Thesis summary:

„Contribution at establish of optimum fertilization system for wheat crop on reddish-brown soil of Oltenia”

Research aim. One of the very important technological links for soil fertility evolutions is crop fertilization.

Permanent modification in soil like a dynamic community under action of natural and technological under action of natural and technological factors, can be observed only on long time experiments (Borlan Z. și colab. 1991; Răuță C. și colab. 1982).

For establish a rational fertilization system at wheat crop that will permit high productions and a good evolution of soil fertility properties, at Agricultural Research and Development Station-Simnic, placed on central area of Oltenia, was initiated a research theme concerning to:

-the interaction among fertilizers with nitrogen, phosphorus and potassium at wheat crop in long time experiments, knowledge about fertilizers optimum rates and its effects in yield.

-evolution of some agrochemical soil index due to long time applied of mineral fertilizers: nitrogen, phosphorus and potassium and also natural organic manure.

-the effects of mineral fertilizers with nitrogen, phosphorus and potassium under yield quality.

-soil nutrient removal and fertilizers utilization coefficient by wheat.

Research method. The experiments were performed at A.R.D.S. Simnic on a reddish-brown soil, characteristic for central part of Oltenia, in static system, in two years crop rotation (wheat-maize) and five years crop rotation (pea, wheat, maize, wheat, sunflower).

These experiments studied more factors, subdivided plot method with two factors, with fallowing variants:

N :P Interaction at wheat sowed after pea crop.

A FACTOR (phosphorus rates)	B FACTOR (nitrogen rates)
$a_1 = P_0$	$b_1 = N_0$
$a_2 = P_{40}$	$b_2 = N_{30}$
$a_3 = P_{80}$	$b_3 = N_{60}$
$a_4 = P_{120}$	$b_4 = N_{90}$
$a_5 = P_{160}$	$b_5 = N_{120}$

N :P Interaction at wheat sowed after maize crop.

A FACTOR (phosphorus rates)	B FACTOR (nitrogen rates
$a_1 = P_0$	$b_1 = N_0$
$a_2 = P_{40}$	$b_2 = N_{40}$
$a_3 = P_{80}$	$b_3 = N_{80}$
$a_4 = P_{120}$	$b_4 = N_{120}$
$a_5 = P_{160}$	$b_5 = N_{160}$

N : P : K Interaction

A FACTOR (N:P levels) at wheat after maize	at wheat after pea	B FACTOR (K levels)
$a_1 = N_0\ P_0$	$a_1 = N_0\ P_0$	$b_1 = K_0$
$a_2 = N_{80}\ P_0$	$a_2 = N_{60}\ P_0$	$b_2 = K_{40}$
$a_3 = N_{80}\ P_{80}$	$a_3 = N_{60}\ P_{80}$	$b_3 = K_{80}$
$a_4 = N_{160}\ P_{80}$	$a_4 = N_{120}$ P80	$b_4 = K_{120}$

N : P + manure interaction was experimented in wheat – maize crop rotation in static system having follow degree of the factors:

A FACTOR (N:P levels)	B FACTOR (manure levels))
$a_1 = N_0\ P_0$	b_1 = without manure
$a_2 = N_0\ P_{50}$	b_2 = 20 t/ha manure at four years
$a_3 = N_{50}\ P_{50}$	b_3 = 40 t/ha manure at four years
$a_4 = N_{100}\ P_{100}$	b_4 = 60 t/ha manure at four years

Mineral fertilization influence. Within modern agricultural program the importance of inorganic fertilizers is uncontested.

The results obtained in wide world show that fertilizations rise yields with around 40% per unit area, and obtained productions in different countries of the world are closely correlated with fertilizers rates used.

Without a corresponding fertilizations it cannot be used yield potential of new varieties and hybrids made by the genetics and breeders (Davidescu D. și colab., 1976; Hera Cr. și colab., 1984; Bâlteanu Gh., 1991; Goian M, 2000; Feher Ecaterina, 2003).

Although has a relatively low consume of available nutrients, wheat is very pretentious with fertilizers, because its root system controlled a low volume of soil, having also power reduced for adsorption and soluble of nutrient elements from show-release forms like other agricultural crops. (Ionescu-Șișești Gh. și Staicu Ir., 1959; Mihăilă V. și Popescu V., 1994).

Results concerning mineral and organic after different agricultural crops, in long time experiments. Experimental research from A.R.D.S. Simnic pointed out that exist a positive interaction between nitrogen and phosphorus fertilizers.

