THE STUDY OF SELECTED ELITES WITH THE PURPOSE OF PROMOTING NEW ALMOND TREE BREEDS

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Abstract

After studying more than 4000 hybrids for four years of fruit bearing, 55 elites were selected, which were grafted on almond trees in 1997 and were planted in the spring of 1999 at 5/4 meters. The development of the trees was studied between 1999 and 2008, as well as the main phenophases of the fruit bearing organs, fruit formations per linear meter of stem, natural pollination, fruit and kernel production and the fruit's physical characteristics. Three elites were certified: Nico, with 930.5 kg/ha, Cristi, with 987.2 kg/ha and Adela with 1043.8 kg/ha of kernel.

Key words: selected elites, certified breeds.

INTRODUCTION

The ideal cultivar (M. Ştefan et al., 1972) should be "of little or medium vigor, with a thin crown and solid stems, well garnished with short fruit formations; it should start bearing fruit early on and ensure large and constant productions, lively colored and uniform fruit, having the taste and the technological characteristics demanded by the standards of free markets and the food industry.

The problems concerning the cultivar conveyor in almond trees has been, is and will remain of great importance for cultivator countries.

The study of the selected elites for the fruit-growing region in the north-western part of our country represents a main preoccupation (Şcheau et al., 1997; Şcheau et al., 2007).

MATERIAL AND METHODS

Following the study of over 4000 hybrids on their own roots for four years of fruit bearing (years IV-VII since plantation), 55 elites were selected, which were grafted on almond trees in August 1997 and were planted in the spring of 1999 at 5/4 m, with five trees per variant, placed linearly.

The observed elements during the study period were: the surface of the trunk section in order to establish the growth rate of the selected elites; the main phenophases of the fruit bearing organs (blooming and maturity at harvesting); fruit formations per linear meter of stem; natural pollination on samples of 300-500 flowers; production of fruit and kernels; physical indices of the fruit, that is: size index, weight index, breaking output index and double kernel index.

The average data for the studied period was processed by using the variance analysis method.

RESULTS AND DISCUSSION

Table 1 presents the vigor of the selected elites rendered through the surface of the trunk section at a distance of 20 cm from the stump in the Xth year since cultivation.

The following elites are very vigorous, being positively ensured statistically as very significant: H16/1974/84, H16/1838/84, H31/1179/82, H16/1718/84, H24/719/82, H16/1610/84, H16/1939/84, H16/1979/84, H16/1992/84, H19/916/81, H1/2012/84, H4/1451/8 and H4/1465/82.

When it comes to relative values, the yields decrease from 79.5% for H16/1974/84 to 24.5% for H4/1451/82 compared to the Primorski reference lot.

The elites H6/1816/84, H9/1464/82, H24/811/81, H5/786/81, H15/2224/84 and H5/785/81 are of upper medium vigor and positively ensured statistically as distinctly significant.

The following elites are statistically ensured as significant, therefore are of average vigor: H23/950/81, H23/2003/84, H16/1617/84 and H8/930/81.

The subsequent ones are of reduced vigor: H31/1175/82, H31/1426/81, H23/2104/84, which are negatively significant statistically; H16/2253/84, H8/1365/82 and H24/794/81, which are distinctly significant; whereas H6/2253/84, H23/2113/84 and H46/1008/82 which are very significant.

Table 1

The development of elites based on surface of trunk section in yea IX since plantation

