

Preliminary researches regarding the optimization of doses of chemical fertilizer applied in potato seeds culture

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Abstract For potato the quality of planted material is an essential factor that determines the tuber quality and the production level obtained. The biological quality depreciation of potato is the consequence of two major causes: infection with viruses and the decrease of growth vigor due to physiological age. Climate changes have led and are leading further to the decrease of cultivated surfaces with potato seeds with negative consequences on potato culture. Development of cultivation technologies for seed potato by using some fertilization reports specific to species and climate conditions are timely and represent a permanent research subject. Potato species react differently to fertilization level and climate and soil conditions of potato plants and implicitly to the level of production.

Key words

potato, seed, quality, soil, climate

In this period when chemical fertilizers are one of the main resources for production increase and control of technological quality of agricultural products [1, 4, 8, 9], when from the technical point of view, they may be achieved in many potential ecological situations for most of cultivated plants [2, 3, 10], the fertilization system becomes one of the main links of the technology for plant growing [7, 8, 11]. Potato being an intensive culture responding in the most ecological conditions by high growth of fertilization, according to concrete conditions of climate, soil and purpose of culture use, in our case being the potato for seed [5, 6, 12, 13].

Material and Method

For these experiences have been used three types of potato varieties created at S.C.D.C. Targu Secuiesc: *Gared*, *Albioana* and *Redsec* and 4 types of chemical fertilizers.

Gared variety is a semi-late variety, resistant to blight having a red peel, white-yellowish pulp, the tuber shape is round-oval with shallow holes, and the culinary quality is good being categorized in the class of use B, it is appropriate for processing as pommes frites.

Albioana variety is a semi-late variety, having a yellow peel, pulp of milky white color, semi-deep holes, very good culinary quality, appropriate for processing as chips.

Redsec variety has round-oval tubers, intense red color of peel, and the pulp color is yellow, with a good culinary quality, recommended for consumption in fresh state for the period of autumn-winter.

Chemical fertilizers

Complex 15:15:15 – grained mineral complex which contains three nutritive elements: azote, phosphorus and potassium in proportion of 15% each.

Nutri Top Amesal NP5:30NG000 – grained fertilizer based on azote, phosphorus and micro-elements, innovative due to the presence of Amesal 200 N.

Patent Kali 30% K grained fertilizer with content of 30% potassium sulfate supplemented with 6% magnesium, soluble in water.

Nitrocalcar – grained fertilizer based on nitrate ammonium completed with calcium carbonate.

Purpose of researches

The researches provided have been developed in 2019, on the experimental fields of Research and Development Station for Potato Targu Secuiesc which will continue in 2020 – 2021.

The purpose of researches was to establish the possibilities of enhancing the tuber production for seeds and maintaining the biological quality of the material to grow.

The theoretical base of researches is the data gathered until present, regarding the close relations between the number of tubers formed and production, between the size of tubers and production and not least between them and the variety.

The present concerns target the effects of dose increase of phosphorus in basic fertilization, as well the azote level administered.

The researches are in a polyfactorial experiment with three factors, as follows: variety, year, fertilization, being determined the productions on fractions of sizes, number of tubers/square meter, average weight of tubers.

Experimental factors and their graduations

✓ A Factor – soil

- a₁ – Gared
- a₂ – Albioana
- a₃ – Redsec

✓ B Factor – culture year

- b₁ – 2019
- b₂ – 2020
- b₃ – 2021

✓ C Factor – fertilization level at planting

- c₁ – N 120 kg s.a./ha : P 90 kg s.a./ha : K 180 kg s.a./ha
- c₂ – N 150 kg s.a./ha : P 120 kg s.a./ha : K 180 kg s.a./ha
- c₃ – N 180 kg s.a./ha : P 150 kg s.a./ha : K 180 kg s.a./ha
- c₄ – N 210 kg s.a./ha : P 180 kg s.a./ha : K 180 kg s.a./ha

The experiment disposition was done in subdivided lots with three repetitions.

As biological material, there were used the varieties *Gared*, *Albioana* and *Redsec* from the biological category Prebase Clone D.