N x P interaction. Generally these are a large variation of the influence of these two nutrients, as well as their interactions depending on climatic conditions. Results obtained carried out the highest nitrogen contributions for yield increase at wheat sowed after pea crop but also at wheat sowed after maize crop.

The highest yields, cooperated with non-fertilizations variant, were obtained in average during experimental years 1997-2001, with fertilizers rates N_{60}- N_{90} (61,2 g/ha, respectively 61,5 q/ha) after pea and N_{120}-N_{160} (52,3 q/ha, respectively 51,3 q/ha) after maize on the same background of phosphorus.

Phosphorus influence at wheat after pea crop, no counting nitrogen fertilization, shows for all, experimented years and in average, without 2001 yield spores, against non-fertilization variants in all rates used. Thus in five years average fertilised with P_{120} and P_{160} (61,2 q/ha respectively 61,5 q/ha) on background with N_0-N_{120}.

The yields being practically equal the most efficient rate was P_{120}. Interaction between phosphorus and nitrogen rates applied at wheat after pea crop shows that at each of phosphorus rates (P_0-P_{160}) productions at variants fertilizations with N_{30}, N_{60}, N_{90} and N_{120} are superior, with statistic assurance.

The highest yield increases were recording at fertilized variants with nitrogen at 60 kg/ha rate and 90 kg/ha rate on P_{80} background (14,8 q/ha respectively 16,4 kg/ha) on P120 background (15,5 q/ha and 16,4 q/ha) and even at phosphorus non-fertilization variant (15,1 q/ha respectively 14,0 q/ha).

At P_{160} rate the highest increase was registered at N_{120} fertilized variant (14,8 q/ha) against nitrogen no fertilization variant.

This can suggest that N_{60} is efficient rate for each of phosphorus rates applied.

Nitrogen influence in the case of different phosphorus rates applied at wheat after crop (N xP interaction) shows that at each of nitrogen rates in five years average, the yield rise with the rise of phosphorus rates (table 1).

The highest yield increases were obtained at P_{120} and P_{160} rates, and P_{120} rate is the most efficiently, even without nitrogen fertilization.

This results are due of particularly conditions in 2001, when yields were not so differentiated with phosphorus rate applied at each of nitrogen rates because climatic conditions during this year.

Table 1.Nitrogen influence in conditions of different phosphorus rates applied, at wheat crop after pea(1997-2001)

Yield q/ha / Studied factors		1997	1998	1999	2000	2001	Average	Dif.	Signification
N_0	P_0	40,7	33,9	38,3	32,8	45,5	38,2	Mt	
	P_{40}	43,0 (x)	42,3 xxx	42,7 xx	37,8 xxx	48,4	42,8	4,6	
	P_{80}	46,4 xx	45,0 xxx	47,5 xxx	41,2 xxx	57,2 xxx	47,5	9,3	x
	P_{120}	46,9 xx	47,8 xxx	48,5 xxx	42,9 xxx	58,8 xxx	49,0	10,8	xx
	P_{160}	47,0 xx	48,6 xxx	48,8 xxx	44,9 xxx	66,4 xxx	51,1	12,9	xx
N_{30}	P_0	49,6	45,3	46,1	39,4	64,6	49,0	Mt	
	P_{40}	60,1 xxx	59,5 xxx	56,8 xxx	41,1	66,4	42,5	-6,5	
	P_{80}	61,6 xxx	60,8 xxx	59,2 xxx	44,1 xxx	65,5	58,2	9,2	x
	P_{120}	62,4 xxx	61,5 xxx	60,2 xxx	44,9 xxx	73,3 xx	60,5	11,5	xx
	P_{160}	63,0 xxx	60,5 xxx	61,0 xxx	46,0 xxx	71,6	60,4	11,4	xx
N_{60}	P_0	60,5	49,9	47,5	40,9	67,5	53,3	Mt	