Nr. Crt.	Elite	Surface of trunk section		+d	Significance
		Absolute (cm²) %	Relative		
1	H16/1974/84	359.8	179.5	+159,3	***
2	H16/1838/84	290,8	145,0	+90,3	***
3	H31/1179/82	289,4	144,3	+88,9	***
4	H16/1718/84	288,4	143,8	+87,9	***
5	H24/719/82	282,3	140,8	+81,8	***
6	H16/1610/84	277,0	138,2	+76,5	***
7	H16/1939/84	274,0	136,7	+73,5	***
8	H16/1979/84	264,2	131,8	+63,7	***
9	H16/1992/84	261,9	130,6	+61,4	***
10	H19/916/81	252,7	126,0	+52,2	***
11	H1/2012/84	250,5	124,9	+50,0	***
12	H4/1451/82	250,4	124,9	+49,9	***
13	H4/1465/82	249,6	124,5	+49,1	***
14	H16/1816/84	245,6	122,5	+45,1	**
15	H9/1464/82	239,5	119,4	+39,0	**
16	H24/811/81	239,4	119,4	+38,9	**
17	H5/786/81	237,9	118,7	+37,4	**
18	H15/2224/84	236,3	117,9	+35,8	**
19	H5/785/81	236,0	117,7	+35,5	**
20	H23/950/81	234,0	116,9	+33,9	*
21	H23/2003/84	232,5	116,0	+32,0	*
22	H16/1617/84	228,7	114,1	+28,2	*
23	H8/930/81	227,9	113,7	+27,4	*
24	H23/1508/82	225,2	112,3	+24,7	
25	H16/1606/84	223,7	111,6	+23,2	
26	H46/985/82	223,4	111,4	+22,9	
27	H16/1828/84	218,6	109,0	+18,1	
28	H3/1421/81	216,4	107,9	+15,9	
29	H31/1178/82	216,1	107,9	+15,6	
30	H14/851/81	212,3	105,9	+11,8	
31	H16/1744/84	207,6	103,5	+7,1	
32	H19/912/81	201,7	100,6	+1,5	
33	PRIMORSKI (Mt)	200,5	100,0	-	
34	H24/818/81	199,0	99,3	-1,5	
35	H16/1919/84	198,0	98,8	-2,5	
36	H1/2006/84	197,7	98,6	-2,8	

37	H16/1730/84	194,0	96,8	-6,5	
38	H30/1125/82	193,7	96,6	-6,8	
39	H31/1223/82	191,1	95,3	-8,8	
40	H1/2025/84	190,2	94,9	-10,3	
41	H23/1501/82	189,7	94,6	-10,8	
42	H12/2148/84	187,2	93,4	-13,3	
43	H8/951/81	185,4	92,5	-15,1	
44	H8/1358/82	183,4	91,5	-17,1	
45	H46/953/82	181,9	90,7	-18,6	
46	H23/2076/84	176,2	87,9	-24,3	
47	H16/1698/84	174,8	87,2	-25,7	
48	H31/1175/82	173,4	86,5	-27,1	o
49	H31/1426/81	172,0	85,8	-28,5	o
50	H23/2104/84	171,7	85,6	-28,8	o
51	H16/1986/84	160,2	79,8	-40,3	oo
52	H8/1365/82	157,0	78,3	-43,5	oo
53	H24/794/81	155,8	77,7	-44,7	oo
54	H6/2253/84	147,3	73,5	-53,2	ooo
55	H23/2113/84	131,9	65,8	-68,6	ooo
56	H46/1008/82	121,5	60,6	-79,0	ooo

*DL 5% = 26.1 1% = 34.8 0.1% = 45.3

Table 2 presents the main phenophases of the fruit bearing organs, respectively the beginning, middle and end of blossoming, the beginning and end of the harvesting maturity period, types of fructiferous formations per linear meter of stem as well as natural pollination.

The beginning of blossoming takes place in 05.03 for H1/2006/84 and H16/1979/84 and ends in 04.04 for H19/916/81 and H15/2224/84, taking place at intervals of 13-20 days.

The following elites have "spur" fructifications, in May blossoms of over 80%: H19/916/81, H14/851/81 and H4/1451/82.

The vast majority of the selected elites recorded values of natural pollination ranging between 15% and 25%, with a minimum of 6.4% for H46/1008/82 and a maximum of 37.8% for H31/1426/81.

Most of the selected elites also have an average maturity at harvesting, starting from 15.08 until 30.08 with limits like 12.08 for H19/912/81 until 06.09 for H1/2025/84.

