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CULTIVAR RELEASE

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IAC OL 3 and IAC OL 4: new Brazilian peanut cultivars with the high oleic trait

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Abstract – *IAC OL 3 and IAC OL 4 peanut cultivars are new releases of Instituto Agronômico (IAC), Campinas, SP. These cultivars were developed to attend the demand of the Brazilian peanut business for high oleic runner cultivars, whose cycle can be better adjusted to the areas of sugarcane renewal than other runner cultivars.*

Key words: Arachis hypogaea *L., high oleic cultivars.*

INTRODUCTION

Brazil presently produces 336 thousand ton of unshelled peanuts (CONAB 2013). Around 80% of the product comes from cropping areas of São Paulo, where the peanut is cultivated in rotation with sugarcane. This production is mostly used for human consumption (confectionery industry), 60% is destined to the Brazilian market and 25% is exported.

In São Paulo, the crop is totally mechanized and, in this case, the predominant demand is for high yielding cultivars of runner growth habit. In areas of sugarcane renewall, the cycle of these cultivars should not exceed 130 days, which imposes limitations to the use of runner-type cultivars whose cycle are longer.

The high oleic characteristic is atractive to the present international peanut business and is now becoming a demand from the Brazilian confectionery industry. The trait was discovered in the United States, as a natural and stable mutation (Norden et al. 1987), and has been incorporated in cultivars. Its main advantage is substantially extending the product´s shelf life (Mozingo et al. 2004).

IAC 503 and IAC 505 were the first high oleic runner cultivars released in Brazil (Godoy et al. 2009). However, due to their long cycle duration, planting of those cultivars was limited in the sugarcane rotation system. To overcome this limitation, IAC has released IAC OL 3 and IAC OL 4 cultivars, which associate good yield performance within a shorter cropping time, and desirable technological traits.

Breeding method

IAC OL 3 and IAC OL4 are sister lines from the F_6 generation of a cross between the breeding line IAC 886-46 and the accession 2562 of the IAC germplasm collection. Line 886-46 was selected from the original population of Runner IAC 886 cultivar, and accession 2562was the source of the high oleic trait. The F_2 population was planted in the field, and 500 individual plants were selected for reproductive traits (pods and kernels). After harvesting, a seed sample of each plant ($F_{2:3}$ seeds) was taken to the laboratory and analyzed for fatty acid profile by gas cromatography. From these analyses, 120 high oleic (homozigous recessive) progenies were identified.

The F_3 generation was planted in the field in the following year for another cycle of individual plant selection for agronomic traits, and the same procedure was repeated in F_4 and F_5 generations. In F_6, 120 families were planted and harvested at 100 days, which provided an anticipated harvesting condition to identify and select plants that exhibited pod/kernel maturity at this time. Around 1,000 plants were individually selected (between and within families), and the

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pods were taken to the laboratory. Each sample was unshelled, and the percentage of visually mature seeds (kernels) was determined. From this evaluation, 90 $F_{6:7}$ progenies were selected and considered as breeding lines to be evaluated in field experiments, in following years, for kernel maturity and size, and yield performance with anticipated (less than 130 days) harvesting. From these experiments, two lines were selected and were indicated to be registered as new cultivars, IAC OL 3 and IAC OL 4.

Agronomic performance and technological quality

IAC OL 3 and IAC OL 4were evaluated and compared with three known cultivars in eight experiments in which harvesting was carried out at different dates, before 130 days (Table 1). IAC OL 3 yield ranged from 3240 to 5823 kg ha^{-1}, whereas IAC OL 4 yield ranged from 3408 to 6800 kgha^{-1}, along the experiments. IAC OL 3 out yielded IAC 503 and IAC 505, both high oleic and with a long cycle, as well as IAC 886, the traditional 130-day cycle (not high oleic) cultivar.

The percentage of mature kernels was determined and compared to IAC 503 (long cycle) and IAC 886 (Table 2) cultivars. The percentages of maturity in IAC OL 3 and IAC OL 4 varied from 60.6 to 87.3, and from 56.1 to 86.6%, respectively, along the experiments. In IAC 886, the percentages varied from 53.1 to 84.9%, and in IAC 503,from 39.5 to 80.5%. These data confirm that the new cultivars are well fit to the need of anticipated harvesting, especially in dates close, but inferior to 130 days, which satisfies the majority of the conditions along the peanut regions in the state of São Paulo.

Despite the relative proximity in field behavior (yield and maturity) between them, IAC OL 3 and IAC OL 4 were both chosen to be released due to their diference in kernel size. This trait is important to the peanut industry and determines the preference for the product according to the

Table 1. Yield of runner cultivars in eight experiments with anticipated harvesting

Experiment[1]	DAS[2]	Cultivars				
		IAC OL 3	IAC OL 4	IAC 503	IAC 505	IAC 886
Pind 7/8	115	5856	6150	_	4093	5238
Pind 8/9	109	4047	4057	_	_	3991
Pind 9/10	115	5222	5143	4966	4527	4613
Pind 10/11	128	5823	6800	3730	4627	5766
RP 9/10	119	3240	3408	3029	3676	3256
RP 10/11	126	4106	4108	5280	4425	4900
Vot 9/10	112	4953	5239	4292	5487	5695
Vot 10/11	128	5193	5992	4845	5448	4815
Means (cultivars)		4805	5112	4357	4612	4784

[1] Experiments (locations and cropping seasons): Pindorama - 2007/08 to 2010/11, Ribeirão Preto – 2009/10 and 2010/11, Votuporanga – 2009/10 and 2010/11. [2] DAS: harvesting dates, in days after sowing

