YIELD COMPARATIVE STUDY OF SOME LOCAL POPULATIONS OF RUNNER BEAN (*PHASEOLUS COCCINEUS* L.)

STUDIUL COMPARATIV AL PRODUCȚIEI UNOR POPULAȚII LOCALE DE FASOLE MARE (*PHASEOLUS COCCINEUS* L.)

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Abstract. *Ten local populations of runner bean were studied in the environmental conditions from Iassy county. The local populations showed a large variability regarding vigurosity, flower colour, size, shape and colour of grains. The highest yields were obtained by the local populations Coccineus 5 (3946 kg/ha), Coccineus 2 (2809 kg/ha) and Coccineus 9 (2608 kg/ha).*

Rezumat. *Zece populații locale de fasole mare au fost studiate în condițiile de cadru natural din zona județului Iași. Populațiile locale au prezentat o mare variabilitate în ceea ce privește vigoarea plantelor, culoarea florilor, dimensiunea, forma şi culoarea semințelor. Cele mai ridicate producții s-au înregistrat la populațiile Coccineus 5 (3946 kg/ha), Coccineus 2 (2809 kg/ha) şi Coccineus 9 (2608 kg/ha).*

Runner bean (*Phaseolus coccineus* L.) is a species well known in our country, but on areas relatively small, being met especially into population gardens from rural area. The plant is grown especially for its dried or green beans. The forms cultivated for pods are less known.

The species is original from South America, being brought at the same time with common bean (*Phaseolus vulgaris* L.), without making a net distinction between those two species. In Europe it is known since 17^{th} – 18^{th} century and in our country since 18^{th} – 19^{th} century (Stan and colab. 2003). In Romania are known exclusively climbing forms.

Runner bean found favourable conditions for growing and this fact was demonstrated by its large currency in all country areas, because of its alimentary and ornamental utilities. Despite of all these aspects, the species did not imposed as a species with an economical importance, probably because of the following factors: low attractiveness for climbing forms of bean, less suitable for mechanization, the lack of an ameliorated assortment (being cultivated only local populations), variable yields from one year to another (depending on meteorological conditions), the lack of a modern or/and standard growing technology and others.

The lack of systematized (scientific) knowledge about biology and ecology of the species in the specific conditions from our country was also an element that had a contribution to the reduced "progress" of this species.

Previous studies (Munteanu, 2006; Popa and colab. 2006; Munteanu and colab. 2007; Popa and colab. 2007) underlined the large diversity of the existent populations in the collection of University of Agricultural Sciences and Veterinary Medicine Iasi from different perspectives: morphological, physiological and agro productive. The yield is considered to be a determining factor for the promotion of a new cultivar. Therefore, our research aimed to evaluate production capacity of some valuable local populations.

In order to accomplish the proposed aim, some objectives have been settled: (1) – general characterization of studied populations and (2) – comparative evaluation of dried beans production for these populations.

MATERIAL AND METHOD

Table 1

Meteorological data from experimental period (Iaşi, 2005-2007)

Month/decade	Average temperature (°C)				Rain (mm)			
	2005	2006	2007	aver.	2005	2006	2007	aver.
IV/I	9,4	10,2	9,9	9,83	0,0	10,6	4,0	4,86
IV/II	12,9	10,5	10,0	11,13	10,6	41,2	16,6	22,8
IV/III	9,6	13,6	13,0	12,06	98,6	1,2	9,0	36,26
Average for April	10,7	11,4	11,0	11,03	109,2	53,0	29,6	63,93
V/I	14,0	12,6	13,6	13,40	99,6	12,2	4,0	38,60
V/II	14,9	17,2	20,3	17,46	19,2	7,2	4,2	10,20
V/III	20,5	17,9	24,5	20,96	12,0	43,2	25,2	26,80
Average for May	16,6	16,0	19,6	17,40	130,8	62,6	33,4	75,60
VI/I	16,8	15,9	22,7	18,46	51,0	64,4	1,2	38,86
VI/II	19,9	19,0	23,8	20,90	23,4	14,6	8,0	15,33
VI/III	20,2	24,1	22,8	22,36	22,2	3,4	12,8	12,80
Average for June	19,0	19,7	23,1	20,60	96,6	82,4	22,0	67,00
VII/I	20,4	21,2	23,9	21,83	84,6	16,2	7,0	35,93
VII/II	21,3	20,1	25,4	22,26	20,0	71,2	32,6	41,26
VII/III	24,5	23,2	26,3	24,66	10,6	11,4	5,4	9,13
Average for July	22,2	21,6	25,2	23,00	115,8	98,8	45,0	86,53
VIII/I	22,2	22,0	20,7	21,63	27,4	12,6	73,0	37,66
VIII/II	20,1	23,1	23,7	22,30	42,4	29,4	4,0	25,26
VIII/III	21,1	18,7	23,4	21,06	12,0	45,8	35,6	31,13
Average for August	21,0	21,2	22,6	21,60	81,8	88,0	112,6	94,13
IX/I	18,6	17,3	17,0	17,63	0,0	12,6	50,2	20,93
IX/II	17,5	16,4	15,1	16,33	7,6	0,0	37,6	15,06
IX/III	16,0	16,6	15,8	16,13	0,2	2,6	0,0	0,93
Average for Sept.	17,4	16,8	16,0	16,73	7,8	15,2	87,8	36,93
X/I	14,6	16,9	13,9	15,13	0,0	7,6	7,9	5,16
X/II	8,8	9,2	9,4	9,13	25,6	7,8	3,4	12,26
X/III	8,8	11,3	8,9	9,66	1,4	9,2	36,4	15,66
Average for Oct.	10,7	12,4	10,7	11,26	27,0	24,6	15,9	11,02
Average TOTAL	16,8	17,01	18,3	17,37	81,28	60,65	49,47	62,16

