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## Survey on the patrimony of almond variety in Sardinia

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### ABSTRACT

The results of a survey on almond sardinian patrimony variety aimed to preserve the ancient local population are reported. Among forty-six almond cultivars of local origin or imported a long time ago, twenty seven were described during the research. Of each variety, flowering time and the most important characteristics of fruit, flower and leaves were recorded.

### RESUME

#### ETUDE SUR LE PATRIMOINE VARIETAL DE L'AMANDIER EN SARDAIGNE

Cet article concerne les résultats d'une étude effectuée sur le patrimoine des variétés d'amandes sardes entreprise dans le but de préserver la population ancienne. Parmi les quarante-six cultivars d'amandiers d'origine locale ou importée il y a longtemps, vingt-sept variétés ont été décrites. Pour chaque variété on a pu déterminer les caractères principaux des fruits, des fleurs et des feuilles ainsi que l'époque de floraison.

### INTRODUCTION

The present trend in almond culture is to reduce the number of cultivars and to substitute the old varieties with new ones that correspond to the most recent demands. On the one hand this is necessary because of the widespread presence of old rundown and neglected orchards; on the other it leads to genetic erosion for the abandonment of numerous «individuals» of both indigenous and of ancient import, both part of the local population. The great genetic variability reached as a result of natural evolution could however produce a necessary base for other improvement of the existing cultivars and for research of new forms enriched in prized characters more appropriate to the changing agronomical and commercial exigences.

However the aim remains the safeguard of ancient local population in which a great range of genetic characters constitutes an important security factor. The Institute of Mediterranean Arboriculture is doing research aimed to protect and collect lines of fruit trees, particularly almond trees, within the national group «Defence of genetic resources of trees». The research involved the almond patrimony of Sardinia, where almonds are traditionally cultivated and rich in special characteristics due to an unusual heterogenic population.

The current state of crisis that concerns the entire country and the gradual tendency to abandonment of almond cultivation has lead, even in Sardinia, to an important production decrease, which is very visible in the province of Cagliari, traditionally one of the most

apt almond areas (fig. 1). Various studies (1, 4, 5, 6, 7) intent on studying and classifying the local gamut of varieties have lead to a very good understanding of the principal problems that affect this field and furnish sufficient data for its review. This notwithstanding a more profound study of the local genetic patrimony is necessary given its mixed configuration. It is not unusual that individuals belonging to the same cultivar be indicated by other names; homonymy is also common.

## MATERIALS AND METHODS

The study was done in successive phases though an examination of specific bibliography in order to compile a complete list of almond cultivars in Sardinia. This list was then verified and completed by means of on the spot checks in the most important cultivation areas. In this way samples were taken and there was direct observation of flowering time. Successively the morphological and qualitative characteristics of the many varieties were defined. The following parameters, were taken into consideration: weight, volume and shape of nut, marking of outer shell and softness, size, weight, volume, shape, texture of kernel, double kernel, empty fruit, kernel yield. The data was compiled on the basis of the description list proposed by the sub-project «Dried fruit» of the C.N.R. and completed with the «Almond descriptor list» proposed by the G.R.E.M.P.A. At the same time photographs of fruit, flower and leaves were taken. In the second phase propagation material was collected with which an experimental orchard was set up. This orchard would permit the study of the genetic material collected more efficiently with particular consideration given to factor not easily found in uncertain original growth conditions.

## DISCUSSION ON RESULTS AND CONCLUSIONS

About fifty varieties either of local origin or long since imported (tab. 1) have been identified within the almond patrimony of Sardinia. These for the most named descriptively or for the person who introduced them or for the place of origin. Traditionally the selection methods are based on the needs of each grower and frequently obtained by spontaneous reproduction which explain the genetic variety. Flowering period (fig. 2) was the first element to be considered in a description of the varieties and, while waiting for more precise experimental comparison we can divide cultivars into three groups: 1) early and medium early; 2) midseason; 3) late and medium late. It has been a general tendency of growers to mix cultivars flowering in different periods in order to palliate the dangers inherent to the particular climatic conditions of Sardinia as a drastic dropping of temperature often associated to strong winds in January and February so to divide the risk of damage to production. Among the varieties identified twenty-seven were chosen for their importance from a cultivation and a commercial point of view and also

for general preference. Further the various difficulties which appeared on the spot checks on trees, almost always in areas of difficult access or abandoned cultivations, rendered the evaluation of some characters (tree productivity and characteristics, etc.) almost impossible.