The planting was performed manually, the planting distance being of 75 x 25 cm, this way achieving a density of 53.300 plants/ ha. The chemical fertilizer administration was done at planting.

For all experiments have been performed observations during the vegetation period regarding:

- data of main agrophytotechnical works provided;
- data of main phenophases;
- sampling was performed on varieties and repetitions and the following was determined:
 - ⊙ number and weight of tubers > 55 mm
 - ⊙ number and weight of tubers 35 – 55 mm
 - ⊙ number and weight of tubers < 35 mm

The result interpretation and count was performed using the variation analysis method, and for the account of differences significance was used the multiple comparison test (*Duncan*).

Results and Discussions

Climate conditions registered at S.C.D.C. Targu Secuiesc in 2019

Targu Secuiesc Depression is characterized by an accentuated continental climate, with warm and dry summers, while winters are cold and long.

Regarding the hydric regime, we can say that the precipitations have been above the normal average (+169.5 mm) with a disproportionate distribution that affected the potato culture, being registered ponding and infection with blight due to the impossibility to provide mechanic works for phytosanitary treatment.

From the thermic point of view, in the analyzed period there were values with +1.88°C above the multiannual average, in the 12 months analyzed the monthly average temperatures have been higher in comparison to the multiannual average, the biggest differences being registered in the period January – March 2019 (d = +3.2°C in February and d = +2.95°C in March) and in November with d = +4.7°C (Fig. 2).

The winter period was performed in the conditions of a pluviometric regime close to MMA, in which there were registered 51 mm, with 12 mm under the multiannual average and with a thermic regime with 3°C higher than the multiannual average of the three winter months (Fig. 1).

In the period April – May 2019 the precipitations quantity registered was with 191 mm above the multiannual average, in the months May – June the differences in comparison to MMA being of d = + 60.3 mm respectively d = + 106.6 mm. Beginning with July until December the precipitations quantity registered was below the multiannual average with 100.5 mm.

The precipitations registered during the entire period analyzed is above the multiannual average with +169.5 mm.

Table 1

Average temperature variation in air and atmospheric precipitations in 2019 against the normal one registered at the Meteorological Station in Târgu Secuiesc

Month	Precipitations (mm)		Difference against MMA	Air temperature (°C)		Difference against MMA
	2019	MMA		2019	MMA	
January	16.4	21.3	-4.9	-3.1	-6.0	2.9
February	20.4	20.2	0.2	-0.5	-3.7	3.2
March	14.2	21.5	-7.3	4.8	1.8	2.95
April	62.6	38.5	24.1	8.3	8.0	0.3
May	131.1	70.8	60.3	13.4	13.0	0.4
June	190.6	84.0	106.6	18.9	16.2	2.7
July	57.1	78.7	-21.6	18.0	17.9	0.1
August	43.0	62.7	-19.7	19.7	17.4	2.3
September	21.7	45.3	-23.6	14.7	13.3	1.4
October	20.5	31.3	-10.8	9.4	7.9	1.5
November	11.8	27.7	-15.9	7.1	2.4	4.7
December	14.8	23.7	-8.9	0.3	0.2	0.1
AVERAGE	X	X	X	9.25	7.37	1.88
AMOUNT	695.2	525.7	169.5	X	X	

