăbuleni (SCDCPN Dăbuleni). The goal of this research was to obtain results with direct applicability into the practice, useful for the Romanian farmers growing maize on the sandy soils from South Romania.

The field experiment started in 1974, but within the present paper there are presented the results, as average values, obtained in the period 2005-2011.

The field experiment was a bifactorial one and it was organized by the method of subdivided plots with 4 replications.

The studied factors were the following:

Factor A = Crop rotation:

a1 = maize monoculture;

a2 = 2-years rotation: wheat + beans (as a second crop) - maize;

a3 = 3-years rotation: wheat + beans (as a second crop) - maize - peas + green fertilizer (in the same year, after peas harvesting);

a4 = 3-years rotation: wheat + silage maize (as a second crop) - maize - soybean;

a5 = 4-years rotation: wheat + green fertilizer (in the same year, after wheat harvesting) - maize - barley + beans (as a second crop) - early potato + maize (as a second crop).

Factor B = Nitrogen rate on a background of 80 kg $P_2O_5$/ha:

b1 = 75 kg N/ha;

b2 = 150 kg N/ha;

b3 = 225 kg N/ha.

The soil preparing for the maize crop was done in the spring. The field was ploughed at the depth of 23-25 cm, and then the disc harrow was passed 2-3 times according to the year conditions in view to have a good seedbed preparation. Just after the seedbed preparation, the sowing was performed at a density of 60,000 germinal seeds per hectare. The sowing took place between 14 and 28$^{th}$ of April, according to the climatic conditions of the year. The used maize hybrids were Fundulea 322 (FAO group 400) and Fundulea 376 (FAO group 500) created in Romania at Agricultural Research and Development Institute Fundulea. The maize plants emerged between 29$^{th}$ of April and 10$^{th}$ of May.

The phosphorus fertilizers in the form of super phosphate were administered before ploughing and the ones with nitrogen in the form of ammonium nitrate were applied half before the last passing of the harrow disc and the other half before the second manual weeding.

For controlling the weeds, herbicides were applied at soil bead preparation and in post emergency. Also, for soil loosening and weed control, there were performed two manual weedings.

During the vegetation period, depending on the climatic conditions of the year, the soil humidity was maintained at over 50% of the active humidity interval into the soil (over 50% between field capacity and wilting coefficient) on the depth of 75 cm. There were applied between 5 and 12 spray irrigations. The irrigation norm was of 300 $m^3$ water/ha for the first 2 irrigations and of 450 $m^3$ water/ha for the other irrigations.

Harvesting took place between 18$^{th}$ of September and 13$^{th}$ of October, according to the climatic conditions of the year.

The field experiment was placed on a brown clay alluvial soil typically phreatic humid, sandy lamellar, with the following profile: horizon A (A0), with 25 cm depth; horizon B (B, Ia), with 25-145 cm depth; horizon BD1, phreatic humid on sandy deposits.

The physical and hydro physical features of the soil, on the depth of 0-40 cm, were the following: volumetric weight ($t/m^3$) has had values between 1.57 and 1.63; the field water capacity (%) is of 11.40; the wilting coefficient (%) is of 2.01; the active humidity interval (%) is of 9.39; the hydraulic conductivity ($10^6$ cm/s) is between 1808 and 1926; the resistance to penetration ($kg/cm^2$) is between 7.00 and 8.25.

The chemical properties of the soil, on the depth of 0-20 cm, were the following: pH ($H_2O$) between 6.8 and 7.5; humus content (%) between 0.44 and 0.58; total nitrogen content (%) between 0.024 and 0.033; $P_2O_5$ mobile (ppm) content between 40.6 and 86.6; $K_2O$ accessible (ppm) content between 163.3 and 233.3; Zn (ppm) content of 0.75; Cu (ppm) content of 1.01; Fe (ppm) content of 0.40; Mn (ppm) content of 16.45.

Regarding the climatic conditions of the years when the field experiment was performed, the average annual temperature varied between 10.9 and 11.3$^o$C, while the multiannual average temperature is of 11.1$^o$C. The average temperatures occurred during the maize vegetation period were slightly lower or at most equal to the multiannual average value.

The highest average monthly temperature was registered in July, the month when the maize also has the highest water demands.

Concerning the pluviometry, it was noticed that in the years when the field experiment was performed, there was registered lower rainfall (522.1 mm) compared to the multiannual average (542.6 mm).