In group one (tab. 2) the cultivars '*Farrau*' and the semi-soft '*Malissa Tunda*' were interesting for the shape and the dimensions of kernel. The first being of good size and elongated amigdaloid shape could be well salted, the second having round kernels could substitute hazelnuts. The kernel yield (respectively 27% and 42.9%) is also interesting, though a certain percentage of double kernels is present. Note also the varieties '*Is Stumbus*' and '*Stampasaccusu*' with kernel yield 27% and 20% and medium sized kernels of similar shape to '*Farrau*'.

Forty five percent of all the varieties flower between February and the first ten days of March (table 3), comprising the main hard shelled cultivars, except '*Casu*' which is soft and '*Fiori*' which is semi-soft. '*Fiori*' also had the highest husked yield (46.6%) and good qualities for confection. Some very well known and appreciated Sardinian varieties, such as '*Arrubia*' and '*Olla*' of certain local origin, can be found in this group and they have frequently been described and found principally in the more interior or at medium height areas. '*Arrubia*' has always had commercial value in confectionery for the excellent size and kernel shape, high yield, constant bearing, hardness. Equally prized is '*Olla*' though it has lesser constancy in bearing, but also a lower percentage of double kernels. '*Arrubia di Spagna*' was noted for its large kernel size though in other respects it is practically analogous to '*Arrubia*'. As regards the other cultivars in this group '*Ibba*' gave 32% kernel yield, '*Lutzeddu*' 26%, '*Provvista*' 25.6%, '*Pala*' 24% but all showed a large number of double kernels; on the contrary the cultivars '*Piras*' and '*Pitichedda*' has no double kernels but lower husked yield.

Finally among the late or medium-late flowering cultivars (tab. 4) '*Cossu*' described first by Milella in 1960, should be mentioned. This cultivar has gradually become known over the years for its good yield and constant bearing. The kernel is of good size and shape for confection. All the cultivars in this group are hard shelled except '*Ciatta Malissa*' which is soft. Other characters such as an acceptable kernel yield (26.4%) and good kernel size make this cultivar worth consideration. The other cultivars spread due to the favorable climatic conditions in flowering period and that can have scientific interest in that their tardivity could be transferred to other varieties though they produce at the moment fruits of inferior size and kernel yield (average 21.5%) and some double kernels.

In conclusion our aim has been to preserve and subse-

quently to increase the value of ancient genetic patrimony of almonds, rich in valuable characters which constitute a wide genetic found to be saved. This must be done to stop the neglect of many improvable varieties which are being supplanted by imported cultivars or by other species though recently consumers are taking interest in local products. The indiscriminate destruction of trees by cutting or fire also endangers the available population. Some documented varieties have not been found, while others till now unmentioned have been discovered. It is probable that there has been some confusion in identification due to uncertain-

ty in naming, which will be clarified by further research.

Among all the cultivars identified some have praiseworthy agronomical or commercial qualities; in particular 'Arrubia' and 'Olla' midseason flowering, 'Cossu' and 'Ciatta Malissa' late flowering, seemed most valuable. Apart from the above mentioned cultivars, better known and already appreciated, there are also others having scientific interest for reaserch on genetic improvement, in that their genetic lines could be bettered or transferred by crossing.