Source: Meteorological Station in Targu Secuiesc

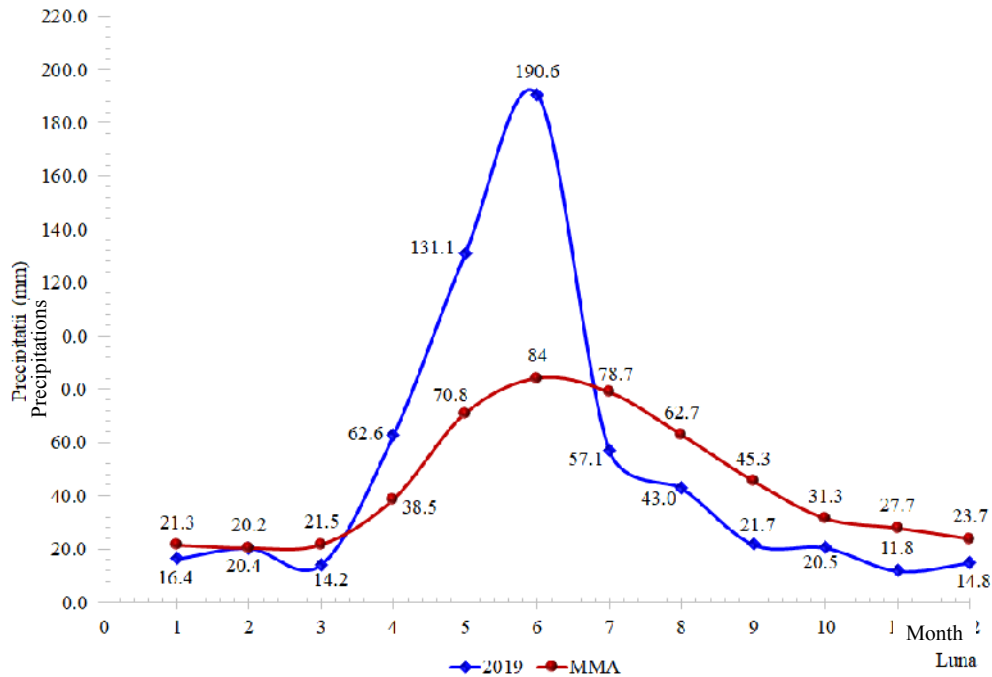


Fig. 1: Variation of atmospheric precipitations in 2019 against the normal one registered at the Meteorological Station in Târgu Secuiesc

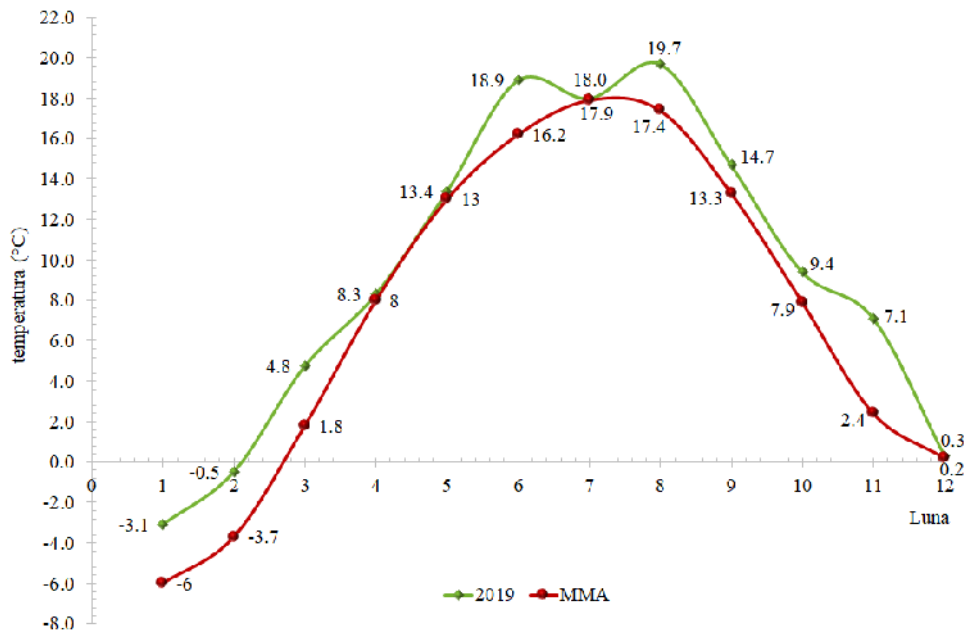


Fig. 2: Air temperature variation in the experimental year 2019 against the normal temperature registered at Meteorological Station Târgu Secuiesc

Regarding the influence of fertilization variant on the production of *Gared* variety it is noticed that the highest total average production was registered at variant V₄ with 57.62 t / ha, difference of $d = +7.38$ t / ha up against the variant 1 (witness point) being distinctively significant and statistically insured, followed by the productions from Variants V₂ and V₃ with 54.49 t / ha respectively 53.89 t / ha, the

differences from the witness point variant being significant (Table 2).