For the sandy areas, the uneven rainfall influences the yields due to the fact that the sandy soil is characterized by a high permeability and low water retention capacity. All of these aspects lead to the necessity to correct the water deficit through irrigation, applying a higher number of irrigations with low irrigation norms.

There were performed the following determinations: grain yield, which was reported at grain moisture content of 15.5%; 1000-grain weight (TGW); plant height; number of sterile plants.

The obtained data were statistically processed through the analysis of variance (ANOVA).

## RESULTS AND DISCUSSIONS

The obtained results have shown that on the improved sandy soils the grain yields of maize cultivated in crop rotations are superior to that obtained in monoculture conditions (Table 1).

The highest grain yields of maize were achieved in the conditions of the 3-years crop rotation of wheat+beans - maize - peas+green fertilizer, respectively 53.9 q/ha, and in the conditions of the 4-years crop rotation of wheat + green fertilizer - maize – barley + beans - early potato + maize, respectively 52.9 q/ha, the yield increases compared to monoculture (control variant) registering values of 12.0 q/ha, respectively 11.0 q/ha, and the differences being statistically significant.

In the 3-years crop rotation with soybean (wheat + silage maize - maize - soybean), the maize yield was higher by 8.9 q/ha compared to that obtained in monoculture conditions, but this increase in the grain yield was not enough to be statistically significant.

The maize cultivated in 2-years crop rotation (wheat + beans - maize) has obtained the lowest yield compared to those obtained in the other crop rotation conditions, but still higher

by 5.1 q/ha than the yield obtained in monoculture conditions.

The good results obtained by maize cultivated in 3-years crop rotation of wheat + beans - maize - peas + green fertilizer and 4-years crop rotation of wheat + green fertilizer - maize – barley + beans - early potato + maize are due mainly to the presence of annual leguminous plants (pulses) within crop rotation (peas and beans), and secondly to the effect of the green fertilizers incorporated into the soil (20-25 tons of fresh matter per hectare annually).

Table 1. The influence of crop rotation on the grain yield of maize cultivated on sandy soils in South Romania

| Crop rotation | Yield (q/ha) | Difference | | |
|---|---|---|---|---|
| | | q/ha | % | Significance |
| Monoculture | 41.9 | control | 100 | - |
| 2 years: wheat+beans - maize | 47.0 | 5.1 | 112 | |
| 3 years: wheat+beans - maize - peas+green fertilizer | 53.9 | 12.0 | 129 | * |
| 3 years: wheat+silage maize - maize - soybean | 50.8 | 8.9 | 121 | |
| 4 years: wheat+green fertilizer - maize - barley+beans - early potato+maize | 52.9 | 11.0 | 126 | * |
| 5% LSD | | 10.9 q/ha | | |
| 1% LSD | | 15.1 q/ha | | |
| 0.1% LSD | | 20.8 q/ha | | |

The use on the improved sandy soils of nitrogen fertilizers together with phosphorus-based fertilizers is a reliable measure of increasing grain yield of maize. Thus, the grain yield of maize increased by 18.3 q/ha at the nitrogen rate of 150 kg/ha and by 28.3 q/ha at the nitrogen rate of 225 kg/ha compared to the control variant with nitrogen rate of 75 kg/ha, the differences being very significant (Table 2).

Table 2. The influence of nitrogen rate on a background of 80 kg $P_2O_5$/ha on the grain yield of maize cultivated on sandy soils in South Romania

| Nitrogen rate (kg/ha) | Yield (q/ha) | Difference | | |
|---|---|---|---|---|
| | | q/ha | % | Significance |
| 75 | 34.1 | control | 100 | - |
| 150 | 52.4 | 18.3 | 154 | *** |
| 225 | 62.4 | 28.3 | 183 | *** |
| 5% LSD | | 4.5 q/ha | | |
| 1% LSD | | 5.4 q/ha | | |
| 0.1% LSD | | 7.2 q/ha | | |

Regarding the combined influence of the studied factors (crop rotation x fertilization), it was found that in the conditions of nitrogen rate of 75 kg/ha on a background of 80 kg $P_2O_5$/ha, there were registered yield increases in all the crop rotation variants compared to the monoculture conditions, but the differences were not statistically significant (Table 3). The lowest yield increase (difference compared to control variant) of 4.7 q/ha was recorded in the conditions of crop rotation of 2-years (wheat + beans - maize), while the highest yield increases were registered in the case of 3-years crop rotation, respectively 9.4 q/ha in the conditions of 3-years crop rotation of wheat + beans - maize - peas + green fertilizer, and 8.7 q/ha in the conditions of 3-years crop rotation of wheat + silage maize - maize - soybean.

