

‘Alata’, ‘Gulsen’, and ‘Uzun’ Seedless Lemons and ‘Eylul’ Early-maturing Lemon

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Lemon [*Citrus limon* (L.) Burm. f.] cultivar improvement is important to consumers as well as the citrus industry. Alata Horticultural Research Institute, Mersin, Turkey, announces four new lemon cultivars obtained by budwood irradiation. Three of the cultivars, Alata, Gulsen, and Uzun, are completely seedless, whereas ‘Eylul’ has seeds and is early-maturing. These new cultivars are suited to the citrus fresh market. The seedless cultivars can be harvested from November to February and ‘Eylul’ produces fruit from the end of August to November in the northern hemisphere.

Origin

All four new lemon cultivars were developed by budwood irradiation from a Femminello lemon, Kutdiken cultivar as described by Gulsen et al. (2007). Irradiation doses were 0, 30, 50, 70, and 90 Gy. Three new seedless cultivars were generated with 50 Gy gamma irradiation, and Eylul was produced with 70 Gy. ‘Kutdiken’ is the most produced lemon in Turkey and has good fruit quality, high yield, and a long storage period under a controlled environment. The four new cultivars and ‘Kutdiken’ lemon were evaluated for seed number, fruit juice content, fruit weight, rind thickness, and fruit segment number between 2003 and 2006 in the field at the Alata Horticultural Research Institute, Mersin, Turkey. Three of these cultivars are completely seedless and one is early-maturing. Ten replicated trees of each cultivar grafted on 10 sour orange rootstocks were also observed for seedlessness. Both original and replicated trees were the same. The seedless genotypes were named ‘Alata’, ‘Gulsen’, and

‘Uzun’. The early-maturing cultivar was named ‘Eylul’. Production permits and breeders’ rights for all cultivars were obtained under these names.

Description and Performance

Plants of the seedless lemon cultivars, Alata, Gulsen, and Uzun, are vigorous with long branches and upright growth habits similar to ‘Kutdiken’. As visually assessed, these three new cultivars did not differ in any other tree morphology such as leaf shape, color, size, or tree characteristics. Compared with ‘Kutdiken’, the branches of the seedless cultivars are thorny as assessed visually, but ‘Eylul’ has smaller and fewer thorns. ‘Eylul’ has a slower growth rate, which is appropriate for denser orchards, e.g., 3 m (within row) × 4 m (between rows) in Turkey. The three seedless cultivars have the same tree size as

‘Kutdiken’. After four controlled inoculations with *Phoma tracheiphila* [(Petri) Kantsch. and Gik.], the causative agent of *Mal secco* disease, the most destructive fungal disease of lemon orchards worldwide, ‘Eylul’ had no disease symptoms, whereas the seedless cultivars were as susceptible as ‘Kutdiken’ as reported by Gulsen et al. (2007). The four cultivars have medium intensity of anthocyanin on young leaves. Among them, however, ‘Eylul’ has more intense anthocyanin on young leaves than the others.

Fruit shape and color of the seedless cultivars, Alata, Gulsen, and Uzun, is the same as ‘Kutdiken’ (Fig. 1). Shape of the fruit apex of new cultivars is mammiform. Fruit surface color at full maturity is light yellow with no color variegation. Fruit has intermediate-sized oil glands and intermediate surface roughness. Fruit shape of ‘Eylul’ is different from the other new cultivars (Fig. 2). Shape of the fruit apex of ‘Eylul’ is slightly acute and the surface color is green at harvest in August. Average fruit weights of ‘Alata’, ‘Gulsen’, ‘Uzun’, and ‘Eylul’ are 106, 131, 117, and 173 g, respectively, whereas ‘Kutdiken’ has an average fruit weight of 134 g (Table 1). Thus, fruit weight of ‘Gulsen’ is not significantly different from that of ‘Kutdiken’. ‘Uzun’ has a thicker rind (6.7 mm) than the other cultivars. This feature may have an impact on the storage life of fruit and is under investigation. Although there is slight variation in the number of fruit segments among cultivars, this variation is probably not of commercial significance and the number of segments was 10. The average number of segments per fruit is slightly larger in the seedless cultivars compared with ‘Kutdiken’. Fruit juice content (%) and acidity (%) of the new cultivars are significantly different (Table 1). ‘Eylul’ has the highest fruit juice content (39%) but the lowest acidity (4.2%). It is sufficiently juicy even when harvested in early August.