Table 3

The main phenophases of fructification, fructiferous formations and natural pollination of selected almond elites

Nr. Crt.	Elite	Blossoming			Fruit formations per linear m of stem			Natural pollination %	Maturity at harvesting	
		Start	Middle	End	Blossom	Cluster	Middle branch		Start	End
1	H23/1508/82	09.03	18.03	26.03	72,7	18,1	9,2	14,0	15.08	26.08
2	H31/1178/82	07.03	16.03	22.03	75,0	18,7	6,3	16,7	20.08	30.08
3	H16/1698/84	10.03	19.03	27.03	63,6	27,3	9,1	31,7	18.08	29.08
4	H4/1465/82	12.03	21.03	30.03	36,2	58,5	5,3	10,4	18.08	30.08
5	H19/912/81	14.03	20.03	27.03	54,5	36,3	9,2	17,4	12.08	24.08
6	H9/1464/82	06.03	14.03	21.03	47,1	11,8	41,1	10,5	20.08	02.09
7	H1/2006/84	05.03	13.03	20.03	65,0	25,1	9,9	28,7	18.08	30.08
8	H16/1744/84	08.03	17.03	26.03	62,5	25,0	12,5	25,9	14.08	26.08
9	H3/1421/81	11.03	21.03	31.03	58,3	25,0	16,7	23,1	20.08	02.09
10	H8/951/81	12.03	20.03	29.03	50,0	35,7	14,3	20,5	20.08	01.09
11	H19/916/81	18.03	27.03	04.04	80,1	17,2	2,7	23,2	16.08	28.09
12	H31/1426/81	10.03	18.03	28.03	62,5	25,0	12,5	37,8	19.08	31.09
13	H30/1125/82	13.03	22.03	31.03	50,0	37,5	12,5	12,5	15.08	28.09

14	H16/1828/84	14.03	23.03	01.04	71,2	24,6	4,2	36,1	14.08	26.08
15	H16/1730/84	11.03	21.03	30.03	59,1	36,3	4,6	15,3	13.08	25.08
16	H16/1816/84	10.03	18.03	29.03	61,5	20,0	18,5	14,6	14.08	28.08
17	H31/1179/82	09.03	18.03	27.03	47,8	19,7	32,5	18,2	17.08	29.08
18	H16/1610/84	15.03	23.03	02.04	50,0	35,7	14,3	14,5	21.08	02.09
19	H16/1617/84	11.03	20.03	29.03	60,5	29,4	10,1	8,3	15.08	27.08
20	H14/851/81	13.03	20.03	28.03	86,2	8,7	5,1	28,8	18.08	31.08
21	H16/1606/84	14.03	23.03	02.04	30,8	61,5	7,7	17,6	16.08	28.08
22	H31/1175/82	17.03	25.03	03.04	61,5	30,8	7,7	10,0	18.08	31.08
23	H1/2012/84	10.03	18.03	26.03	41,7	50,0	8,3	31,4	18.08	30.08
24	H8/1358/82	06.03	14.03	23.03	20,0	66,7	13,3	31,8	15.08	28.08
25	H4/1451/82	07.03	15.03	24.03	87,5	6,3	6,2	32,4	13.08	26.08
26	H5/786/81	13.03	20.03	28.03	61,2	18,5	20,3	14,9	16.08	29.08