	P_{40}	69,0^{xxx}	65,2^{xxx}	60,7^{xxx}	43,5	70,4	61,8	8,5	x
	P_{80}	70,1^{xxx}	66,7^{xxx}	63,4^{xxx}	45,3^{xxx}	66,2	62,3	9,0	x
	P_{120}	69,9^{xxx}	66,7^{xxx}	63,7^{xxx}	47,8^{xxx}	73,5	64,3	11,0	xx
	P_{160}	70,0^{xxx}	67,7^{xxx}	64,8^{xxx}	48,2^{xxx}	72,4	64,6	19,3	xx
N_{90}	P_0	47,1	58,3	47,8	42,4	65,6	52,2	Mt	
	P_{40}	68,0^{xxx}	70,8^{xxx}	62,7^{xxx}	45,7^{xxx}	52,1	60,0	7,8	
	P_{80}	69,3^{xxx}	72,6^{xxx}	66,0^{xxx}	50,0^{xxx}	61,5	63,9	11,7	xx
	P_{120}	68,9^{xxx}	72,9^{xxx}	64,9^{xxx}	50,1^{xxx}	74,8$^{(xxx)}$	66,3	14,1	xxx
	P_{160}	62,8^{xxx}	74,6^{xxx}	65,1^{xxx}	50,4^{xxx}	74,0$^{(xx)}$	65,4	13,2	xx
N_{120}	P_0	45,1	57,6	46,4	40,0	59,7	50,0	Mt	
	P_{40}	66,8^{xxx}	71,1^{xxx}	62,0^{xxx}	44,8^{xxx}	51,7^{0}	59,3	9,3	x
	P_{80}	67,2^{xxx}	73,2^{xxx}	64,2^{xxx}	48,4^{xxx}	50,0^{000}	60,6	10,6	(xx)
	P_{120}	67,4^{xxx}	73,9^{xxx}	63,5^{xxx}	49,3^{xxx}	74,0^{xxx}	65,9	15,9	xxx
	P_{160}	67,8^{xxx}	74,8^{xxx}	64,7^{xxx}	49,2^{xxx}	73,0^{xxx}	65,9	15,9	xxx
	DL 5%	3,7	3,6	2,6	2,9	7,1	8,0		
	1%	5,0	4,8	3,5	3,3	8,4	10,6		
	0,1%	6,4	6,2	4,5	3,5	9,2	13,7		

At wheat sowed after maize crop phosphorus influence under yield, no counting nitrogen supply is the same for five testing years. Thus, at phosphorus rates : P_{40}, P_{80}, P_{120} și P_{160} the production are higher, very significant, comparated with phosphorus non-fertilization variant. Also in the first four years, the yields at variant with P_{80}, P_{120} and P_{160} recording increases against P_{40} fertilized variant.

Nitrogen influence under wheat yield after maize crop no counting phosphorus supply, is constantly like we showed previously for live testing years.

But yield maximum alternate among variants fertilized with N_{40} (1998), N_{80} 1997, 2001) and N_{120} (1999 and 2000). In all years (without 1988 and 2001) pointed out that N_{80} obtained yields are significant superior against those with N_{40} fertilization.

In average, all variants fertilized with nitrogen were obtained very significant superior yields against non-fertilizations variant.

P x N interaction presented on bases of results of five testing years suggest the fact that for each of phosphorus rates are distinct and very significant superior against nitrogen non-fertilizations. In five years average yields obtained at variants with N_{80}, N_{120} and N_{160} are much related, that suggest N_{80} like the most efficient rate applied on each of phosphorus tested background even on phosphorus non-fertilization variant.

Two factors interaction (table 2) nitrogen and phosphorus fertilizations carried out in five years average that only at N_{80}, N_{120} and N_{160} (nitrogen rates) were significant differences among phosphorus rates applied, the most efficiently being P_{80}.

Table 2. Nitrogen influence in conditions of different phosphorus rates applied, at wheat crop after pea(1997-2001)