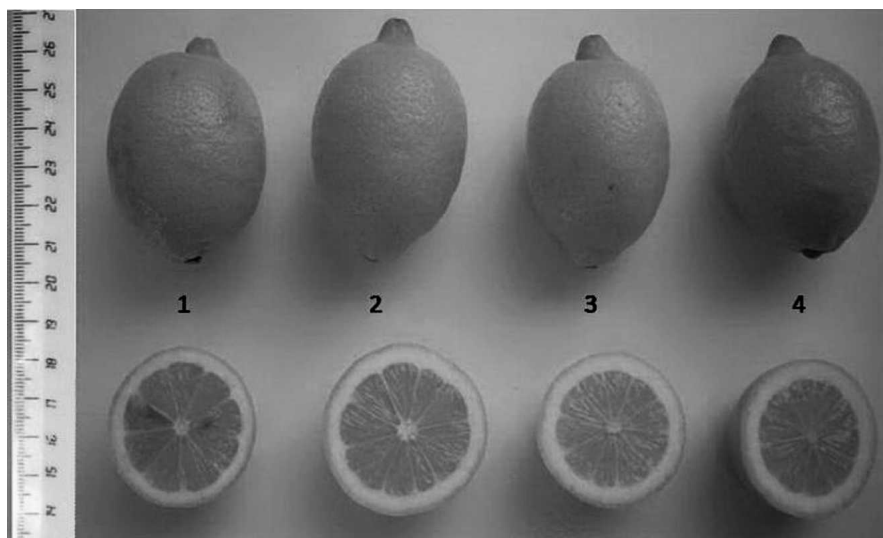


Fig. 1. The seedless cultivars photographed in November and abbreviated as follows: (1) ‘Kutdiken’ (control); (2) ‘Gulsen’; (3) ‘Alata’; and (4) ‘Uzun’. A ruler in centimeters is inserted.

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Fig. 2. Fruit of the early-maturing Eylul cultivar as photographed in September. A ruler in centimeters is inserted.

Table 1. Some selected fruit characteristics of new lemon cultivars and 'Kutdiken' as control²

Cultivars	Fruit wt (g) ^y	Rind thickness (mm) ^y	Seed number ^y	Fruit segment number ^y	Fruit juice (%) ^y	Acidity (%) ^y
Alata	106 d ^x	5.9 b	0.0 c	10.2 a	32 c	6.5 a
Gulsen	131 b	5.5 bc	0.0 c	10.3 a	37 b	6.6 a
Uzun	117 c	6.7 a	0.0 c	10.1 ab	33 c	7.1 a
Eylul	173 a	5.5 bc	6.2 b	9.7 c	39 a	4.2 b
Kutdiken (control)	134 b	5.4 c	8.1 a	9.9 bc	37 b	6.7 a

²Groupings for each trait are indicated with letters a to d.

^yAveraged for 4 years data in September for 'Eylul' and November for the others (data obtained by analyzing 50 fruits for each cultivar and year).

^xMean separation within columns by Tukey test ($P \leq 0.05$).

Production of seedless citrus fruits is generally considered to be a significant improvement in quality of fruits for fresh markets. The most important feature of the new seedless lemon cultivars in this report is complete seedlessness. Based on 4 years of observations in the field, there were no seeds detected in 'Alata', 'Gulsen', and 'Uzun' (Fig. 1; Table 1). Seedlessness is an impor-

tant characteristic demanded by consumers of citrus fruit and seedless citrus cultivars have a distinct commercial advantage (Raza et al., 2003). 'Eylul' is seedy and has an average of 6.2 seeds per fruit (Fig. 2; Table 1). The three seedless cultivars can be harvested from November to February, the same time as 'Kutdiken' in the northern hemisphere, whereas 'Eylul' can be harvested

from the end of August, being much earlier than 'Interdonato', which is popular for early maturation. If left on the tree for an extended period, 'Eylul' fruit characteristics become similar to those of 'Meyer' lemon by decreasing acidity and softening rind. For this reason, 'Eylul' must be harvested earlier than the middle of November.

One of the primary goals of citrus breeding programs is to obtain seedless cultivars. Recently, some seedless lemon cultivars have been generated by Calabrese et al. (2000) and Spiegel-Roy et al. (2007). In the future, new seedless lemon cultivars may replace seedy lemon cultivars as a result of increasing market demand. Therefore, the citrus industry will need a number of seedless lemons varying in adaptive potential and fruit characteristics. In addition, new seedless cultivars should be tested under different environmental conditions for their performances. One major consideration from the view of cultivar identification for protecting breeders' rights is difficulty in distinguishing mutation-derived cultivars, depending on whether they have point or chromosomal modification.

Availability

Limited quantities of budwood are available for research purposes only from Alata Horticultural Research Institute, Erdemli, Mersin, Turkey.

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