The research was accomplished in the experimental field of Faculty of Horticulture during 2005-2007. The experiences were settled on an average leached chernozem (cambic) with an average supply of nutritive elements, 3,8% organic matter and an pH of 5,8. Meteorological conditions (average temperature and rains) during the vegetation period are presented in the table 1.

Experimental variants consisted in 10 local populations (table 2) considered "perspective" species from the productivity point of view (based on the evaluation made in the collection).

Table 2

Experimental variants

Variant		Source (citycounty)	Reference data Flowers and seeds colour
No.	**Specification**		
1.	Coccineus 1	Great Britain	White flowers, white seeds
2.	Coccineus 2	Great Britain	White flowers, white seeds
3.	Coccineus 3	Galaţi	White flowers, white seeds
4.	Coccineus 4	Bacău	White flowers, white seeds
5.	Coccineus 5	Vaslui	White flowers, white seeds
6.	Coccineus 9	Bacău	White flowers, white seeds
7.	Coccineus 10	Iaşi	White flowers, white seeds
8.	Coccineus 12	Botoşani	Red flowers with white wings, beige seeds with brown drawing
9.	Coccineus 16	Suceava	Red flowers, lilac seeds with black drawing
10.	Coccineus 17	Iaşi	Red flowers, lilac seeds with black drawing

The experience was settled in a experimental plot of randomized blocks with three repetitions and the size of each variant from repetition being of 8 m^2 (1,60 m x 5,00 m). The crop was made by direct sowing during 3rd –10th of May depending on meteorological conditions of experimental years. The sowing was accomplished in nests, each of them with three seeds at 50 cm, on equidistant rows at 80 cm, resulting a density of 25 000 nests (75 000 plants)/ha. In each plot – variant from the repetition were placed 20 nests (60 plants).

The plants were tied with synthetic strings as in figure 1 (after Munteanu and colab. 1989) on an individual trellis for every row.

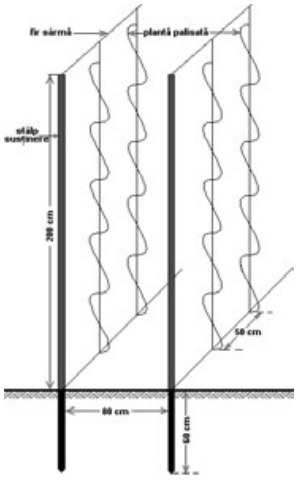

Fig.1. – Possibility of tiding the plants of runner bean

During fertilization period were applied common care operations: 3-4 annual hoeing, phase fertilization with almost 300 kg of complex chemical fertilizers (NPK), drip irrigation once a week, treatments to control bean's ladybug (three times at two weeks during blooming period).

During vegetation period some observations and biometric determinations were accomplished regarding the main morphological, physiological and yields characteristics. Experimental data regarding the yield were statistically worked by using analysis of variance and yield differences were appreciated by using differences – limit based on Student (t) test (Săulescu and Săulescu, 1967).

RESULTS AND DISCUSSIONS

General, morphological and physiological characterization of the studied assortment is presented in Table 3.

