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# The influence of fresh pericarp on the kernel production in almond <sup>(1) (2)</sup>

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## ABSTRACT

The results of a study carried out in order to ascertain the incidence of the whole fresh pericarp on the commercial kernel production of twenty almond cultivars are reported.

Owing to the high incidence of the fresh hulls, paper-shell cultivars gave the same kernel outputs as most of hard-shell ones.

From the horticultural standpoint, it could be methodologically incorrect to continue involving shelling percentage in the qualitative evaluation of whatever almond cultivar, whereas the character should keep a basic importance only in almond cultivars characterization and in nut price fixation.

Before selling the crop to handlers, almond growers are concerned with harvesting, hulling and drying the nuts.

The selling price of the nuts, based upon the current prices of the kernels, is greatly affected by the shelling percentage; this is a varietal characteristic and may range, in commercial cultivars, between the 20-25 % of the nuts with very hard, thick and bony shells and the 65-70 % of the nuts with paper, thin and light shells.

It is known that the Mediterranean almond growing is based upon very hard and hard-shell cultivars, with shelling percentages from medium to low, whereas the commercial cultivars of California are soft or paper-shelled, with high shelling percentages.

Obviously, the highest is the shelling percentage,

the highest is the selling price of the nuts. This must have induced many Authors, most of Mediterranean area, to identify a high shelling percentage with a high quality of the nuts and a high productivity of the cultivar<sup>(1, 4, 5, 11, 13, 14)</sup>, thus including high shelling percentage among the objectives of breeding for specific characters<sup>(3, 7, 8, 10, 12)</sup>.

In a previous study, carried out on twenty almond cultivars, it was emphasized the high incidence, in absolute and percentual values, of the hulls on fresh fruit weight, particularly in the paper-shell cultivars, such as to compensate the lightness of the shells<sup>(6)</sup>. Moving from those results, it was decided to examine the influence of the whole fresh pericarp on the production of commercial kernels, i.e. with 5 % water, of the same twenty cultivars.

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(2) Progetto finalizzato MAF «Sviluppo e miglioramento della frutticoltura da industria, della frutticoltura precoce e dell'agrumicoltura». Pubblicazione N. 58.

Table 1

Results<sup>(1)</sup>

Cultivar	Shelling <sup>(2)</sup> %	Fresh fruit g	Nut <sup>(3)</sup> g	Kernel <sup>(4)</sup> g	Doubles %	Shelling %	Kernel to Fresh fruit %
CATUCCIA	(39.2)	13.86 h	4.62 f	1.78 ce	58.5	38.5 d	12.8 a
MINCONE	(28.3)	9.96 i	4.41 f	1.27 i	29.0	28.8 hl	12.7 a
SCORZA VERDE	(36.5)	13.96 h	4.94 f	1.76 ce	55.0	35.6 de	12.6 a
FERRANTE	(35.4)	17.41 g	6.39 cd	2.18 a	63.3	34.1 ef	12.5 a
FILIPPO CEO	(37.1)	12.96 h	4.60 f	1.44 fi	23.3	31.3 fi	11.1 a
FRANCISCUDDA	(30.2)	12.49 h	4.69 f	1.29 hi	28.5	27.5 l	10.3 bc
ZIN ZIN	(30.7)	18.02 fg	6.20 cd	1.76 ce	35.0	28.4 il	9.8 bd
RACHELE GRANDE	(30.5)	22.35 cd	7.29 b	2.13 ab	36.5	29.2 hl	9.5 be
MONTRONE	(24.8)	18.86 eg	7.59 b	1.76 ce	11.7	23.2 m	9.3 be
GENCO	(34.1)	17.30 g	5.25 ef	1.59 dh	3.3	30.3 gl	9.2 be
TUONO	(39.2)	18.26 fg	5.09 e	1.68 df	18.3	33.0 eg	9.2 be
TEXAS	(48.4)	18.05 fg	3.60 g	1.65 dg	26.5	45.8 c	9.1 be
CRISTOMORTO	(29.8)	23.17 bc	8.65 a	2.06 ac	16.7	23.8 m	8.9 be
FALSA BARESE	(35.0)	17.42 g	4.70 f	1.50 ei	0.0	31.9 fh	8.6 cf
NONPAREIL	(69.1)	21.20 ce	2.85 g	1.77 ce	3.3	62.0 a	8.3 cf
NE PLUS ULTRA	(59.9)	20.20 df	2.97 g	1.65 dg	15.0	55.5 b	8.2 cf
CINQUANTA VIGNALI	(24.4)	17.22 g	5.91 de	1.36 gi	0.0	23.0 m	7.9 df
TRIANELLA	(28.7)	22.36 cd	6.38 cd	1.76 ce	16.7	27.6 l	7.9 df
FRAGIULIO PICCOLA	(30.5)	25.38 b	6.90 bc	1.87 bd	13.5	27.1 l	7.4 ef
JORDANOLO	(64.4)	29.62 a	3.60 g	2.05 ac	1.6	57.0 b	6.9 f
MEAN	(37.8)	18.50	5.33	1.72	22.8	34.7	9.6

(1) For each character, the values accompanied by the same letters, single or between the couples, are not significant (P=0.01).

(2) At full maturity.

(3) Air dried.

(4) Air dried, with 5 % water.

## MATERIAL AND METHODS

The investigation was carried out in 1982, in an experimental dry-farmed orchard near Bari. The trees were 13-years-old and grafted on sweet almond.

Besides four well known Californian cultivars ('Jordanolo', 'Ne Plus Ultra', 'Nonpareil' and 'Texas') sixteen additional Apulian cultivars were considered, whose shells ranged from very hard to hard, shelling percentage from medium to low and doubles percentages from very high to very low.