Regarding the production structure at *Gared* variety in 2019, the highest quantity of tubers > 55 mm (20.94 t / ha) and the lowest quantity of tubers < 35 mm (3.15 t / ha) was registered within the variant V₃ (Table 2, Fig. 3).

Table 2

The influence of fertilization variant on the total average production for Gared variety

GARED	Caliber > 55 mm		Caliber 35 – 55 mm		Caliber < 35 mm		Total	
	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha
V ₁	2.57	16.64±0.85	9.94	28.05±1.89	5.32	5.55±0.28	17.8	50.24±2.30
V ₂	3.56	18.68±0.61	11.39	29.55±2.65	6.11	6.26±0.29	21.1	54.49*±1.92
V ₃	3.05	20.94*±1.14	14.01	29.80±2.11	7.11	3.15±1.89	24.2	53.89*±0.95
V ₄	2.90	20.57*±1.21	14.36	30.33±0.97	6.56	6.72±0.76	23.8	57.62***±1.53
LSD 5%=		1.43		1.78		1.18		2.24
LSD 1%=		2.11		2.63		1.75		3.31
LSD 0,1%=		2.38		2.97		1.97		3.74

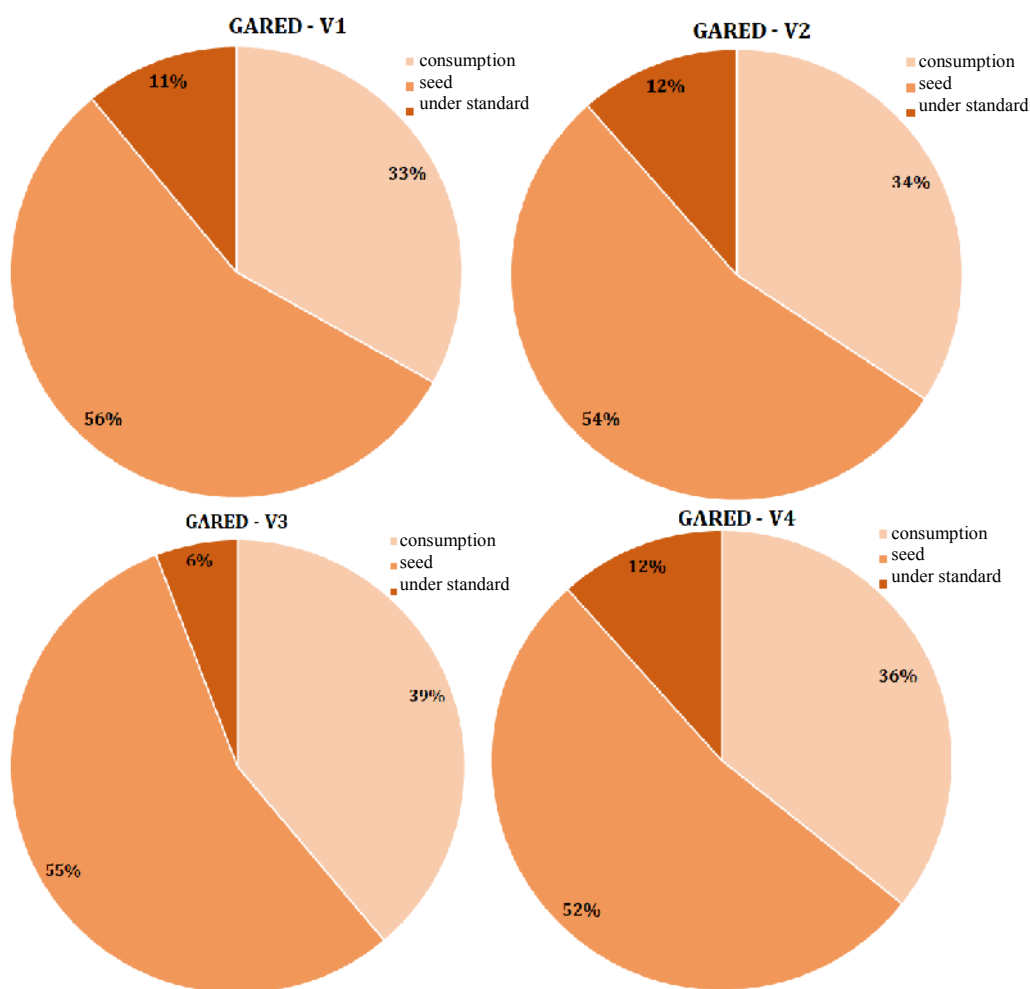


Fig. 3: Average production structure for Gared variety in 2019

Regarding the influence of fertilization variant on the production for Redsec variety it is noticed that the highest total average production was registered at the variant V₄ with 61.92 t / ha, difference of d = +10.29 t / ha in comparison with variant 1 (witness point), being very significant and