Yield q/ha Studied factors		1997	1998	1999	2000	2001	Average	Dif.	Significations
N_0	P_0	28,7	15,1	20,8	19,9	39,4	24,8	Mt	
	P_{40}	30,0	18,5	22,9	23,5^{xx}	44,4^{x}	27,9	3,1	
	P_{80}	33,5^{xx}	18,3	24,4^{xx}	25,5^{xxx}	48,6^{xxx}	30,1	5,3	
	P_{120}	33,4^{xx}	20,8^{xx}	25,4^{xxx}	26,1^{xxx}	50,4^{xxx}	31,2	6,4	
	P_{160}	33,8^{xxx}	20,9^{xx}	27,7^{xxx}	28,9^{xxx}	54,1^{xxx}	33,1	8,3	
N_{40}	P_0	45,5	31,3	35,1	29,8	55,1	39,4	Mt	
	P_{40}	49,1^{x}	33,6	39,4^{xxx}	30,6	58,2	42,2	2,8	
	P_{80}	51,9^{xxx}	40,6^{xxx}	41,1^{xxx}	36,7^{xxx}	59,3^{x}	45,9	6,5	
	P_{120}	53,0^{xxx}	41,2^{xxx}	40,4^{xxx}	37,1^{xxx}	57,9	45,9	6,5	
	P_{160}	53,2^{xxx}	41,0^{xxx}	40,9^{xxx}	37,6^{xxx}	57,5	46,0	6,6	
N_{80}	P_0	49,0	42,9	41,1	30,3	55,3	43,7	Mt	
	P_{40}	49,1	45,9	48,2^{xxx}	35,2^{xxx}	58,8	49,4	5,7	
	P_{80}	62,2^{xxx}	51,9^{xxx}	51,5^{xxx}	40,5^{xxx}	62,7^{xxx}	53,8	10,1^{x}	
	P_{120}	61,9^{xxx}	50,8^{xxx}	51,6^{xxx}	41,8^{xxx}	57,5	52,7	9,0	
	P_{160}	61,8^{xxx}	50,5^{xxx}	52,3^{xxx}	41,4^{xxx}	58,2	52,8	9,1	
N_{120}	P_0	37,3	51,6	46,8	31,3	56,4	44,7	Mt	
	P_{40}	57,3^{xxx}	56,1^{x}	51,2^{xxx}	38,4^{xxx}	59,9	52,6	7,9	
	P_{80}	61,4^{xxx}	57,5^{xx}	53,9^{xxx}	43,1^{xxx}	63,6^{xxx}	55,9	11,2^{x}	
	P_{120}	61,5^{xxx}	58,0^{xxx}	53,7^{xxx}	43,8^{xxx}	54,3	54,3	9,6^{x}	
	P_{160}	61,0^{xxx}	58,5^{xxx}	53,6^{xxx}	43,1^{xxx}	53,6	54,0	9,3^{x}	
N_{160}	P_0	35,4	54,0	44,3	30,4	55,5	43,9	Mt	
	P_{40}	55,9^{xxx}	58,3^{x}	50,6^{xxx}	36,9^{xxx}	58,2	52,0	8,1	
	P_{80}	58,4^{xxx}	59,5^{xx}	52,8^{xxx}	41,6^{xxx}	55,4	53,5	9,6^{x}	
	P_{120}	60,4^{xxx}	59,9^{xx}	53,5^{xxx}	42,2^{xxx}	53,9	54,0	10,1^{x}	
	P_{160}	59,1^{xxx}	60,7^{xxx}	52,9^{xxx}	40,2^{xxx}	51,4^{0}	52,9	9,0	
	DL 5%	3,3	3,5	2,5	2,2	4,1	9,3		
	1%	4,3	4,7	3,4	2,9	5,4	12,3		
	0,1%	5,6	6,1	4,3	3,8	6,9	15,9		

Its found that at wheat after pea as well as wheat after maize yield differences among N_{30}-N_{90} rates (after pea) and N_{80}-N_{160} (after maize) are small, so results that the most efficiently are : N_{60} rate after pea and N_{80} after maize, on phosphorus background. In variants with nitrogen fertilizers but without phosphorus or lack of balance rates, yield increases in 2001 and in average during 1997-2001 are small, in comparation with nitrogen and phosphorus fertilizers applied together at optimum rates.

In these variants was registered a nitrate nitrogen toxinfection of plants, in wet and cool springtime, delayed vegetation and dimishing yield.

Results shows that after pea yield increases gave by phosphorus fertilizers only, are bigger then after maize because of nitrogen supply from legume, witch interactions with phosphorus applied (10-13 q/ha, comparated with 8,4-8,5 q/ha).

Based on this, the most efficiently rates for wheat nitrogen fertilization are N_{60} after pea and N_{80} after maize, apply together with P_{40}-P_{80} rates.

Also at wheat sowed after pea are not justified N_{90}-N_{120} variants, and at wheat sowed after maize N_{120} and N_{160} variant, where the yield were smaller or closely of $P_{160}N_{60}$ variant respectively $P_{160}N_{80}$ variant.

Interaction NP x K. In average during 1979-2001 potassium fertilizer give it only or in complex with nitrogen and phosphorus, modify no significant grain production at wheat after pea or after maize crop.

As the results shows in previous experiments, NP fertilizers have an important role in yield increases. Phosphorus and nitrogen influence under wheat production after pea crop, without potassium rates, is evidently.

Registered increase are placed among 13,4 q/ha at $N_{60}P_0$ and 22,6 q/ha at $N_{120}P_{80}$ comparated with no fertilization variant N_0P_0.

However yield increase recording at $N_{60}P_{80}$ variants such as 21,3 q/ha pointed out the efficient of this nitrogen and phosphorus rates.

At Simnic with its environmental conditions, potassium influence, no counting nitrogen and phosphorus fertilizers, is not pointed out. Yield spores performer with rates of K_{40}, K_{80} and K_{120} (1-2 q/ha) are not significant, so we can conclude, that, this element isn't essential for yield increases at wheat after pea crop.

