HortScience 56(9):1130–1131. 2021. https://doi.org/10.21273/HORTSCI15882-21

MAGNA and BLANQ Series: Two Yellow-fleshed and Three White-fleshed Nectarines

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Additional index words. color, fruit quality, *Prunus persica*, ripening, yield

The continuous release of new nectarine [*Prunus persica* (L.) Batsch] cultivars by breeders from around the world, together with consistent improvements in orchard management strategies by growers, commercial interest in the production of fruit fresh consumption, and the introduction of new cultivars from Spanish scion nectarine breeding programs have positioned Spain as the preeminent worldwide nectarine exporter and currently the largest European producer [Ministry of Agriculture, Food and Environment (MAPAMA), 2021]. In Spain, the main nectarine-producing area is the Ebro Valley that accounts for more than 60% of the total Spanish peach and nectarine production (MAPAMA, 2021).

Among all type fruits (nectarine, peach, flat peach, and flat nectarine), nectarine is the most produced in the last 15 years in Spain. The most significant change in the Spanish nectarine industry in recent decades has been the development and introduction of precocious new cultivars which generally have a full red overcolor, good size, predominantly sweet taste, and slow-melting flesh. This change started two decades ago, with the introduction of the yellow-fleshed nectarine 'Big Top' (Zaiger Genetics Inc., Modesto, CA), which has been widely accepted by European retailers and consumers, offering significant advantages in harvest and postharvest management and fruit quality characteristics (Reig et al., 2017). 'Big Top' continues to be the midseason (July) reference nectarine cultivar in Europe for fresh consumption, with 95% of the cultivars that are currently planted belonging to this fruit typology. However, some of these new cultivars are not well-adapted to Spanish environmental conditions (Font i Forcada et al., 2014, 2019).

The Agro Séléctions Fruits (ASF)-Institute of Agrifood Research and Technology (IRTA) scion nectarine breeding program started in 2004 (Batlle et al., 2012) aiming to develop high-quality nectarine cultivars well-adapted to the typical edaphoclimatic conditions of Ebro Valley and other similar hot climates, covering full harvesting period from June to September (Cantín et al., 2017). Trees were selected that produce high-quality fruits at both harvest and after cold storage, with the ultimate objective of satisfying consumers. Therefore, as a result of the continued effort from the ASF-IRTA nectarine breeding program, the initial MAGNA and BLANQ series of yellow- and white-fleshed nectarine cultivars, respectively, have been recently released.

These five new nectarine cultivars will supply high-quality, firm, attractive, and sweet fruit over 12 weeks, from mid-June until mid-September, in the medium chilling zone of Ebro Valley and similar areas (moderate temperatures during winter, periods of fog during wintertime, summer temperatures of over 30 °C, and yearly accumulated annual rainfall of 300–400 mm).

Origin

Regarding MAGNA nectarines, 'MAGNA 2901' was a seedling from 'Redpearl' × ASF 01.23.15.02 NJ, and 'MAGNA 3701' was from 01.16.13.02 NJ × ASF 01.24.93.02 NJ. For BLANQ nectarines, 'BLANQ 2601' was a seedling from ASF 11.01.290.94 NB × ASF 01.01.02.00 NJ, 'BLANQ 3001' was from ASF 01.14.77.01 NB × ASF 01.07.43.01 NJ, and 'BLANQ 3301' was from 'JMD698 NB' × 01.24.49.02 NJ.

Description

Phenotypic and morphologic descriptors (tree, flower, leaf, and fruit traits) developed by the International Union for the Protection of New Varieties and Plants (UPOV, 2010) and the Community Plant Variety Office (CPVO, 2015) were used to describe the MAGNA and BLANQ nectarine series (Supplemental Table 1).

The MAGNA nectarine series (yellow-fleshed) generally have spreading growth habit, although 'MAGNA 3701' tends to have some upright branches. Under Gimenells climatic conditions, full bloom occurs during March, and harvesting between July and September. Both selections exhibit sparse density of flower buds (Table 1).

The BLANQ nectarine series (white-fleshed) have spreading growth habit, although 'BLANQ 2601' and 'BLANQ 3001' tend to have some upright branches. Under our climatic conditions, full bloom occurs during March, and harvesting between June and August. They all have showy flowers, with the exceptions of 'BLANQ 2601', which has

Received for publication 30 Mar. 2021. Accepted for publication 11 June 2021.
Published online 20 August 2021.
This research was supported by the Research Centers of Catalonia (CERCA) Program/Generalitat of Catalonia. We also thank FruitFutur (Spain) for their support of the breeding program and FruitFutur members for their help during the whole trialing process carried out at Gimenells.
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Table 1. Comparison of several characteristics of the MAGNA and BLANQ nectarine series with the commercial standard 'Big Top' and 'Garcica' trialed at the Institute of Agrifood Research and Technology, Spain.