Table 3

Morpho-physiological characterization of the assortment from comparative crop (Average data, 2005-2007)

Variant	Morphological characters								Physiological characters (days no.)				
	No. of ramifications	Leaves colour	Vigour	Flower colour	Pod size (L/l) (cm)	No. of seeds in pod	Seed size (mm)	Seed colour	Sowing - rising	Rising-first leaf with three lobes	Rising-First flowers	Rising-first pods	Rising-the end of vegetation
C_1	3-4	dark green	big	white	20/1,7	5-7	22	white	7-10	7	35	71	120-125
C_2	4-7	dark green	big	white	17/1,9	4-6	20	white	7-10	8	35	66	120-125
C_3	3-4	green	big	white	10/1,9	2-3	17	white	7-10	3	34	74	120-125
C_4	3-4	green	big	white	10/1,8	2-3	17	white	7-10	3	34	74	120-125
C_5	2-3	dark green	big	white	10/1,9	2-3	19	white	7-10	3	35	73	120-125
C_9	2-3	green	average	white	10/1,8	2-3	18	white	7-10	4	35	70	120-125
C_{10}	2-3	green	average	white	9/1,7	2-3	20	white	7-10	4	33	70	120-125
C_{12}	2-3	dark green	average	red with white wings	11/2,3	3-4	19	beige with brown drawing	7-10	6	32	71	120-125
C_{16}	3-5	dark green	big	red	10/1,9	2-3	17	lilac+ black	7-10	6	34	71	120-125
C_{17}	3-5	dark green	big	red	12/1,6	3-4	17	lilac+ black	7-10	4	33	71	120-125

In accordance with data presented above, it can be noticed a variation of morphological characters into those 10 populations taken for this study. Comparatively, physiological characters presented a relatively restrained

variability; this aspect could be determined of high temperatures which made uniform the behaviour of the populations.

Referring to the dried seeds/beans production; this is presented for each experimental year and as an average for all three years of research.

Table 4

Synthesis data regarding seeds yield

Variant		Dried beans quantity (kg/ha)			
No.	**Specification**	**2005**	**2006**	**2007**	**Media**
1.	Coccineus 1	2712	2010	2164	2295
2.	Coccineus 2	2809	2237	2108	2385
3.	Coccineus 3	1733	1548	916	1399
4.	Coccineus 4	1507	1445	1369	1440
5.	Coccineus 5	2946	2701	2239	2629
6.	Coccineus 9	2608	2380	1755	2248
7.	Coccineus 10	2348	2160	1852	2120
8.	Coccineus 12	1460	1401	1493	1451
9.	Coccineus 16	1506	1395	1313	1405
10.	Coccineus 17	2576	2407	2449	2477
Experience average $\bar{x}$		2221	1968	1766	1985

According to table 4, total yield of dried beans varied in large limits, being of 2946 – 916 kg/ha during those three experimental years with an average of experience of 1985 kg/ha.

The yield obtained in 2005 is presented in table 5.

Table 5

Dried beans yield in 2005

Variant		Yield		Differences face to $\bar{x}$	Differences significance
No.	**Specification**	**Kg/ha**	**% face to $\bar{x}$**		
5.	Coccineus 5	2946	132	+725	Xxx
2.	Coccineus 2	2809	126	+588	Xxx
1.	Coccineus 1	2712	122	+431	Xx
6.	Coccineus 9	2608	117	+387	X
10.	Coccineus 17	2576	115	+355	X
7.	Coccineus 10	2348	105	+127	–
Experience average $\bar{x}$		2221	100	0	
3.	Coccineus 3	1733	78	-488	00
4.	Coccineus 4	1507	67	-714	000
9.	Coccineus 16	1506	67	-715	000
8.	Coccineus 12	1460	65	-761	000

DL 5% = 270 kg/ha
DL 1% = 409 kg/ha
DL 0,1% = 587 kg/ha

As it can be noticed in table above, the highest yield registered in the case of Coccineus 5 population (2946 kg/ha) with a very significant positive difference toward the experience average (2221 kg/ha). In the same time, the lowest value registered at Coccineus C_{12} (1460 kg/ha), with very significant negative differences

face to the experience average. Growth face to average also registered at C_2, C_1, C_9, C_{17}, C_{10} populations, while inferior yields being obtained in the case of C_3, C_4, C_{16} and C_{12} populations. The yield obtained in 2006 is presented in table 6.