Interaction of NP x K factors at wheat after pea crop carried out no yield spores at each potassium fertilization rates to any NP rates.

In change, K x NP factors interaction at wheat after pea crop (table 3) shows yield spores at NP fertilization variants against non fertilization at each of potassium rates. Fact that at potassium non-fertilization variant are registered spores depending on nitrogen and phosphorus fertilizers, from $N_{60}P_0$ rate till $N_{120}P_{80}$ suggest that at Simnic conditions, potassium-fertilizers are no efficient.

Higher spores yield performed at $N_{60}P_{80}$ variant find out the efficient of this rate.

Table3. Yield potassium influence in conditions of different nitrogen and phosphorus rates applied at wheat after crop maize. (1997-2001)

Yield q/ha / Studied factors		1997	1998	1999	2000	2001	Average	Dif.	Signification
K_0	N_0P_0	42,3	32,2	41,0	30,6	43,0	37,8	Mt	
	$N_{60}P_0$	59,7[xxx]	49,4[xxx]	50,3[xxx]	41,2[xxx]	64,8[xxx]	53,1	15,3	xxx
	$N_{60}P_{80}$	69,9[xxx]	64,1[xxx]	63,4[xxx]	46,3[xxx]	61,6[xxx]	61,1	23,3	xxx
	$N_{120}P_{80}$	67,4[xxx]	72,7[xxx]	65,9[xxx]	48,1[xxx]	60,6[xxx]	62,9	25,1	xxx
K_{40}	N_0P_0	43,2	32,1	42,1	30,8	53,4	40,3	Mt	
	$N_{60}P_0$	59,9[xxx]	50,0[xxx]	51,4[xxx]	41,8[xxx]	67,4[xxx]	54,1	13,8	xxx
	$N_{60}P_{80}$	69,8[xxx]	64,9[xxx]	63,2[xxx]	46,8[xxx]	63,4[xxx]	61,6	21,3	xxx
	$N_{120}P_{80}$	67,6[xxx]	73,3[xxx]	65,0[xxx]	47,7[xxx]	60,8[xxx]	62,9	22,6	xxx
K_{80}	N_0P_0	43,8	30,0	42,5	30,9	60,9	41,6	Mt	
	$N_{60}P_0$	60,6[xxx]	50,4[xxx]	52,1[xxx]	42,4[xxx]	67,9[xxx]	54,7	13,1	xxx
	$N_{60}P_{80}$	70,6[xxx]	65,1[xxx]	63,8[xxx]	45,9[xxx]	66,8[xxx]	62,4	20,8	xxx
	$N_{120}P_{80}$	68,0[xxx]	73,6[xxx]	66,0[xxx]	48,3[xxx]	61,6	63,5	21,9	xxx
K_{120}	N_0P_0	43,6	32,9	42,6	31,2	63,2	42,7	Mt	
	$N_{60}P_0$	60,2[xxx]	50,3[xxx]	51,6[xxx]	42,6[xxx]	66,1[(x)]	54,2	11,5	xxx
	$N_{60}P_{80}$	70,5[xxx]	65,4[xxx]	64,2[xxx]	46,9[xxx]	65,5	63,5	20,8	xxx
	$N_{120}P_{80}$	68,2[xxx]	73,8[xxx]	65,1[xxx]	49,3[xxx]	60,7	63,4	20,7	xxx
	DL 5%	4,8	4,0	3,0	2,5	2,9	3,0		
	1%	6,4	5,3	4,0	3,5	3,9	4,0		
	0,1%	8,3	6,9	5,2	4,6	5,1	5,2		

In average, at studied years 1997-2001, potassium fertilizers spored only or in complex with nitrogen and phosphorus, not significant influenced yield wheat after pea crops.

After maize crop, situation is similarly like wheat after pea.

Higher crops yield has been obtained at fertilized variants with $N_{60}P_{80}$ (25,4 q/ha) and $N_{160}P_{80}$ (26,5 q/ha) in average during five years, indifferent of potassium rate. Increases being so related, the most efficient rate and also recomendated is $N_{80}P_{80}$.

Potassium fertilizers apply with different rates at wheat after maize crop, has not influenced significantly the yield.

NP x K interaction shows that at each of NP rates experimented has been obtained yield increases at potassium fertilized variants against these non-fertilization, but its are not statistic assurance, in average for five years.

Spores had very small limits of variation from K_{40} to K_{120}, that suggest K40 efficiently rate.

K x NP interaction (table 4) at wheat after maize crop as will as wheat after pea crop is not obvious because of each potassium rates apply, each of NP rates are doubled by very significant yield increases against NP no fertilization variant.