27	H23/950/81	11.03	19.03	28.03	33,3	55,5	11,2	12,3	16.08	28.08
28	H46/953/82	12.03	21.03	30.03	50,0	33,3	16,7	10,1	18.08	30.08
29	H8/930/81	15.03	24.03	03.04	23,5	70,6	5,9	9,5	13.08	25.08
30	H8/1365/82	09.03	18.03	27.03	52,2	34,8	13,0	8,6	16.08	28.08
31	H5/785/81	10.03	18.03	26.03	44,4	50,0	5,6	10,3	18.08	30.08
32	H46/1008/82	09.03	17.03	28.03	47,1	41,2	11,7	6,4	20.08	02.09
33	H46/985/82	10.03	18.03	25.03	75,0	20,0	5,0	19,4	16.08	28.08
34	H16/1919/84	08.03	16.03	25.03	61,5	30,8	7,7	29,3	22.08	03.09
35	H16/1986/84	11.03	19.03	28.03	35,7	57,1	7,2	6,8	18.08	30.08
36	H16/1838/84	12.03	20.03	27.03	60,9	30,4	8,7	12,4	18.08	29.08
37	H46/1008/82	13.03	22.03	02.04	58,1	30,2	11,7	12,1	24.08	05.09
38	H24/719/82	09.03	18.03	26.03	51,1	36,8	12,1	33,7	16.08	28.08
39	H16/1816/84	14.03	23.03	03.04	57,1	28,6	14,3	31,5	19.08	31.08
40	H23/1501/82	13.03	21.03	30.03	54,1	27,2	18,7	15,8	18.03	30.08
41	H16/1979/84	05.03	14.04	22.03	61,1	22,8	16,1	22,9	20.08	02.09
42	H16/1992/84	08.03	16.03	25.03	35,7	57,1	7,2	9,8	20.08	02.09
43	H1/2025/84	12.03	20.03	27.03	55,1	40,3	4,6	27,6	25.08	06.09
44	H16/1939/84	11.03	20.03	29.03	42,8	50,2	7,0	14,1	14.08	26.08
45	H6/2253/84	08.03	17.03	27.03	47,8	44,1	8,1	18,5	17.08	30.08
46	H16/1718/84	09.03	17.03	26.03	52,2	36,1	11,7	12,3	18.08	31.08
47	H6/1974/84	10.03	19.03	29.03	55,2	31,6	13,2	12,7	16.08	27.08
48	H23/2003/84	13.03	22.03	31.03	51,1	29,3	19,6	10,2	18.08	29.08
49	H24/811/81	09.03	18.03	27.03	61,1	37,2	1,7	15,7	13.08	25.08
50	H23/2076/84	11.03	19.03	28.03	54,1	29,9	16,0	27,5	18.08	31.08
51	H24/794/81	15.03	24.03	02.04	18,3	66,5	15,2	29,4	16.08	29.08
52	H15/2224/84	17.03	23.03	04.04	41,7	51,4	6,9	20,9	15.08	28.08
53	H2/2148/84	09.03	18.03	26.03	53,3	41,1	5,6	11,9	22.08	03.09
54	H23/2113/84	10.03	18.03	27.03	44,4	33,3	22,3	6,7	18.08	30.08
55	H23/2104/84	12.03	22.03	01.04	33,3	55,5	11,2	16,2	17.08	29.08
56	Primorski	11.03	21.03	31.03	55,8	23,9	20,3	19,1	18.08	31.08

