

THE EFFECT OF SEVERAL FERTILIZER TYPES ON THE WHEAT, CORN AND SOYBEAN CROPS IN LONG TERM EXPERIMENTS AT ARDS CARACAL

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Among the oldest long term experiments from our country, on the first place is the experiments begun in 1965 at ARDS Caracal that continues in present. These experiments comprise a crop rotation formed of three crops, wheat, corn and soybean with different fertilization systems. The results obtained in the last three years within this experiment are presented in this paper. With the wheat crop on P_0 background there was noticed that the yield was between 23.73 and 39.46 q/ha. When applying 200 kg N/ha the yield differences ranged between 8.71 q/ha with N_0 and 15.73 q/ha with N_{200} resulting a yield output of 36.7 – 66.3%.

With the corn crop, on P_0 background the yields are between 41.17 q/ha (N_0) and 63.38 q/ha (N_{200}).

With the soybean crop, on P_0 background, as a result of nitrogen fertilizers applying the yield has recorded an increase between 11.7 q/ha when not fertilized to 18.6 q/ha with N_{120} . The yield differences have been of 1.46 q/ha (N_{30}), 2.54 q/ha (N_{60}) and 5.16 q/ha (N_{120}).

Key words: long term researches, wheat, corn, soybean, fertilizers

The long term experiments, some more than 150 years old, (Rothamsted – England) or 100 years (Marrowplatz and Sanssborn – USA, Gotingen – Germany, Grignon – France, Askow – Denmark) have contributed to the scientifically set up of the prognosis of the evolution of the soil fertility, to the diminish or remove the soil pollution, to the improving of different cropping systems in order to achieve a sustainable agriculture. In comparison with stationary experiments from other countries that are located in one or more places, the one from Romania are located in a geographical net in different soil and climate conditions that ensure an advantage that is not in other countries.

In the long term experiments from our country beginning with 1965 there can be differentiated study the impact of different systems of plant cropping on the quantitative and qualitative evolution of the yield of the soil fertility in function of the chemical and physical properties and climatic ones.

In such a system of research there can be obtained results that can contribute to the set up of laws in soil plant animal food system, there can be studied aspects of the influence of agricultural technologies on the environment, there can be

forwarded economical measures, there can be obtained methodologies that will determine the rational use of the fertilizers.

Among the oldest long term experiments from our country, on the first place are the ones begun in 1965 at ARDS Caracal, Olt that continues today. Within these experiments we have researched the effect of different fertilizer doses of nitrogen phosphorus and potash on the yield of wheat, corn and soybean cropped in three years crop rotation.

The present results are the average yields on ten years (1999 – 2008).

MATERIAL AND METHOD

The experiments were located on the cambic baticalcric chernozem with the following formula CZCB-K₄ – Tem – TT(52) T5(52) with the following horizons: Ap1, A/B, B/C, Cca that is specific for the Romanian Plain. The soil reaction is low acid at the surface, neutral and low alkaline in the depth, the humus content is middle, the phosphorus and potash supplying degree is good. Climatically, after Kopper it is enclosed as sylvosteppe Cfx with an average annual temperature of 11.1°C and 553.1 mm rainfall.

The experiments with different fertilizer doses have been polifactorial the researched factors being presented in the *table 1*.

Table 1

The researched factors within the long term experiments

Factor/dose	Wheat	Corn	Soybean
Factor A – Phosforus			
a ₁	P ₀	P ₀	P ₀
a ₂	P ₄₀	P ₄₀	P ₄₀
a ₃	P ₈₀	P ₈₀	P ₈₀
a ₄	P ₁₂₀	P ₁₂₀	P ₁₂₀
Factor B – Potash			
b ₁	K ₀	K ₀	K ₀
b ₂	K ₄₀	K ₄₀	K ₄₀
b ₃	K ₈₀	K ₈₀	K ₈₀
Factor C - Nitrogen			
c ₁	N ₀	N ₀	N ₀
c ₂	N ₅₀	N ₆₀	N ₃₀
c ₃	N ₁₀₀	N ₁₂₀	N ₆₀
c ₄	N ₁₅₀	N ₁₈₀	N ₉₀
c ₅	N ₂₀₀	N ₂₄₀	N ₁₂₀

RESULTS AND DISCUSSIONS

The average yields obtained during 10 years with the three researched crops are presented as follows. With the wheat crop:

- the A factor – the phosphorus fertilization has contributed to the increasing of the wheat yield as the doses increased, too. The yield output have been of 12.1% with P₄₀, 18.1% with P₈₀ and 25.1% with P₁₂₀ being statistically significant.

- the B factor, potash fertilization has less contributed to the to the increasing of the yield, by 7.3% with K_{80} dose and 4.9% with the K_{40} dose.

- the C factor, nitrogen fertilization has been the main factor of wheat yield increase. Such way, with N_{50} there is obtained a yield output of 32.8%, with N_{100} of 50.8% and with N_{200} , 58.8%.

- the interaction N-P on all phosphorus graduation (P_0 , P_{40} , P_{80} , P_{120}) there were recorded significant yield differences over the not fertilized control (N_0) with all graduation of the C factor: N_{50} , N_{100} , N_{200} (table 2).