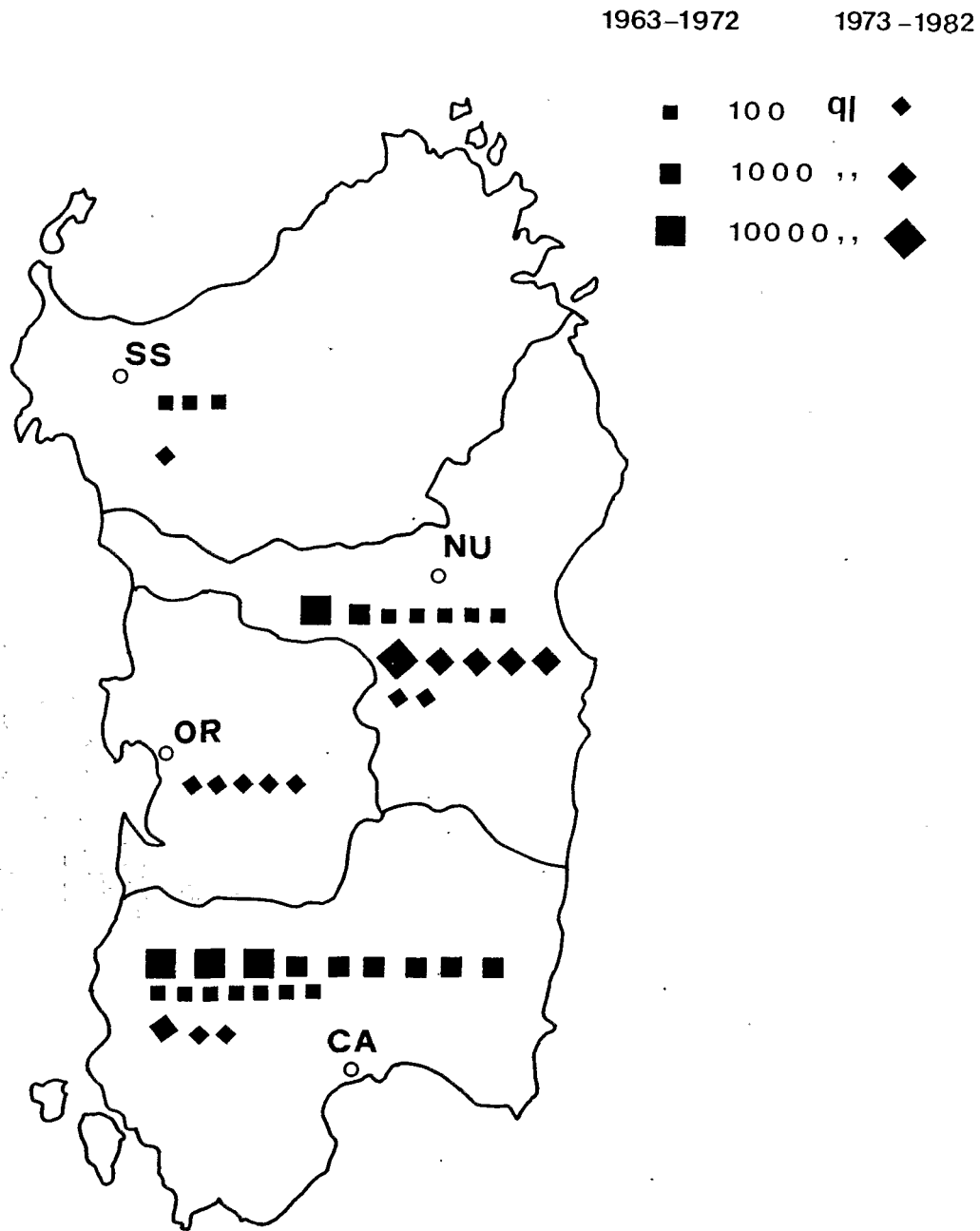


Figure 1. Total almond production expressed in cwt. Average of the ten year periods 1963-72 and 1973-82. (The data for the province of Oristano is limited to the period 1973-82, as previously it was included in the provinces of Cagliari and Nouro).