Table 3 presents the quantity of fruit and kernels per ha, in medium values, between 2002 and 2008. Large quantities of fruit exceeding 3000 kg/ha were recorded for only two elites, respectively H4/1451/82 with 3662.5kg/ha and H5/786/81 with 3014.8 kg/ha, whereas for 10 elites the production of fruit ranges between 2338.4 kg/ha for H16/1828/84 and 2794.1 kg/ha for H9/1464/82.

Given the breaking outputs ranging from 15.1% kernels for H15/2224/84 and 60.6% for H23/2076/84, the order of the elites is considerably modified. Therefore, the elites H4/1451/82, H1/2025/84, H14/815/81, H9/1464/82, H23/1501/82, H5/786/81, H16/1939/84, H16/1974/84, H5/785/81, H6/2253/84, H23/2003/84, H1/2012/84, H24/719/82, H31/1426/81 and H46/1008/82 are positively ensured statistically as very significant, while H16/1606/84 and H16/816/84 as distinctly significant.

Table 3

The production of fruit and kernels of the selected almond elites

Nr. crt.	Elite	Production (kg/ha)		Relative	+d	Significance
		Fruit	Kernel			
1	H4/1451/82	3662,5	1043,8	241,4	+611,4	***
2	H1/2025/84	2768,2	982,7	227,3	+150,3	***
3	H14/851/81	2337,9	930,5	215,2	+498,1	***
4	H9/1464/82	2794,1	899,7	208,1	+467,3	***
5	H23/1501/82	2533,6	770,2	178,1	+337,8	***
6	H5/786/81	3014,8	732,6	169,4	+300,2	***
7	H16/1939/84	2090,7	719,2	166,3	+286,8	***
8	H16/1974/84	2393,5	701,3	162,2	+268,9	***
9	H5/785/81	1094,4	699,3	161,7	+266,9	***
10	H6/2253/84	2583,9	692,5	160,2	+260,1	***
11	H23/2003/84	2433,8	691,2	159,9	+258,8	***
12	H1/2012/84	1061,8	664,7	153,7	+232,3	***
13	H24/719/82	1204,6	624,0	144,3	+191,6	***
14	H31/1426/81	1025,7	614,4	142,1	+182,0	***
15	H46/1008/82	1458,8	570,4	131,9	+138,0	***
16	H3/1421/81	1091,4	561,0	129,7	+128,6	**
17	H16/1606/84	2334,5	527,6	122,0	+95,2	**
18	H16/1816/84	1459,7	518,2	119,8	+85,8	
19	H16/1730/84	1415,1	488,2	112,9	+55,8	
20	H16/1986/84	2408,4	486,5	112,5	+54,1	
21	H8/1365/82	1415,1	456,9	105,7	+24,5	
22	H16/1919/84	1923,5	440,5	101,9	+8,1	
23	H46/985/82	1012,5	436,4	100,9	+4,0	
24	PRIMORSKI (Mt.)	1225,0	432,4	100,0	-	
25	H16/1838/84	2183,3	419,2	96,9	-13,2	
26	H16/1992/84	2098,5	409,2	94,6	-23,2	
27	H8/1358/82	739,2	408,8	94,5	-23,6	
28	H1/2006/84	826,6	407,5	94,2	-24,9	
29	H16/1828/84	2338,4	402,2	93,0	-30,2	
30	H16/1744/84	1195,6	379,0	87,6	-53,4	
31	H23/2113/84	1481,8	349,7	80,9	-82,7	o
32	H31/1175/82	1398,4	342,6	79,2	-89,8	oo
33	H4/1465/82	1328,2	338,7	78,3	-93,7	oo
34	H24/811/81	1097,0	329,1	76,1	-103,3	oo
35	H12/2148/84	1318,8	315,2	72,9	-117,2	ooo
36	H16/1698/84	666,2	315,1	72,8	-117,3	ooo
37	H31/1179/82	1152,5	303,1	70,1	-129,3	ooo
38	H31/1223/82	1203,2	298,4	69,0	-134,0	ooo
39	H30/1125/82	766,1	295,7	66,9	-136,7	ooo
40	H23/950/81	1278,4	283,8	65,6	-148,6	ooo
41	H23/2104/84	947,7	282,2	65,3	-150,2	ooo
42	H16/1718/84	1084,7	262,5	60,7	-166,9	ooo
43	H16/1617/84	1243,4	254,9	59,0	-177,5	ooo
44	H8/951/81	641,7	223,3	51,6	-209,1	ooo
45	H24/818/81	821,4	218,5	50,5	-213,9	ooo
46	H19/912/81	750,5	215,4	49,8	-217,0	ooo
47	H23/2076/84	347,9	210,8	48,8	-221,6	ooo
48	H24/794/81	617,6	206,9	47,8	-225,5	ooo
49	H15/2224/84	1352,3	204,2	47,2	-228,2	ooo
50	H19/916/81	859,7	194,3	44,9	-238,1	ooo
51	H31/1178/82	519,2	178,1	41,2	-254,3	ooo
52	H16/1610/84	487,1	166,6	38,5	-265,8	ooo
53	H23/1508/82	654,9	165,7	38,3	-266,7	ooo
54	H16/1979/84	588,3	161,2	37,8	-271,2	ooo
55	H46/953/82	665,7	147,8	34,2	-284,6	ooo
56	H8/930/81	555,3	120,5	27,9	-311,9	ooo

*DL 5% = 62.2 1% = 82.7 0.1% = 107.6

Table 4 presents the physical characteristics of the fruit produced by the selected almond elites. The size index shows values between 20.8 mm for H23/2076/84 and 31.3 mm for H31/1178/82. Most of the elites have medium to large fruit. The weight index

shows more varied values, which range from 2 kg for H16/1696/84 and H23/2076/84 to 6.1 kg for H16/1718/84. Most weight values fall into the 3-5 kg category, ranking the elites in the large fruit group. The breaking output varies from 15.1% for H15/2224/84 to 63.9% for H5/785/81.

The European norm is that the breaking output be between 30-40%, a category in which most of the selected elites fit. Having more that 10% of double kernels, a fault of almonds, only three out of the 55 selected elites recorded this aspect.