Trait	MAGNA 2901	MAGNA 3701	BLANQ 2601	BLANQ 3001	BLANQ 3301	Big Top[z]	Garcica[z]
Flowering period	7–17 Mar.	8–18 Mar.	2–16 Mar.	8–15 Mar.	7–17 Mar.	4–14 Mar.	5–22 Mar.
Harvest period	17–31 July	8–24 Sept.	20 June–5 July	21 July–8 Aug.	22 Aug.–7 Sept.	25 June–10 July	27 June–19 July
Yield (kg/tree)	78.6	91.9	44.3	61.5	58.1	30.5	32.5
Flesh firmness (N)	50.2	60.1	47.1	50.2	52.0	39.5	44.5
Soluble solids (°Brix)	12.9	12.1	11.6	12.0	12.2	11.3	11.7
Acidity ($g \cdot L^{-1}$ malic aid)	5.1	4.3	5.3	5.1	4.6	5.0	5.4
Red blush (%)	80–100	50–70	90–100	70–90	70–80	90–95	90–95
Dominant caliber (mm)	70–75	80–85	70–75	75–80	75–80	75–80	75–80

[z]Reference cultivar.

campanulate flowers, and 'BLANQ 3001' and 'BLANQ 3301' present sparse density of flower buds (Table 1).

For both nectarine series, there is no need for thinning at full bloom, as fruit thinning will effectively optimize fruit size.

Performance

All five cultivars were originally selected as seedlings grown at selection plots and then grafted onto 'Cadaman' rootstock after selection, being the fifth most used rootstock in Ebro Valley's (Reig et al., 2020). Three or four trees of each selection were placed at an experimental orchard of the Institute of Agrifood Research and Technology, Gimenells, Spain (lat. 41°39'18.77 N, long. 0°23'31.41 E; elevation, 230 m). Trees were trained to an open or Catalan vase system (Iglesias, 2019), spaced at 5 × 3 m. Each year, the trees received integrated pest management. The quantitative data presented summarizes the average values for 9 years collected on full-size trees.

Maturity time. Among the MAGNA nectarine series, 'MAGNA 2901' is a midseason cultivar, whereas 'MAGNA 3701' is a late-season cultivar (Table 1). Regarding the BLANQ nectarine series, 'BLANQ 2601' is an early-season cultivar, whereas both 'BLANQ 3001' and 'BLANQ 3301' are midseason cultivars.

Yield. The trees were harvested in two to three picks separated by 3 to 5 d. After harvesting, the whole production of each controlled tree was graded for fruit size and weight using a commercial electronic fruit grader (MAF RODA, Iberica, Spain). Total yield per tree, average fruit weight, and total number of fruits per fruit size were then calculated for each pick. Under our conditions, all five nectarine cultivars stood out for their high productivity and good fruit size, regardless of their harvest season (Table 1).

Fruit quality. Fruits of five cultivars were examined at commercial maturity, using samples of 12 fruits per cultivar. All cultivars were generally found to be sweeter than current commercial cultivars within each harvest period, juicy, aromatic, and crunchy (Table 1, Supplemental Table 1). All of them are nearly 100% red skin colored, except for 'MAGNA 3701' (Supplemental Fig. 1), which could be considered a bi-color nectarine. The fruits are generally round shape without a mucron tip. The presence of skin lenticels is visible in 'BLANQ 3301' (Supplemental Fig. 1), weakly visible in 'MAGNA 2901', and low in the other cultivars. It should be noted that hot climates such as Ebro Valley's are conducive to the development of lenticels on fruit skin. In addition, this defect is related to wood aging. However, these two issues do not seem to affect 'MAGNA 2901' fruits.

Postharvest performance. Thirty fruits from the first harvest of each cultivar were kept at 0.5 °C for 30 d and then for 2 additional days at 20 °C. Each fruit was then scored based on a visual rating of chilling-injury symptoms (mealiness and internal browning). Each cultivar was then classified as having good, moderate, or poor long-term performance. The yellow- and white-fleshed nectarines 'MAGNA 3701' and 'BLANQ 2601', and 'BLANQ 3301', respectively, were the least susceptible to chilling injury after long periods of cold storage (Supplemental Table 1).