Table 2

The influence of nitrogen and phosphorus fertilizers on the wheat yield

Researched factors	Average yield q/ha	Difference		Significance
		q/ha	%	
P_0	N_0	23,7	Mt	100
	N_{50}	32,44	8,71	136,7
	N_{100}	35,53	11,80	149,7
	N_{150}	38,63	14,90	162,8
	N_{200}	39,46	15,73	166,3
P_{40}	N_0	27,39	Mt	100
	N_{50}	37,16	9,77	135,7
	N_{100}	41,48	14,09	151,4
	N_{150}	42,40	15,01	154,8
	N_{200}	43,07	15,68	157,2
P_{80}	N_0	29,33	Mt	100
	N_{50}	37,75	8,42	128,7
	N_{100}	43,47	14,14	1148,2
	N_{150}	44,61	15,28	152,1
	N_{200}	45,24	15,91	154,2
P_{120}	N_0	29,36	Mt	100
	N_{50}	38,65	9,29	131,6
	N_{100}	45,11	15,75	153,6
	N_{150}	46,28	16,92	157,6
	N_{200}	46,63	17,27	158,8

DL 5% = 2,13; DL 1% = 2,93; DL 0,1% = 4,70

With the corn crop

- the A factor, phosphorus fertilization has, also, contributed with the corn crop to the increasing of the yield by 8.1% with P_{40} and by 10.2% with P_{80} and 11.7% with P_{120} .

- the B factor, potash fertilization has less contributed to the yield increasing obtaining 2.8% output with K_{40} and 4.0% with K_{80} .

- the C factor, nitrogen fertilization has been for corn the main yield increasing factor by 8.44% with N_{60} , by 14.73% with N_{120} , 17.5% with N_{180} and 21.21% with N_{240} .

- The nitrogen-phosphorus interaction on all phosphorus backgrounds the nitrogen fertilizers applying has determined very significant yield outputs between 8.51% and 21.91 q/ha or 17.3% till 52.8% (table 3).

Table 3

The influence of nitrogen and phosphorus fertilizers on the corn yield

Researched factors	Average yield q/ha	Difference		Significance
		q/ha	%	
P ₀	N ₀	41,47	Mt	100
	N ₆₀	50,43	8,96	121,6
	N ₁₂₀	55,61	14,14	134,1
	N ₁₈₀	59,80	18,33	144,2
	N ₂₄₀	63,38	21,91	152,8
P ₄₀	N ₀	45,76	Mt	100
	N ₆₀	54,27	8,51	118,6
	N ₁₂₀	61,29	15,53	139,9
	N ₁₈₀	63,64	17,88	139,1
	N ₂₄₀	67,64	21,88	147,8
P ₈₀	N ₀	47,50	Mt	100
	N ₆₀	55,71	8,21	117,3
	N ₁₂₀	62,38	14,88	131,3
	N ₁₈₀	64,74	17,24	136,3
	N ₂₄₀	68,11	20,61	143,4
P ₁₂₀	N ₀	48,54	Mt	100
	N ₆₀	56,51	7,97	116,4
	N ₁₂₀	63,05	14,51	129,9
	N ₁₈₀	65,32	16,78	134,6
	N ₂₄₀	69,05	20,25	142,3

DL 5% = 4,0; DL 1% = 5,2; DL 0,1% = 7,1

With the soybean crop

- the phosphorus fertilizers has conducted to yield differences of 1.46 - 3.11 q/ha (from P₄₀ to P₈₀) the yield outputs being between 10.1 and 21.6% . the potash fertilizer has determined yield outputs of 0.71 – 1.03 q/ha (K₄₀-K₈₀) that are not significant.

- the nitrogen fertilizers has determined the obtaining of yield outputs of 9.3 – 38.8%.

- the interaction between nitrogen and phosphorus has significantly influenced the soybean yield. With N₀P₀ the yield is 11.71 q/ha and with P₄₀ (N₃₀, N₆₀, N₉₀, N₁₂₀), it increased to 14.42 – 18.26 q/ha with a yield output of 8.0-36.5%. With higher phosphorus doses, P₈₀, P₁₂₀, the outputs are not evident (*table 4*).

Table 4

The influence of nitrogen and phosphorus fertilizers on the soybean yield

Researched factors	Average yield q/ha	Difference		Significance
		q/ha	%	
P ₀	N ₀	11,71	Mt	100
	N ₃₀	13,17	1,46	112,5
	N ₆₀	14,25	2,54	121,7
	N ₉₀	16,24	4,53	138,7
	N ₁₂₀	16,87	5,16	144,1
P ₄₀	N ₀	13,30	Mt	100
	N ₃₀	14,42	1,12	108,4
	N ₆₀	16,05	2,75	120,7
	N ₉₀	17,35	4,23	131,8
	N ₁₂₀	18,26	4,86	136,5
P ₈₀	N ₀	14,60	Mt	100
	N ₃₀	15,65	1,05	107,2
	N ₆₀	17,33	2,73	118,7
	N ₉₀	18,84	4,24	129,0
	N ₁₂₀	19,77	5,17	135,4
P ₁₂₀	N ₀	14,60	Mt	100
	N ₃₀	16,07	1,47	110,1
	N ₆₀	17,39	2,79	119,1
	N ₉₀	19,20	4,60	131,5
	N ₁₂₀	20,43	5,83	139,9

DL 5% = 3,5; DL1% = 4,9; DL 0,1% = 8,3

CONCLUSIONS

With the long term experiments involving wheat, corn and soybean from ARDS Caracal, the yield reflects the necessity to apply fertilizers to these crops.

- with the wheat crop there is recommended a moderate phosphorus dose between P₄₀ and P₈₀ and N 100 – N 150 in function of the founds affordable of each farmer;

- with the corn crop there are, also, recommendable moderate phosphorus doses between P₄₀ – P₈₀ with high nitrogen doses between N₁₈₀ and N₂₄₀;

- with the soybean crop, there are recommended moderate phosphorus doses, P₄₀ with moderate nitrogen doses, N₉₀;

- the potash fertilizers is not recommendable with this soil type and crops.

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