statistically insured, followed by the productions from variants V₃ and V₂ cu 60.52 t / ha respectively 59.04 t / ha, the differences from the witness point variant being distinctively significant (d

= +8.89 t / ha) respectively significant (d = +7.41 t / ha) (Table 3, Fig. 4).

Regarding the production structure for Redsec variety in 2019, the highest quantity of tubers > 55 mm (24,14 t / ha) was registered for variants V₃ (24.14 t / ha) and V₂ (21.67 t / ha). The lowest production of tubers of the caliber 35 – 55 mm was registered at variant 3 with 11.42 t / ha, the highest production being registered at variant 4 with 14.30 t / ha.

Table 3

The influence of fertilization variant on the total average production for Redsec variety

REDSEC	Caliber > 55 mm		Caliber 35 – 55 mm		Caliber < 35 mm		Total	
	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha
V ₁	2,24	9,48±1,52	13,19	35,08±5,94	8,01	6,49±0,70	23,45	51,63±4,91
V ₂	3,44	21,67±5,12	13,75	31,50±2,55	6,51	5,85±0,59	23,7	59,04*±2,40
V ₃	3,12	24,14*±0,57	11,42	30,52±2,13	5,43	6,54±0,85	20,0	60,52**±2,47
V ₄	3,77	20,87±4,54	14,30	34,51±2,13	6,33	6,59±0,33	24,4	61,92***±2,11
LSD 5%=		5,13		3,67		0,82		3,81
LSD 1%=		7,56		5,41		1,21		5,62
LSD 0,1%=		8,54		6,11		1,36		6,34