Table 4. Yield potassium influence under nitrogen different rates apply at wheat crop after maize (1997-2001)

Yield q/ha / Studies factors		1997	1998	1999	2000	2001	Average	Dif.	Signification
K_0	N_0P_0	24,8	16,8	19,7	17,9	34,9	22,8	Mt	
	$N_{80}P_0$	50,8 ^{xxx}	41,7 ^{xxx}	41,0 ^{xxx}	30,7 ^{xxx}	50,6 ^{xxx}	43,0	20,2	xxx
	$N_{80}P_{80}$	56,3 ^{xxx}	51,5 ^{xxx}	49,4 ^{xxx}	40,1 ^{xxx}	54,2 ^{xxx}	50,3	27,5	xxx
	$N_{160}P_{80}$	55,2 ^{xxx}	57,2 ^{xxx}	52,1 ^{xxx}	40,4 ^{xxx}	52,5 ^{xxx}	51,5	28,7	xxx
K_{40}	N_0P_0	25,2	17,7	20,8	17,8	46,3	25,6	Mt	
	$N_{80}P_0$	51,0 ^{xxx}	43,2 ^{xxx}	41,9 ^{xxx}	31,3 ^{xxx}	58,6 ^{xxx}	45,0	19,4	xxx
	$N_{80}P_{80}$	57,3 ^{xxx}	51,8 ^{xxx}	50,7 ^{xxx}	40,9 ^{xxx}	55,1 ^{xx}	51,2	25,6	xxx
	$N_{160}P_{80}$	56,0 ^{xxx}	58,4 ^{xxx}	53,3 ^{xxx}	40,9 ^{xxx}	53,6 ^{xx}	52,4	26,8	xxx
K_{80}	N_0P_0	24,9	18,0	20,7	18,0	50,7	26,5	Mt	
	$N_{80}P_0$	52,2 ^{xxx}	42,8 ^{xxx}	42,2 ^{xxx}	31,7 ^{xxx}	57,0 ^{xx}	45,2	18,7	xxx
	$N_{80}P_{80}$	57,2 ^{xxx}	52,8 ^{xxx}	50,2 ^{xxx}	41,1 ^{xxx}	55,6 ^{x}	51,4	24,9	xxx
	$N_{160}P_{80}$	56,7 ^{xxx}	58,1 ^{xxx}	53,4 ^{xxx}	40,8 ^{xxx}	53,9	52,6	26,1	xxx
K_{120}	N_0P_0	24,4	18,2	19,4	18,2	56,2	27,3	Mt	
	$N_{80}P_0$	52,4 ^{xxx}	43,0 ^{xxx}	42,6 ^{xxx}	31,4 ^{xxx}	56,2	45,1	17,8	xxx
	$N_{80}P_{80}$	57,6 ^{xxx}	52,0 ^{xxx}	50,3 ^{xxx}	41,3 ^{xxx}	53,9	51,0	23,7	xxx
	$N_{160}P_{80}$	56,4 ^{xxx}	58,3 ^{xxx}	53,1 ^{xxx}	41,0 ^{xxx}	52,4	52,2	24,9	xxx
	DL 5%	2,9	3,9	2,6	2,4	4,9	2,8		
	1%	3,9	5,2	3,5	3,0	6,6	3,7		
	0,1%	5,1	6,7	4,5	3,8	8,9	4,8		

Thus, at K_0 spores were among 20,2 q/ha and 28,7 q/ha for nitrogen and phosphorus fertilized variants; at K_{40} spores recording among from 19,4 q/ha to 26,8; at K_{40} among, 18,7 and 26,1 q/ha and at K_{120} from 17,8 q/ha to 24,9 q/ha.

Very closely yield increases between $N_{60}P_{80}$ and $N_{120}P_{80}$ fertilized variants, pointed out that $N_{60}P_{80}$ rate is the most efficient at each of potassium rates.

Based on these results we can conclude that is not compulsory potassium fertilizers apply, but if its used rate cannot be more than 40 kg K_2O/ha.

N x P + manure interaction. For assurance a positive result of nutritive elements in agriculture and also for permanent hence of soil fertility, use of manure and all other vegetal rests was and will be in future a very important measure.

Method and time of apply can influence different manure efficacious.

Manure effect, like nutritive source, in first years of action is equal with around 1, 2 kg N, 0,8 kg P_2O_5 and 2 kg K_2O out of inorganic fertilizers per manure tone used.

Indifferently of manure apply, in average for five years, were obtained yield increases distinct significantly when were applied $N_{50}P_{50}$ and $N_{100}P_{100}$ rates.