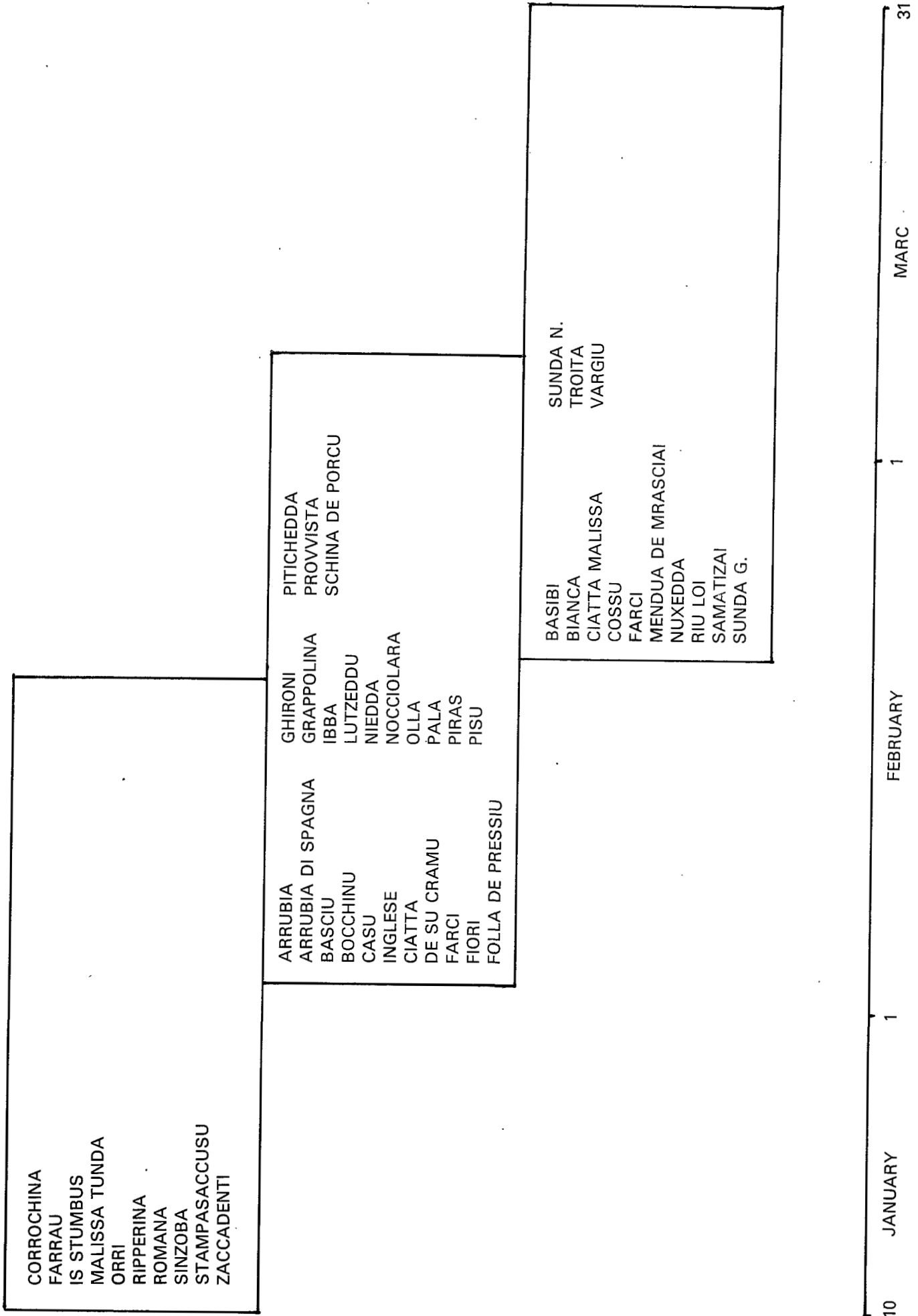


Figure 2. Illustration of flowering period

Table 1

List of almond cultivars identified during the research.