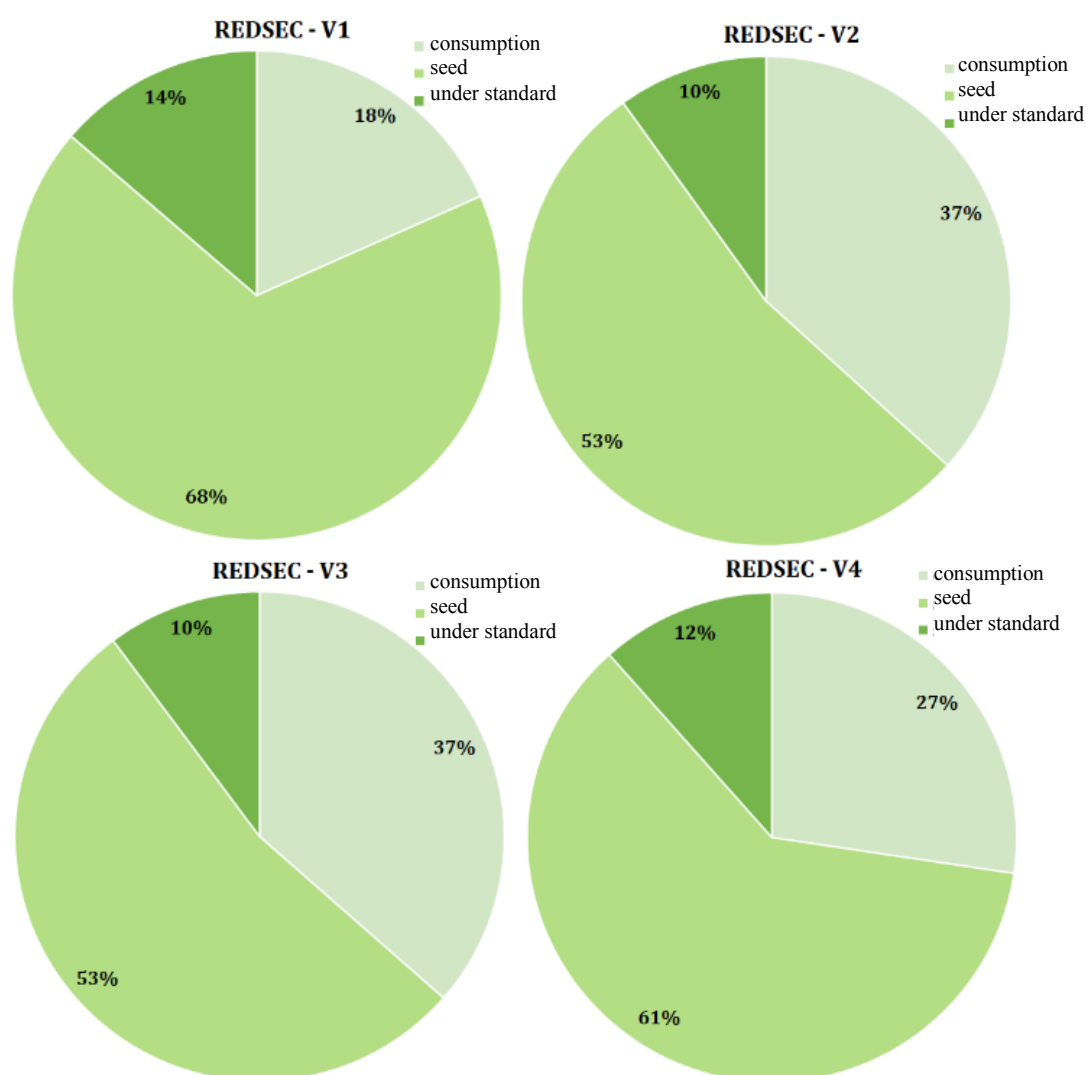


Fig. 4: Production structure for Redsec variety in 2019

Regarding the influence of fertilization variant on the production for *Albioana* variety it is noticed that the highest total average production was registered for variant V₄ with 56.62 t / ha, difference of d = +6.86 t / ha in comparison to variant 1 (witness point) being distinctively significant and statistically insured, followed by the productions from variant V₃ cu 55.00 t

/ ha, the difference from the variant witness point being distinctively significant (d = +5.24 t / ha) (Table 4, Fig. 5).

Regarding the production structure for *Albioana* variety in 2019, the highest quantity of tubers > 55 mm was registered within the variants V₄ (26.86 t / ha) and V₃ (25.65 t / ha).

Table 4

The influence of fertilization variant on the total average production for Albioana variety

ALBIOANA	Caliber > 55 mm		Caliber 35 – 55 mm		Caliber < 35 mm		Total	
	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha	No. of tubers /nest	t / ha
V ₁	2,48	17,01±2,17	9,58	27,43±0,57	5,21	4,68±0,29	17,3	49,76±2,81
V ₂	2,71	24,46±2,52	9,96	23,48±0,21	5,55	5,00±0,14	18,2	53,32±2,40
V ₃	3,28	25,65*±1,23	9,28	24,36±0,21	5,29	5,65±0,20	17,9	55,00***±0,86
V ₄	3,23	26,86*±0,89	8,25	24,11±0,61	4,49	5,08±0,13	16,0	56,62***±0,79
	LSD 5% =	2,91	1,53		0,32	2,51		
	LSD 1% =	4,29	2,25		0,47	3,71		
	LSD 0,1% =	4,85	2,54		0,53	4,18		