Table 4

Physical traits of the fruit produced by the selected almond elites

Nr. Crt.	Elite	Size index (mm)	Weight index (gr)	Peeling output (% of kernel)	Double kernels (%)
1	H4/1451/82	25,3	3,7	28,5	5,9
2	H1/2025/84	25,1	3,5	35,5	-
3	H14/851/81	26,2	4,4	35,5	3,2
4	H9/1464/82	26,6	2,9	32,2	-
5	H23/1501/82	24,6	4,1	30,4	-
6	H5/786/81	26,2	2,4	24,3	18,9
7	H16/1939/84	26,7	4,1	34,4	-
8	H16/1974/84	25,5	4,4	29,3	3,6
9	H5/785/81	24,4	2,1	63,9	10,8
10	H6/2253/84	27,7	5,7	26,8	-
11	H23/2003/84	26,2	4,5	28,4	-
12	H1/2012/84	27,7	2,6	62,6	-
13	H24/719/82	27,2	3,4	51,8	3,4
14	H31/1426/81	25,5	2,7	59,9	-
15	H46/1008/82	26,8	3,2	39,1	-
16	H3/1421/81	28,8	2,7	51,4	7,1
17	H16/1606/84	27,1	5,5	22,6	-
18	H16/1816/84	27,3	5,2	35,5	-
19	H16/1730/84	25,9	3,4	34,5	-
20	H16/1986/84	25,6	4,4	20,2	-
21	H8/1365/82	23,0	2,0	32,3	2,9
22	H16/1919/84	26,2	4,8	22,9	-
23	H46/985/82	26,2	2,9	41,3	4,3
24	PRIMORSKI (Mt.)	22,4	4,0	32,1	2,2
25	H16/1838/84	26,6	5,2	19,2	5,6
26	H16/1992/84	27,0	6,1	19,5	-
27	H8/1358/82	28,2	2,7	55,3	10,0
28	H1/2006/84	25,8	2,5	49,3	-
29	H16/1828/84	27,6	5,2	17,2	-
30	H16/1744/84	26,6	4,1	31,7	-
31	H23/2113/84	26,8	4,2	23,6	13,0
32	H31/1175/82	24,9	4,7	24,5	2,8
33	H4/1465/82	26,9	3,8	25,5	-
34	H24/811/81	25,6	3,8	30,0	-
35	H12/2148/84	24,1	4,4	23,9	-
36	H16/1698/84	23,0	2,0	47,3	-
37	H31/1179/82	26,2	3,8	26,3	-
38	H31/1223/82	28,0	5,5	24,8	-
39	H30/1125/82	27,9	2,5	38,6	-
40	H23/950/81	27,2	4,8	22,2	-
41	H23/2104/84	25,4	3,7	29,8	-
42	H16/1718/84	28,3	6,1	24,2	-
43	H16/1617/84	25,6	4,8	20,5	-
44	H8/951/81	25,6	4,2	34,8	-
45	H24/818/81	27,1	3,6	26,6	-
46	H19/912/81	27,8	5,1	28,4	-
47	H23/2076/84	20,8	2,0	60,6	3,0

48	H24/794/81	25,6	3,1	33,5	4,2
49	H15/2224/84	26,6	5,4	15,1	8,3
50	H19/916/81	26,2	4,2	22,6	-
51	H31/1178/82	31,3	5,8	34,3	-
52	H16/1610/84	28,8	4,5	34,2	8,6
53	H23/1508/82	27,8	5,4	25,3	-
54	H16/1979/84	25,5	3,5	27,4	-
55	H46/953/82	26,6	4,9	22,2	-
56	H8/930/81	28,5	5,0	21,7	-

CONCLUSIONS

Following the tests performed at the State Institute for the Testing of Breeds (Institutul de Stat pentru Testarea şi încercarea soiurilor) – Bucharest during the 2007-2008 period, some elites were certified and included in the Official Catalogue of Romanian crop plant breeds in 2009, these elites being: H14/851/81, under the name Nico, having a production of 2337.9 kg/ha of fruit and 930.5 kg/ha of kernels; H4/1451/82, with the name Adela, having a production of 3662.5 kg/ha of fruit and 1043.8 kg/ha of kernel; H1/2025/84 with the name Cristi, having a production of 2768.2 kg/ha of fruit and 982.7 kg/ha of kernel.

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