Counting of between these two rates are not significant differences is recomndated N50P50 being more efficiently rates.

Although in each of experimental years, yield increases give it by manure apply only in different rates, were significant, in average, only 40 t/ha and 60 t/ha rates show significant increases.

Limit difference bigger for mean case was due to great differences among experimental years expressed by obtained yield.

In average, from 1997 to 2001, yield increases recording by manure apply were: 10-16,5 q/ha on N_0P_0 background; 5,7-10,6 q/ha on N_0P_{50} background; 4,3-7,6 q/ha on $N_{50}P_{50}$ background; 2,5-3,7 q/ha on $N_{100}P_{100}$ background.

As a conclusion we can say that manure, supply in good measure nitrogen and phosphorus fertilization because on N0P0background were obtained highest spores. At 40 t/ha and 60 t/ha rates its are statistic assured.

On $N_{50}P_{50}$ and $N_{100}P_{100}$ background yield spores had rise substantial, the most efficiently spores being registered with 40 t/ha at four years and $N_{50}P_{50}$.

In change, on a background with $N_{50}P_{50}$ + manure (60 t/ha); $N_{100}P_{100}$ and manure (60 t/ha) accomplished yields not justify these rates.

On $N_{50}P_{50}$ and $N_{100}P_{100}$ background, yield spores hence substantially, the most efficiently increases were obtained with 40 t/ha manure and $N_{50}P_{50}$ (table 5).

In change, at N50P50 + manure (60 t/ha) and at N100P100 + manure (60 t/ha) accomplished yields not justify these rates.

Table 5. Influence of NP different rates under yield, cocording with manure rates apply at wheat after maize crop at A.R.D.S. Simnic conditions (1997-2001)

Yield q/ha / Studies factors		1997	1998	1999	2000	2001	Average	Dif.	Signification
M0	N0P0	24,6	17,1	20,5	18,6	36,6	23,5	Mt	
	N0P50	27,9	20,4	23,4 x	21,0 x	55,8 xxx	29,7	6,2	
	N50P50	50,8 xxx	38,0 xxx	41,4 xxx	36,9 xxx	59,3 xxx	45,3	21,8	xxx
	N100P100	57,9 xxx	56,7 xxx	50,1 xxx	41,4 xxx	44,2 xxx	50,1	26,6	xxx
M 20 t/ha	N0P0	30,3	24,5	30,2	24,0	58,3	33,5	Mt	
	N0P50	33,7	26,8	31,4	25,0	60,1	35,4	1,9	
	N50P50	54,5 xxx	42,3 xxx	49,2 xxx	40,8 xxx	61,0	49,6	16,1	xxx
	N100P100	62,7 xxx	61,2 xxx	51,8 xxx	40,1 xxx	47,0 ooo	52,6	19,1	xxx
M 40 t/ha	N0P0	34,8	28,7	41,9	26,4	61,7	38,7	Mt	
	N0P50	35,6	29,7	43,5	26,7	62,1	39,5	0,8	
	N50P50	58,3 xxx	46,8 xxx	53,2 xxx	44,4 xxx	62,0	52,9	14,2	xxx
	N100P100	63,6 xxx	65,8 xxx	50,5 xxx	44,1 xxx	49,4 ooo	54,7	16,0	xxx
M 60 t/ha	N0P0	36,8	31,8	46,5	25,3	59,7	40,0	Mt	
	N0P50	36,9	32,2	42,4	26,0	57,9	40,3	0,3	
	N50P50	55,7 xxx	48,3 xxx	52,1 xxx	41,8 xxx	58,3	51,2	11,2	xxx
	N100P100	63,2 xxx	64,7 xxx	49,9 xxx	42,5 xxx	48,6 ooo	53,8	13,8	xxx
	DL 5%	3,5	4,0	2,4	2,2	3,5	4,0		
	DL1%	4,6	5,3	3,2	3,0	4,6	5,3		
	DL0,1%	6,0	6,9	4,2	4,0	6,0	6,9		

The evolution of some agrochemical soil index under systematic fertilization with nitrogen, phosphorus, potassium and manure. Soil acidity has like effect rise of hydrolytique acidity (without phosphorus background - from 3,4 m.e/100 g soil to 6,1 m.e/100 g soil ; with phosphorus background - from 3,6 m.e/100 g soil to 5,6 m.e/100 g soil), diminution of total exchangeable bases (without phosphorus background - from 15,4 m.e/100 g soil to 12,1 m.e/100 g soil ; on background with P_{80}- from 15,2 m.e/100 g soil to 13,0 m.e/100 g soil), diminution of percentage base saturation (without phosphorus background - de la 79% to 68% ; on background with P_{80}- from 78% to 70%) and rise of exchangeable aluminium (without phosphorus background –

from 0,5 mg/100 g soil to 1,36 mg/100 g soil; on background with P_{80}- from 0,4 mg/100 g soil to 1,17 mg/100 g soil).