Maize grain yield increased with the increase in nitrogen rate on a background of 80 kg $P_2O_5$/ha, the differences compared to control variant (monoculture conditions and fertilization of the maize crop with the nitrogen rate of 75 kg/ha) being very significant, except for the variant when the maize was cultivated in monoculture conditions and was fertilized with 150 kg/ha of nitrogen, in this case the difference being distinct significant.

The largest maize yields were obtained in the conditions of the nitrogen rate of 225 kg/ha on a background of 80 kg $P_2O_5$/ha, the highest grain yield (77.1 q/ha) being registered for the variant when the maize was cultivated in the 3-years crop rotation of wheat + beans - maize - peas + green fertilizer.

Whether for the nitrogen rate of 75 kg/ha the highest grain yields were registered in the case of both 3-years crop rotations, for the nitrogen rates of 150 and 225 kg/ha the highest grain yields were registered in the case of 3-years crop rotation of wheat + beans - maize – peas + green fertilizer and in the case of 4-years crop rotation of wheat + green fertilizer - maize – barley + beans - early potato + maize.

Table 3 shows that the grain yield of maize obtained in monoculture conditions but with a nitrogen rate of 225 kg/ha on a background of 80 kg $P_2O_5$/ha is smaller or comparable with the grain yields obtained in conditions of 3-years and 4-years crop rotations but with a nitrogen rate of 150 kg/ha on a background of 80 kg $P_2O_5$/ha, which means a saving of 75 kg

of nitrogen. This demonstrates that the use of high nitrogen rates cannot substitute the negative effect of monoculture on the grain yield of maize cultivated on sandy soils. Also, this demonstrated that maize makes better use of fertilizers in conditions of crop rotation than in monoculture conditions.

The effect of crop rotation on yield growth was higher in the conditions of nitrogen rates of 150 and 225 kg/ha on a background of 80 kg $P_2O_5$/ha compared to the nitrogen rate of 75 kg/ha.

Analyzing the way that the studied factors (crop rotation and fertilization) influenced the maximum yield increase of 49.3 q/ha, it is noticed that fertilizers contributed to this increase by more than half (54.2%), the crop rotation with 19%, and the interaction crop rotation x fertilizers with 26.8% (Figure 1).

Table 3. Influence of crop rotation and nitrogen rate on a background of 80 kg $P_2O_5$/ha on the grain yield of maize cultivated on sandy soils in South Romania

| Crop rotation | 75 kg/ha of nitrogen | | | | 150 kg/ha of nitrogen | | | | 225 kg/ha of nitrogen | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yield (q/ha) | Difference | | | Yield (q/ha) | Difference | | | Yield (q/ha) | Difference | | |
| | | q/ha | % | Significance | | q/ha | % | Significance | | q/ha | % | Significance |
| Monoculture | 27.8 | control | 100 | - | 43.2 | 15.4 | 155 | ** | 54.5 | 26.7 | 196 | *** |
| 2 years: wheat+beans - maize | 32.5 | 4.7 | 117 | - | 48.8 | 21.0 | 176 | *** | 59.6 | 31.8 | 214 | *** |
| 3 years: wheat+beans - maize - peas+green fertilizer | 37.2 | 9.4 | 134 | - | 57.4 | 29.6 | 206 | *** | 77.1 | 49.3 | 277 | *** |
| 3 years: wheat+silage maize - maize - soybean | 36.5 | 8.7 | 131 | - | 53.9 | 26.1 | 194 | *** | 62.1 | 34.3 | 223 | *** |
| 4 years: wheat+green fertilizer - maize - barley+beans - early potato+maize | 34.9 | 7.1 | 126 | - | 56.9 | 29.1 | 205 | *** | 67.9 | 40.1 | 244 | *** |
| 5% LSD | | 11.0 q/ha | | | | | | | | | | |
| 1% LSD | | 14.8 q/ha | | | | | | | | | | |
| 0.1% LSD | | 19.4 q/ha | | | | | | | | | | |