Table 6

Dried beans yield in 2006

Variant		Production		Differences face to $\bar{x}$	Differences significance
No.	Specification	Kg/ha	% face to $\bar{x}$		
5.	Coccineus 5	2701	137	+733	xxx
10.	Coccineus 17	2407	122	+439	xx
6.	Coccineus 9	2380	121	+412	xx
2.	Coccineus 2	2237	114	+269	x
7.	Coccineus 10	2160	110	+192	–
1.	Coccineus 1	2010	102	+42	–
Experience average $\bar{x}$		1968	100	0	
3.	Coccineus 3	1548	79	-420	00
4.	Coccineus 4	1445	73	-523	00
8.	Coccineus 12	1401	71	-567	00
9.	Coccineus 16	1395	71	-573	00

DL 5% = 248 kg/ha
DL 1% = 377 kg/ha
DL 0,1% = 638 kg/ha

In 2006 the dried beans yield varied between large enough limits into the assortment. The biggest yield was obtained at Coccineus 5 population (2701 kg/ha) and the smallest was obtained at Coccineus 16 population while the experimental average was of 1968 kg/ha. Positive differences face to average were accomplished by Coccineus 17, Coccineus 9, Coccineus 2, Coccineus 10, Coccineus 1 populations while negative differences were noticed at Coccineus 3, Coccineus 4, Coccineus 12 and Coccineus 16 populations.

The yield obtained in the experimental year 2007 is presented in table 7.

Table 7

Dried beans yield in 2007

Variant		Yield		Differences face to $\bar{x}$	Differences significance
No.	Specification	Kg/ha	% face to $\bar{x}$		
10.	Coccineus 17	2449	139	+683	xxx
5.	Coccineus 5	2239	127	+473	xxx
1.	Coccineus 1	2164	123	+398	xx
2.	Coccineus 2	2108	119	+342	xx
7.	Coccineus 10	1852	105	+86	–
Experience average $\bar{x}$		1766	100	0	
6.	Coccineus 9	1755	99	-11	–
8.	Coccineus 12	1493	85	-273	00
4.	Coccineus 4	1369	78	-397	00
9.	Coccineus 16	1313	74	-453	000
3.	Coccineus 3	916	52	-850	000

DL 5% = 178 kg/ha
DL 1% = 267 kg/ha
DL 0,1% = 431 kg/ha

Comparing with previous year, in 2007 the dried beans yield was more reduced. On average, its value was of 1766 kg/ha. The yield varied from 2449 kg/ha (Coccineus 17) to 916 kg/ha (Coccineus 3). As it can be noticed, Coccineus 17 population accomplished a yield superior to average with a significant difference. The results also demonstrate negative differences than average for Coccineus 3, Coccineus 4, Coccineus 9, Coccineus 12 and Coccineus 16 population.

The average yield accomplished during 2005-2007 is presented in table 8.

Table 8

Dried beans yield during 2005–2007

Variant		Yield		Differences face to $\overline{x}$	Differences significance
No.	Specification	Kg/ha	% face to $\overline{x}$		
5.	Coccineus 5	2629	132	+644	xxx
10.	Coccineus 17	2477	125	+492	xx
2.	Coccineus 2	2385	120	+400	xx
1.	Coccineus 1	2295	116	+310	x
6.	Coccineus 9	2248	113	+263	x
7.	Coccineus 10	2120	107	+135	–
Experience average $\overline{x}$		1985	100	0	
8.	Coccineus 12	1451	73	-534	000
4.	Coccineus 4	1440	72,5	-545	000
9.	Coccineus 16	1405	71	-580	000
3.	Coccineus 3	1399	70	-586	000

DL 5% = 254 kg/ha
DL 1% = 386 kg/ha
DL 0,1% = 521 kg/ha

After three experimental years, the highest average yield was registered at Coccineus 5 (2629kg/ha) population, in the conditions of an experimental average of 1985 kg/ha. With one exception (from 2007) the Coccineus 5 population had the best results in the assortment taken for study. This population accomplished (during the experimental period) yields very significant from a statistic perspective.

CONCLUSIONS

1. Meteorological conditions from experimental period were average favourable to runner bean crop; the exception was registered in 2007 that presented a major risk factor: the drought from atmosphere.

2. The dried beans yield (over all three experimental years) varied in large limits (between 2946 – 916 kg/ha) into the assortment taken for study.

3. For both 2005 and 2006, as for all years taken as average, the highest yield was accomplished at Coccineus 5 local population with an multiannual average of 2629 kg/ha. Coccineus 5 obtained in all yield years results that framed

between 2239 – 2946 kg/ha with significant positive differences than experimental average.

4. Comparing with Coccineus 5 population, during experimental period Coccineus 1, Coccineus 2, Coccineus 9, Coccineus10 and Coccineus 17 populations assured yields with positive differences than average while Coccineus 3, Coccineus 4, Coccineus 12 and Coccineus 16 populations registered yields with negative differences than average.

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