The influence of fertilizers applied long time under chemical composition and quality at wheat grain productions. Nitrogen and phosphorus fertilizers influenced protein content of wheat grain production, sowed after pea crop from 11,6 at 15,0%, frequently where nitrogen rates were high (N_{120}-N_{160}) and gave it together with phosphorus. Amount of protein per unit area increased most in variants with highest productions; after pea crop – 13,60% brut protein content on $N_{120}P_{80}N_{40}$ background, with 73,3 q/ha protein; at wheat after maize crop – 14,98% brut protein content, on $N_{80}P_{80}K_{40}$ background with 51,8 q/ha level of production).

Rising rates of nitrogen fertilizers determinate protein quality, respectively amino acid content.

NPK fertilization influenced differently pure protein content as well as some quality index (wet starch, dry starch, valuable index, sedimentation index) depending by previously plant.

NPK content in wheat plants varied concording with type and rates of fertilizers.

-nitrogen content increased with nitrogen rates applied, especially on phosphorus background (2,63-2,72% Kernel at wheat sowed after maize crop).

-phosphorus content increased under phosphorus fertilizer influence, kernel phosphorus content being from 0,95-1,02 % at wheat sowed after pea crop, 0,96-1,06 % at wheat after maize, in steam phosphorus content being smaller than in kernels.

Soil nutrient removal and fertilizers utilization coefficient by wheat.

NPK elements removal was due more by high of yield then nutrient elements content.

Nitrogen total removal (in kernels + steams) increased with fertilizers rates (133,6-181,4 kg/ha N at wheat after pea crop; 117,1-148,3 kg/ha N at wheat after maize crop).

The highest nitrogen consumption –around 70% - was registered in kernels.

Phosphorus removal was higher in variants with the highest productions. Potassium removal varied with fertilizers rates applied, increasing with rates and being higher in steam than in kernels.

Nitrogen and phosphorus utilization coefficient for yield formation, varied inversely proportional to size of fertilizers rates used: at nitrogen from 58,7% to 86,8% at wheat after pea; from 40,1% to 77,0% at wheat after maize crop.

Phosphorus utilization coefficient alternated from 9,8% to 23,3% after pea crop; from 9,7% to 18,6% at wheat after maize crop.

Based on obtained results, following soil fertility traits under fertilizers apply influence were registered data and viable technologic for farmers regarding chemical and organic fertilization with balance rates, microelements and other measures for rise the yield in quality and quantitative and also for a high level of soil fertility.

Results pointed out viability of a scientifique agriculture, ecological, with environmental quality protection for making constant productions which assure a rational use of labour, food security and stable economical benefits.

Recommendations. Based on obtained results for wheat fertilization are recommandated N_{60} rate after pea crop and N_{80} rate after maize crop, applied with P40-P_{80} rates.

Phosphorus rates will be together differentiated in showed limits depending on soil content in light-release phosphorus established by agrochemical soil test.

If will be necessary to assure with phosphorus fertilization a optimum level of phosphorus in soil of 8-9 mg/100 g soil on 32-36 ppm.

Are not recommended potassium fertilizers applicably only or in complex with nitrogen and phosphorus, because does not exist significant influence at wheat production after pea and maize crops. In change are recommended organique fertilizers for having efficient spores in variant with $N_{50}P_{50}$ annually + 40 t manure.

For rising soil fertility level, at Simnic area with luvic reddish-brown soil, is important the improvement of chemical properties by using agro technical measures.

For future are recommended experimental studies regarding to:

-microelements (Mo, Zn, Mg) influence for improvement soil fertility properties and increases yield;

-algorithms and mathematic formula find for moving forms content in ploughed part of the soil in related with fertilizers amount applied annually, static experimental period and obtained yields;

-studies in greenhouse that lead of knowledge about metabolisation type, nutritive elements contribution at yield farm, absorption, removal, result of soil elements, etc;

-is necessary to follow in these long time experiments, the evolution of some elements of soil physic and biology, land cultural conditions, plant phytosanitary conditions and other problems.

Obtained data in these experiments will be the base for founding new resources, it's rational and counting of some mathematical low for prognoses of: soil and crops evolutions with different type of fertilizations.

Also, yield increases and rational uses of labour will lead to rise people benefits and also at living level improvement in rural medium in the same direction with results and standard from U.E.

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