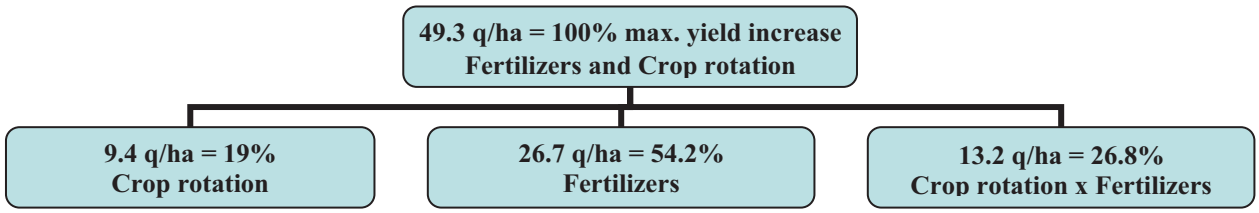


Figure 1. Influence of crop rotation, nitrogen rate on a background of 80 kg $P_2O_5$/ha and interaction of crop rotation x nitrogen rate to achieve the maximum increase of grain yield at maize cultivate on sandy soils in South Romania

The influence of crop rotation and fertilization on morphological and yielding components at maize are presented in Tables 4, 5, and 6.

The 1000-grain weight (TGW) registered higher values in conditions of 3-years and 4-years crop rotations and in conditions of increasing nitrogen rates from 75 to 150 and 225 kg/ha (Table 4).

The highest TGW value (314.3 g) was registered in the conditions of 3-years crop rotation of wheat + beans - maize – peas + green fertilizer and fertilization with the nitrogen rate of 225 kg/ha on a background of 80 kg $P_2O_5$/ha.

For the nitrogen rates of 75 and 150 kg/ha, the highest TGW values were registered in the conditions of the 4-years crop rotation of wheat + green fertilizer - maize – barley + beans - early potato + maize. However, it has to be noticed that for the nitrogen rate of 150 kg/ha, the TGW value registered quite close values for conditions of 3-years crop rotation of wheat + beans - maize - peas + green fertilizer, with 295.3 g, and of 4-years crop rotation of wheat+green fertilizer - maize – barley + beans - early potato + maize, with 295.8 g.

Table 4. The influence of crop rotation and nitrogen rate on a background of 80 kg $P_2O_5$/ha on 1000-grain weight (TGW) at maize cultivate on sandy soils in South Romania

| Crop rotation | TGW (g) at different nitrogen rates | | | Average | |
|---|---|---|---|---|---|
| | 75 kg N/ha | 150 kg N/ha | 225 kg N/ha | g | % |
| Monoculture | 250.7 | 277.3 | 284.0 | *270.7* | 100 |
| 2 years: wheat+beans - maize | 264.0 | 281.6 | 287.0 | *277.5* | 102.5 |
| 3 years: wheat+beans - maize - peas+green fertilizer | 267.6 | 295.3 | 314.3 | *292.4* | 108.0 |
| 3 years: wheat+silage maize - maize - soybean | 267.3 | 285.8 | 297.9 | *283.7* | 104.8 |
| 4 years: wheat+green fertilizer - maize - barley+beans - early potato+maize | 270.4 | 295.8 | 299.2 | *288.5* | 106.6 |
| *Average (g)* | *264.0* | *287.2* | *296.5* | *282.5* | - |
| % | 100 | 108.8 | 112.3 | - | - |

| | Crop rotation | Fertilizer | Crop rotation x Fertilizer |
|---|---|---|---|
| 5% LSD | 20.5 | 6.9 | 17.1 |
| 1% LSD | 27.7 | 9.3 | 22.8 |
| 0.1% LSD | 32.0 | 12.1 | 29.6 |

Table 5. The influence of crop rotation and nitrogen rate on a background of 80 kg $P_2O_5$/ha on the plant height of maize cultivate on sandy soils in South Romania

| Crop rotation | Plant height (cm) at different nitrogen rates | | | Average plant height | |
|---|---|---|---|---|---|
| | 75 kg N/ha | 150 kg N/ha | 225 kg N/ha | cm | % |
| Monoculture | 184.5 | 193.2 | 200.7 | *192.8* | 100 |
| 2 years: wheat+beans - maize | 185.6 | 193.2 | 203.5 | *194.1* | 100.7 |
| 3 years: wheat+beans - maize - peas+green fertilizer | 186.6 | 201.6 | 207.0 | *198.4* | 102.9 |
| 3 years: wheat+silage maize - maize - soybean | 193.0 | 202.5 | 206.4 | *200.6* | 104.1 |
| 4 years: wheat+green fertilizer - maize – barley+beans - early potato+maize | 189.6 | 205.6 | 210.1 | *201.8* | 104.7 |
| *Average (cm)* | *187.9* | *199.2* | *205.5* | *197.5* | - |
| % | 100 | 106.0 | 109.4 | - | - |

| | Crop rotation | Nitrogen | Crop rotation x Nitrogen |
|---|---|---|---|
| 5% LSD | 6.2 cm | 3.3 cm | 7.9 cm |
| 1% LSD | 8.4 cm | 4.3 cm | 10.6 cm |
| 0.1% LSD | 11.2 cm | 5.6 cm | 13.8 cm |

The height of the maize plants was correlated directly with the increasing of the nitrogen rate from 75 to 150 and 225 kg/ha on a background of 80 kg $P_2O_5$/ha, as well as with the crop rotations, especially 3-years and 4-years crop rotations (Table 5).