Availability

The cultivars are protected by the Community Plant Variety Office, with the following registration numbers: 20113179 for 'MAGNA 2901', 20122741 for 'MAGNA 3701', 20132984 for 'BLANQ 2601', 20122738 for 'BLANQ 3001', and 20113183 for 'BLANQ 3301'. Virus-free plants are available from nurseries authorized by the Institute of Agrifood Research and Technology (IRTA, Spain). The plant material was laboratory-tested and showed negative results for *Agrobacterium tumefaciens* [via reverse transcription–polymerase chain reaction (RT-PCR)], *Apple chlorotic leaf spot virus* [via enzyme-linked immunosorbent assay (ELISA)], *Candidatus Phytoplasma prunorum* (via RT-PCR), *Peach latent mosaic viroid* (via molecular hybridization), *Plum pox virus* (via ELISA), *Prune dwarf virus* (via ELISA), *Prunus Necrotic ring spot virus* (via ELISA), *Xanthomonas arboricola* pv. *pruni* (via RT-PCR), and *Xylella fastidiosa* (via RT-PCR).

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Supplemental Fig. 1. Typical fruit appearance of commercially ripe MAGNA and BLANQ nectarine series: (**A**) 'MAGNA 2901', (**B**) 'MAGNA 3701', (**C**) 'BLANQ 2601', (**D**) 'BLANQ 3001', and (**E**) 'BLANQ 3301'.

Supplemental Table 1. Comparison of several characteristics of the MAGNA and BLANQ nectarine series trialed at the Institute of Agrifood Research and Technology, Gimenells, Lleida, Spain.

Trait	MAGNA 2901	MAGNA 3701	BLANQ 2601	BLANQ 3001	BLANQ 3301
Tree					
Growth habit	Spreading	Upright to spreading	Upright to spreading	Upright to spreading	Spreading
Fruit development period (d)	125–134	181–192	98–118	127–144	155–174
Flowering shoot					
Thickness	Medium	Medium to thick	Medium	Medium to thick	Thick
Density of flower buds	Medium to large	Very sparse to sparse	Medium to large	Very sparse to sparse	Very sparse to sparse
Flower					
Type	Showy	Showy	Campanulate	Showy	Showy
Leaf blade					
Shape in cross section	Concave	Concave	Concave	Concave	Concave
Color	Medium green	Medium green	Medium green	Medium green	Light green
Petiole					
Shape of nectarines	Reniform	Reniform	Reniform	Reniform	Reniform
Fruit					
Size	Medium	Medium to large	Small to medium	Medium	Medium to large
Shape	Broad elliptic	Round	Round	Broad elliptic	Round
Dominant caliber (mm)	70–75	80–85	70–75	75–80	75–80
Mucron tip at pistil end	Absent to weak	Absent	Absent	Absent	Absent
Prominence of suture	Medium	Weak to medium	Medium to strong	Medium to strong	Weak to medium
Ground color of skin	Yellow	Creamy yellow	Creamy white	Creamy white	Greenish to white
Relative area of over color of skin	Large to very large	Medium	Large to very large	Medium to large	Medium to large
Hue of over color of skin	Dark red	Medium red	Medium red	Light red	Dark red
Conspicuousness of lenticels	Weak	Weak to medium	Weak to medium	Medium	Strong
Flesh firmness	Very firm	Firm	Firm	Medium	Very firm
Carotenoid coloration of flesh	Orange-yellow	Orange-yellow	White	White	White
Flesh fiber	Moderate	Strong	Moderate	Absent or weak	Strong
Flesh texture	Crunchy and melting	Crunchy and melting	Crunchy and melting	Crunchy and melting	Crunchy and melting
Flavor	Moderate to intense	Moderate to intense	Moderate to intense	Moderate	Intense
Postharvest performance[z]	Moderate to poor	Good	Good	Moderate	Good
Stone					
Shape	Elliptic	Elliptic	Elliptic	Elliptic	Elliptic
Tendency of splitting	Absent or very low	Absent or very low	—	Absent or very low	Absent or very low to low
Adherence to flesh	Present	Present	Present	Present	Present
Time of beginning of leaf bud burst	Medium	Medium	Early	Very early	Medium

[z]Good long performance, <25% of total fruits had mealiness and/or internal browning symptoms; moderate, 25% to 50% of total fruits had mealiness and/or internal browning symptoms; and poor, >50% of total fruits had mealiness and/or internal browning symptoms.