Cultivars	Origin	Varieties Collected	Bibliographic Reference
ARRUBIA	LOCAL	I.A.M.-C.R.A.S.	1, 2, 3, 4, 5, 6, 7, 8
ARRUBIA DI SPAGNA	UNKNOWN		
BASCIU F.	LOCAL		
BASIBI-BASILI	LOCAL	I.A.M.	1, 4, 7
BIANCA	UNKNOWN	I.A.M.	
BOCCHINU-BOCCHINO	LOCAL	C.R.A.S.	4
CASU	LOCAL	C.R.A.S.	1, 4
CIATTA INGLESE	UNKNOWN		
CIATTA MALISSA	LOCAL		
CORROCHINA	LOCAL	I.A.M.	
COSSU	LOCAL	I.A.M.-C.R.A.S.	1, 3, 4, 6, 8
DE SU CRAMU	LOCAL		
FARCI	LOCAL	I.A.M.-C.R.A.S.	1, 4
FARRAU	LOCAL		
FIORI	LOCAL	C.R.A.S.	
FOLLA DE PRESSIU	LOCAL		1, 4, 7
FRANCESA	IMPORT	C.R.A.S.	1, 4, 7
GHIRONI	LOCAL	I.A.M.-C.R.A.S.	4
GRAPPOLINA	IMPORT	I.A.M.	2
IBBA	UNKNOWN	C.R.A.S.	1, 4
IS STUMBUS	LOCAL	C.R.A.S.	
LUTZEDDU	LOCAL	C.R.A.S.	4
MALISSA TUNDA	LOCAL		
MENDUEDDA DE MRASCIAI	LOCAL	I.A.M.	
NIEDDA	LOCAL	I.A.M.	
NOCCIOLARA-NOCELLARA	UNKNOWN		1, 4, 6, 7, 8
NUXEDDA	IMPORT	I.A.M.	
OLLA	LOCAL	I.A.M.-C.R.A.S.	1, 4, 6, 7, 8
ORRI	LOCAL		
PALA A.	LOCAL		1
PIRAS A.	LOCAL	I.A.M.	
PISU F.	LOCAL		1, 4, 7
PITICHEDDA	LOCAL		
PROVVISTA	LOCAL	C.R.A.S.	1, 2, 4, 7
RIPPERINA-RAPPARINA	SICILY		1, 4, 7
RIU LOI	LOCAL	C.R.A.S.	
ROMANA	SICILY	C.R.A.S.	2, 4, 7
SAMATZAI	LOCAL		
SCHINA DE PORCU	UNKNOWN		1, 4, 6, 7, 8
SINZOBA	LOCAL	I.A.M.	
STAMPASACCUSU	LOCAL	I.A.M.	
SUNDA G.	LOCAL	C.R.A.S.	
SUNDA N.	LOCAL	C.R.A.S.	
TROITA	IMPORT	I.A.M.-C.R.A.S.	
VARGIU	LOCAL	I.A.M.-C.R.A.S.	1, 4
ZACCADENTI	LOCAL		

*Table 2*  
*Characteristics of early and medium-early flowering varieties*

Cultivars	Nut weight g	Nut volume cc	Marking of outer shell	Nut shape	Shell softness	Kernel size			Kernel weight g	Kernel volume cc	Kernel shape		Kernel texture	Double kernel %	Empty fruit %	Kernel yield %	Flower diameter mm	Petals colour
						L mm	W mm	T mm			longit. section	cross section						
FARRAU	6,8	8,6	dens. pored.	oblong.	hard	25,8	15,4	47,9	1,9	1,6	amig. elong.	flat	slightly wrinkled	12	2	27,0	40,6	white
IS STUMBUS	4,7	5,03	moder. pored.	oblong	hard	32,5	13,9	7,7	1,4	1,4	amig.	flat	wrinkled	—	—	27,1	30,6	white
MALISSA TUNDA	3,2	2,9	dens. pored	round	semi-hard	21,0	14,7	6,9	1,3	1,5	round	round	very wrinkled	8	—	42,9	41,9	white
STAMPASACCUSU	6,2	7,3	spars. pored	ovate	hard	25,2	12,5	7,4	1,2	0,95	amig. elong	flat	wrinkled	2	—	19,8	47,9	light pink