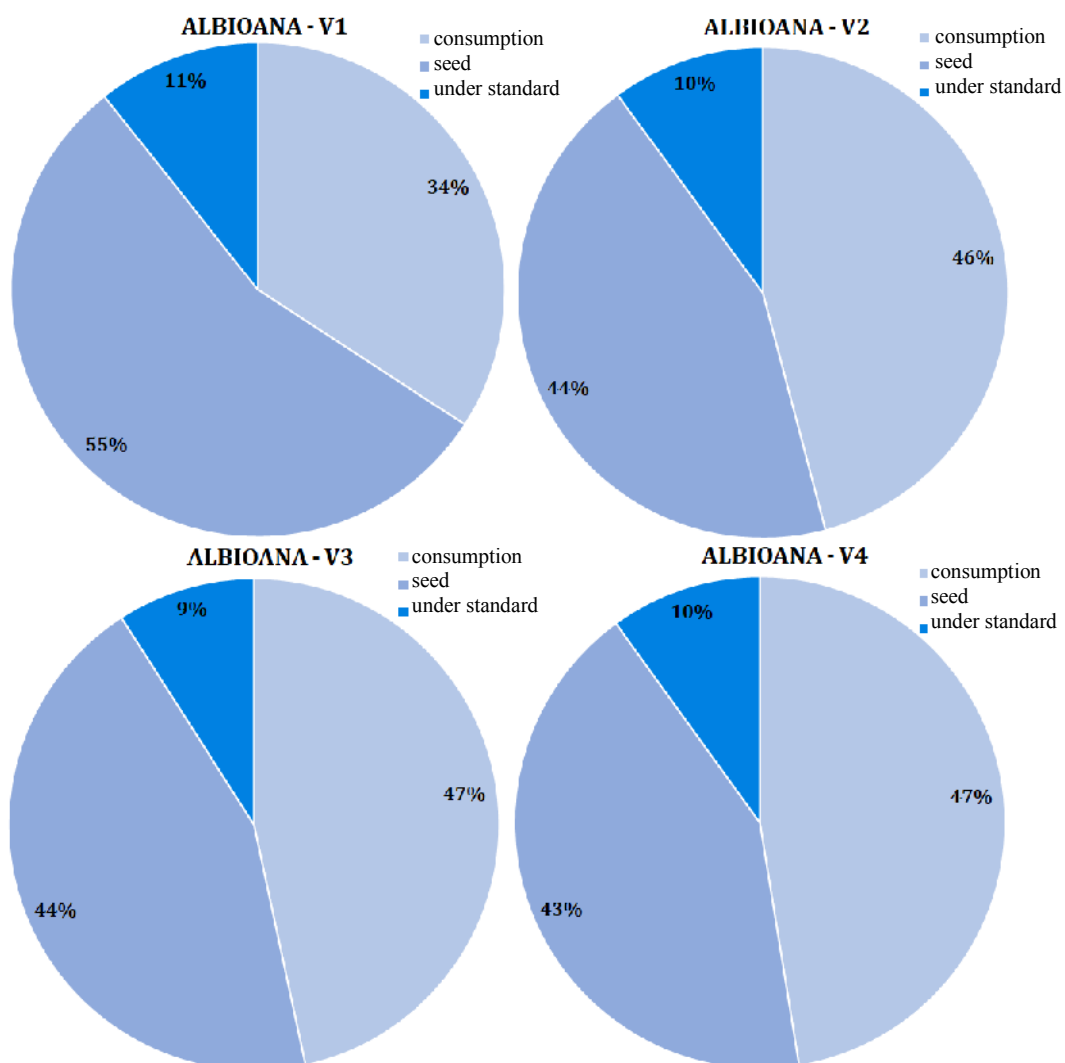


Fig. 5: Production structure for *Albioana* variety in 2019



Fig. 6: Views from the experimental field – Fertilization optimization through the improvement of chemical fertilizer in 2019

Conclusions

- Through the geographical position, space isolation and altitude (578 m) and the cool and wet climate conditions, the micro-area Targu Secuiesc fulfills all the necessary conditions for a very favorable area for growing and reproduction of potato for seeds;
- The uniform distribution of the thermic degrees in the vegetation period in the micro-areas taken into consideration for study are within the potato requirements from planting to ripening phase,
- The amount of annual precipitations fallen and the distribution of precipitations in the vegetation period of 380 mm, insure the optimal necessary for a good development of plants;
- The precipitation deficit in the months July and August 2019 and daily temperatures above the multiannual average have contributed to a limitation of production of potato varieties Gared, Redsec and Albioana;
- *Redsec* variety reacted the best of all to the increase of fertilizer doses with an increment of 10.29 t/ha for V_4 in comparison to V_1 followed by *Gared* variety with an increment of 7.38 t/h.

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