As in the previous study, the fruits were chosen at random only among those between the «J» and the «K» stages<sup>(5)</sup>, i.e. with a barely visible suture line, no wider than 1-2 mm.

Three samples of 50 fruits each were prepared for each cultivar and the fresh weight was calculated. After hulling and drying, it was determined the shelling percentage of the nuts. Lastly, the weight of the dried kernels was related to the weight of the whole fresh fruit. For each cultivar, it was reported also the shelling percentage of fully ripe nuts of the same trees.

The experimental data were worked out statistically and referred to single fruit.

## RESULTS AND DISCUSSION

Table 1 shows that all the considered characters varied significantly among the cultivars.

The fresh weight of the fruit averaged 18.50 g, ranging between a maximum of 29.69 g ('Jordanolo') and a minimum of 9.96 g ('Mincone'); the weight of dried nuts averaged 5.33 g, ranging between a maximum of 8.65 g. ('Cristomorto') and a minimum of 2.85 g ('Nonpareil'); the weight of dried kernels averaged 1.72 g, ranging between a maximum of 2.18 ('Ferrante') and a minimum of 1.27 g ('Mincone'). Doubles averaged 22.8 %, ranging between a maximum of 63.3 % ('Ferrante') and a minimum of 0.0 % ('Cinquanta vignalì' and 'Falsa barese'), thus affecting the total weight of the kernel of some cultivars<sup>(2)</sup>.

Shelling percentage (average 34.7 %) ranged from a maximum of 62.0 % ('Nonpareil') to a minimum of 23.0 % ('Cinquanta vignalì'), and the paper-shell cultivars showed obviously the highest values.

Shelling percentage of the fruits harvested between the «J» and the «K» stages resulted lower than that of the fruits harvested at fully maturity. Such differences are probably to be attributed to the early harvesting of fruits, in that the dry-weight accumulation continues during ripening process until the abscission zone is fully formed<sup>(9)</sup>. However, early harvesting did not change substantially neither the range of the cultivars nor the gap between the extreme values.

It is worth pointing out the ranging overturn of the cultivars when the kernel percentage was referred to the weight of the fresh fruit rather than to that of the dried nut. In this case, the significantly highest values were not reached by the paper-shell cultivars, but by some of the hard-shell ones, with shelling percentages notoriously from medium to low. In other words, paper-shell cultivars were placed at medium-low level in the cultivars range because of the heaviness of their hulls<sup>(6)</sup>. After, all, no significant differences were found in the percentages of kernel to fresh fruit between Californian paper-shell cultivars and most of Apulian hard-shell cultivars.

Moving from the data concerning the percentage of kernel referred to the weight of the fresh fruit, it was calculated the yield of fresh fruits per hectare and per tree required by each cultivar for a crop of one ton of kernels per hectare. Table 2 shows that the yield of fresh fruits appeared to be directly related to the fresh fruit total weight, confirming the high incidence of the useless hull in the paper-shell cultivars, but also that of the shell in some very hard-shell cultivars.

It was confirmed the influence of the whole fresh pericarp on the production of the stated crop of kernels and, therefore, the different fruitful effort of the cultivars; however, for bearing the same crop of kernel per hectare, the cultivars with very thin and light shell but also with very heavy hulls and some of the cultivars with very hard shell appeared to have to bear more tons per hectare and kilograms per tree of fresh fruits than other cultivars.

## CONCLUSIONS

Immediately after harvesting, almond nuts are separated from the hulls; therefore, there is a common trend to ignore the outer part of the pericarp and its incidence and to consider the almond fruits as consisting only of the shell and the kernel.

The overturn of behaviour of the cultivars when kernel percentage was determined on the whole fresh fruit confirmed the determinant role of the hulls and emphasized the higher fruitful effort of the cultivars qualified for the high shelling percentage to give a stated crop of kernels.

However, it will be avoided falling into mistake asserting that some hard-shell cultivars, such as 'Catuccia', 'Mincone', etc., with poor quality kernels (i.e. high doubles, small size and irregular shape) are to be preferred only because of their higher percentages of kernels to whole fresh fruit.

It is known that numerous are the horticultural traits involved in almond fruits evaluation: yet, the results of the present investigation allow us to suggest that the shelling percentage should be no more considered

as a synonym of quality of the nuts and of productivity of whatever almond cultivar, but should keep a

basic importance only for almond cultivars characterization and for nuts selling price fixation.

*Table 2*

*Fresh fruits per hectare and per tree required for a yield of one ton per hectare of commercial Kernel.*

Cultivar	Yield	
	Tons/Hectare	Kg/Tree <sup>(1)</sup>
JORDANOLO	14.4 a	51.8
FRAGIULIO PICCOLA	13.6 ab	48.9
CINQUANTA VIGNALI	12.7 bc	45.7
TRIANELLA	12.7 bc	45.7
NE PLUS ULTRA	12.2 bd	43.9
NONPAREIL	12.0 cd	43.2
FALSA BARESE	11.6 ce	41.7
CRISTOMORTO	11.2 cf	40.3
TEXAS	10.9 df	39.2
GENCO	10.9 df	39.2
TUONO	10.9 df	39.2
MONTRONE	10.7 df	38.5
RACHELE GRANDE	10.5 eg	37.8
ZIN ZIN	10.2 eg	36.7
FRANCISCUDDA	9.7 fg	34.9
FILIPPO CEO	9.0 fh	32.4
FERRANTE	8.0 h	28.8
SCORZA VERDE	7.9 h	28.4
MINCONE	7.8 h	28.1
CATUCCIA	7.7 h	27.7
MEAN	10.7	38.6

(1) Spacing 6 m x 6 m (278 tree/hectare)

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