*Table 3*  
*Characteristics of midseason flowering varieties*

Cultivars	Nut weight g	Nut volume cc	Marking of outer shell	Nut shape	Shell softness	Kernel size			Kernel weight g	Kernel volume cc	Kernel shape		Kernel texture	Double kernel %	Empty fruit %	Kernel yield %	Flower diameter mm	Petals colour
						L mm	W mm	T mm			longit. section	cross section						
ARRUBIA (Sarda)	5,7	6,6	moderately pored	oblong	hard	27,0	15,9	7,6	0,7	1,9	amigdaloid	flat	wrinkled	1	1	27,3	38,9	white
ARRUBIA DI SPAGNA	7,1	8,4	moderately pored	oblong	hard	27,8	15,9	1,7	1,7	2,2	amigdaloid elongated	flat	wrinkled	1	2	23,7	36,3	white
BOCCHINO	5,0	6,3	sparsely pored	round	hard	21,7	14,5	8,9	1,8	2,4	round	flat	wrinkled	20	17	28,2	22,2	white
CASU	4,7	6,7	densely pored	ovate	soft	24,0	15,1	8,2	1,3	1,5	amigdaloid	flat	wrinkled	1	1	28,0	21,8	white
FIORI	3,3	5,2	moderately pored	ovate	semi-hard	22,9	12,6	8,3	1,5	2,5	amigdaloid	flat	wrinkled	12	2	46,6	33,5	white
CHIRONI	6,2	6,7	densely pored	cordate	hard	24,3	15,2	7,1	1,2	1,4	amigdaloid elongated	flat	wrinkled	11	1	19,7	34,7	white
GRAPPOLINA	6,9		densely pored	ovate	hard	22,4	15,1	8,8	1,6	1,2	amigdaloid	flat	wrinkled	10	1	36,0	32,9	light pink
IBSA	2,9	3,2	sparsely pored	cordate	hard	21,2	11,2	8,3	0,9	1,0	amigdaloid elongated	round	wrinkled	4	3	32,4	26,9	white
LUTZEDDU	4,9	5,6	moderately pored	oblong	hard	23,4	13,2	8,5	1,2	1,3	amigdaloid elongated	flat	wrinkled	—	—	26,0	32,7	white
OLLA	5,7	6,1	moderately pored	ovate	hard	21,9	14,7	8,1	1,3	1,0	amigdaloid elongated	flat	wrinkled	5	6	24,0	40,0	white
PALA A.	5,1	6,3	moderately pored	ovate	hard	22,3	15,0	7,3	1,0	1,0	amigdaloid elongated	flat	wrinkled	11	—	24,0	42,8	light pink
PIRAS A.	5,6	6,2	sparsely pored	ovate	hard	21,3	15,0	6,9	0,9	0,7	amigdaloid	flat	wrinkled	1	2	19,9	41,3	white
PITICHECKA	4,5	5,1	moderately pored	round	hard	22,5	13,1	7,6	1,0	1,0	amigdaloid elongated	flat	wrinkled	—	—	21,1	33,9	light pink
PROVVISTA	4,6	5,2	moderately pored	cordate	hard	23,6	13,3	7,3	1,0	1,1	elongated elongated	flat	wrinkled	36	—	25,4	53,6	white

Table 4

Characteristics of late and medium-late flowering varieties

Cultivars	Nut weight g	Nut volume cc	Marking of outer shell	Nut shape	Shell softness	Kernel size			Kernel weight g	Kernel volume cc	Kernel shape		Kernel texture	Double kernel %	Empty fruit %	Kernel yield %	Flower diameter mm	Petals colour
						L mm	W mm	T mm			longt section	cross section						
CIATTA MALISSA	5,3	8,8	moderately pored	ovate	soft	24,2	16,8	7,7	1,5	1,7	amigdaloid short	round	wrinkled	5	—	26,4	38,7	white
COSSU	4,8	5,6	moderately pored	ovate	hard	20,8	14,0	7,9	1,1	1,0	amigdaloid	flat	wrinkled	14,3	2	25,0	31,4	white
FARCI	2,9	3,7	moderately pored	round	hard	19,4	10,6	7,0	0,7	4,0	amigdaloid elongated	round	wrinkled	—	3	22,0	37,2	white
MENDUEDDA DE MRASCIAI	6,1	9,2	moderately pored	ovate	hard	20,6	11,2	6,6	1,1	1,1	amigdaloid	flat	wrinkled	—	3	18,9	39,9	white
RIU LOI	3,5	4,3	densely pored	ovate	hard	17,4	11,8	8,4	0,9	0,9			wrinkled	1	1	26,2	37,1	white
SUNDA G.	4,6	5,4	moderately pored	ovate	hard	21,3	14,6	6,8	0,9	1,0	amigdaloid	flat	wrinkled	0,6	—	20,3	34,7	white
SUNDA M.	3,4	3,2	moderately pored	cordate	hard	21,3	12,3	6,6	0,8	1,0	amigdaloid elongated	round	wrinkled	2	3	24,0	33,0	light pink
TROITA	5,1	5,8	sparsely pored	oblong	hard	24,2	14,4	6,9	1,0	1,1	amigdaloid	round	wrinkled	5	1	21,0	27,5	pink
VARGIU P.	7,2	8,6	moderately pored	oblong	hard	25,1	14,4	7,2	1,1	0,8	amigdaloid	flat	wrinkled	8	4	14,3	41,0	white

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