Table 2. Percentage of mature kernels of IAC OL 3 and IAC OL 4 and two control cultivars in eight experiments with anticipated harvesting

Experiment[1]	DAS[2]	Cultivars			
		IAC OL 3	IAC OL 4	IAC 503	IAC 886
Pind 7/8	115	81.0	78.0	_	72.1
Pind 8/9	109	67.0	62.7	_	54.3
Pind 9/10	115	75.0	74.6	75.7	77.2
Pind 10/11	128	86.6	86.6	66.0	84.9
RP 9/10	119	60.6	56.1	62.5	53.1
RP 10/11	126	87.3	84.5	76.9	81.8
Vot 9/10	112	62.8	68.7	39.5	62.8
Vot 10/11	128	82.4	85.4	80.5	80.8
Means (cultivars)		75.3	74.6	66.8	70.8

[1,2] See codes in Table 1

market to which it is destined. Cultivars with larger kernels may be interesting to some confectionery purposes, while medium-sized kernels may be suitable to other products.

The new cultivars and two controls were characterized for weight of 200 kernels (Table 3). In seven experiments, the mean kernel weight of IAC OL 3 was similar to that of large-seeded cultivar IAC 503, while IAC OL 4 presented weight similar to the known IAC 886 cultivar, whose kernel size is desirable in the international market.

Kernel size distribution of the new cultivars was characterized and compared with the IAC 886 cultivar using small laboratory screens of seed size classification (Table 4). Size distribution of IAC OL 4 was close to the standard IAC 886. Confirming the difference between the two new cultivars, IAC OL 3 produces more than 20% of extra-large kernels, offering a product that can be atractive for a large size peanut market. On the other hand, IAC OL 4 fits better the size distribution aiming exportation standards (medium-size runner peanuts).

The oil variables of IAC OL 3 and IAC OL 4 cultivars, as compared to two known IAC cultivars, are shown in Table 5. Oil content of the new cultivars is close to that obtained for the runner-type cultivars IAC 503 and IAC 886. The high oleic condition (around 80%) is also confirmed, as opposed to IAC 886, whose oleic acid content is a little above 50%. The high oleic and low linoleic condition yields O/L ratios over 20/1, while in non-high oleic, such as IAC 886,

Table 3. Mean weight of 200 kernels of IAC OL 3 and IAC OL 4 and two control cultivars in seven experiments with anticipated harvesting

Experiment[1]	DAS[2]	Cultivars			
		IAC OL 3	IAC OL 4	IAC 503	IAC 886
Pind 7/8	115	135.0	129.2	_	119.7
Pind 8/9	109	136.7	133.1	_	137.9
Pind 9/10	115	126.0	117.9	131.3	127.1
Pind 10/11	128	136.2	120.0	139.2	131.7
RP 9/10	119	129.5	118.7	123.4	121.2
RP 10/11	126	141.9	134.4	151.8	137.9
Vot 9/10	112	113.5	107.2	111.2	121.6
Means (cultivars)		131.3	122.9	131.4	128.2

[1,2] See codes in Table 1

Table 4. Kernel size distribution[1] of cultivars IAC OL 3 and IAC OL 4 compared to the standard IAC 886 cultivar, using screens for seed size classification

Cultivar	Screens							
	16	18	20	22	24	26	28	30
	%							
IAC OL 3	1.2	3.3	9.9	16.0	21.8	27.6	15.4	4.8
IAC OL 4	2.4	5.4	12.8	18.2	28.0	22.6	8.6	2.0
IAC 886	2.2	5.8	10.7	15.7	28.4	21.4	12.8	3.0

[1] Means of two samples

Table 5. Oil and fatty acid contents[1] in kernels of IAC OL 3, IAC OL 4 and two control cultivars

Variable (%)	Cultivars			
	IAC OL 3	IAC OL 4	IAC 503	IAC 886
Oil	46.6	47.5	48.7	47.3
Oleic acid (O)	81.8	81.6	79.8	53.1
Linoleic (L)	2.9	3.4	3.0	27.9
O/L ratio	28.2/1	24.0/1	26.6/1	1.9/1
Saturated	12.9	12.2	13.4	17.6
Unsaturated	87.1	86.8	86.6	82.4

[1] Means of two samples

this ratio stays around 2/1. Both new cultivars also show an additional advantage over the non-high oleic genotypes by having 4-5% more unsaturated fatty acids.

Seed production

IAC OL 3 was registered in RNC (Ministry of Agriculture, Brazil) in 2012; IAC OL 4 was registered in 2013. IAC is the creator and maintainer of the cultivars, and produces the genetic seeds.

REFERENCES

CONAB - Companhia Nacional de Abastecimento (2013) Acompanhamento da safra brasileira – grãos, Julho/2013. Available at <www.conab.gov.br>. Accessed in July 2013.

Godoy IJ, Carvalho CL, Martins ALM, Bolonhezi D, Freitas RS, Kasai FS, Ticelli M, Santos JF, Oliveira EJ and Morais LK (2009) IAC 503 e IAC 505: cultivares de amendoim com a característica "alto oleico". In **Anais do 5º congresso brasileiro de melhoramento de plantas**. SBMP, Guarapari (CD-ROM).

Mozingo RW, O'Keefe SF, Sanders TH and Hendrix KW (2004) Improving shelf life of roasted and salted in shell peanuts using high oleic fatty acid chemistry. **Peanut Science 31**: 40-45.

Norden AJ, Knauft DA and Young CT (1987) Variability in oil quality among peanut genotypes in the Florida breeding program. **Peanut Science 14**: 7-11.

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