The highest height of the maize plants (210.1 cm) was registered in the conditions of 4-years crop rotation of wheat + green fertilizer - maize - barley + beans - early potato + maize and fertilization with the nitrogen rate of 225 kg/ha on a background of 80 kg $P_2O_5$/ha.

Regarding the percentage of sterile plants, the increasing of nitrogen rate on a background of 80 kg $P_2O_5$/ha decreased the percentage of sterile plants, the smallest values being registered at the nitrogen rate of 225 kg/ha (Table 6). Also, the cultivation of maize in crop rotations decreased the percentage of sterile plants except for the nitrogen rate of 225 kg/ha, in this case the smallest percentage of sterile plants being registered in conditions of monoculture.

Table 6. The influence of crop rotation and nitrogen rate on a background of 80 kg $P_2O_5$/ha on the percentage of sterile plants of maize cultivate on sandy soils in South Romania

| Crop rotation | Percentage of sterile plants at different nitrogen rates | | | *Average* |
|---|---|---|---|---|
| | 75 kg N/ha | 150 kg N/ha | 225 kg N/ha | *%* |
| Monoculture | 15.5 | 8.9 | 4.6 | *9.7* |
| 2 years: wheat+beans - maize | 12.0 | 7.2 | 5.2 | *8.1* |
| 3 years: wheat+beans - maize - peas+green fertilizer | 10.6 | 7.6 | 5.1 | *7.8* |
| 3 years: wheat+silage maize - maize - soybean | 11.4 | 7.8 | 5.7 | *8.3* |
| 4 years: wheat+green fertilizer - maize - barley+beans - early potato+maize | 13.6 | 5.6 | 5.1 | *8.1* |
| *Average* | *12.6* | *7.4* | *5.1* | *8.4* |

The simple correlations between yield and some maize traits as well as the correlation coefficients are shown in Table 7. The strongest correlation is between grain yield and plant height, but a good correlation is also between grain yield and TGW, the correlation coefficients of 0.96811 and 0.931777 being distinct significant (Table 7).

Table 7. Simple correlations between yield and some growth elements and productivity at maize and the significance of correlation coefficients

| Correlated elements | a | b | r |
|---|---|---|---|
| Grain yield - Plant height | 166.00542 | 0.64637 | 0.96811** |
| Grain yield - TGW | 244.8238 | 1.14292 | 0.931777** |
| Plant height - TGW | 36.139 | 1.603787 | 0.87297** |

## CONCLUSIONS

On the improved sandy soils from Southern Romanian region Oltenia, the grain yield of maize cultivated in crop rotations is superior to that obtained in monoculture conditions. Also, the use of nitrogen fertilizers together with phosphorus-based fertilizers is a reliable measure of increasing maize grain yield.

The grain yield of maize obtained under crop rotation conditions compared to that under monoculture conditions, in the variants fertilized with 150 and 225 kg/ha of nitrogen on a background of 80 kg $P_2O_5$/ha, were superior to those obtained in the variants fertilized with 75 kg/ha of nitrogen. This leads to the conclusion that the fertilizers do not diminish the role of the crop rotation, but amplify it.

The use of high nitrogen rates cannot substitute the negative effect of monoculture on the grain yield of maize, the maize plants cultivated on sandy soils using in a better way the fertilizers in conditions of crop rotation compared to monoculture conditions.

The obtained results have shown that, for the farmers growing maize on the improved sandy soils from Southern Romanian region Oltenia, using crop rotations which include leguminous plants and green fertilizers and associating the crop rotation with optimal rates of nitrogen fertilizers are important elements of the crop technology for increasing the grain yield at maize.

For the exploitation of the improved sandy soils, it is essential to have a crop rotation with plants that improve soil fertility, such as annual leguminous and green fertilizers, as well as crop rotations that make the maximum use of chemical fertilizers.

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