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晚熟苹果新品种福星的选育

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摘 要:福星是青岛农业大学以新世界×粉红佳人杂交选育出的晚熟苹果新品种。果实近圆形,单果质量为238.08 g,果形指数为0.93,外观美丽、高桩;果面光洁,有蜡质,在不套袋栽培条件下果实全面着鲜红色。果实可溶性固形物含量(*w*,后同)为17.83%,果肉硬度为11.61 kg·cm^{-2},可滴定酸含量为0.28%,果实酸甜,果肉硬脆,风味好,香气浓郁;果实可鲜食加工兼用。在山东省青岛市栽培区,果实10月下旬成熟,果实发育期180 d。果实晚采有糖心现象。11月中旬树体落叶,营养生长期220 d。叶片高抗炭疽叶枯病和早期落叶病。贮藏性好,果实在冷藏条件下(0~4 ℃)贮存至第二年5月中旬果肉硬度为8.13 kg·cm^{-2}。适应性强,在苹果栽培适区均可栽植;丰产性好,以M$_9$T337为砧木的3年生树平均单株产量为9.52 kg,折合每666.7 m^{2}产量为1 504.6 kg。

关键词:苹果;新品种;福星;晚熟;免套袋栽培

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Breeding report of a new late-ripening apple cultivar Fuxing

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Abstract: Fuxing is a late-ripening apple cultivar derived from the cross between Shinsekai (female parent) and Cripps Pink (male parent). The cross was made in the spring of 2010 in the Modern Agricultural Technology Demonstration Farm of Qingdao Agricultural University, and 2498 seeds were obtained in the autumn. The seeds were sown in the early spring of 2011 and the seedlings were raised in a greenhouse. The buds taken from the upper parts of the seedlings were grafted in March of 2012 on M_{26} interstocks previously planted in the field. The hybrid tree numbered 2010-W15-13Z-N3 was noticed for elegant fruits in 2014. It was determined as a promising strain for further field trail in 2015. The regional cultivation experiments were undertaken in 2016. The provincial variety certificate of fruit crop was obtained in 2019 (S-SV-MD-013-2019). It was registrated as Fuxing by the Ministry of Agriculture and Rural Affairs in 2020 (GPD apple(2020) 370015) and the plant variety right (CNA20184367.5) was obtained in the same year. The tree has moderate growth vigor with an open canopy. The color of tree trunk is taupe, with a slightly rough surface. The perennial branches are brown and relatively smooth. The leaf sizes are medium to large, the leaf is elliptical in shape and flat, with slightly clasped edges on both sides, the leaf color is thick green, and the back of the leaf is furry and sparse; and the petiole has small stipules at the base. The leaf buds are nearly triangular in shape, pointed in the middle, tightly attached on the branch, with tight scales and furry hairs. The flower buds are large in size, conical in shape, and pink in color, slightly pointed at the apex, with tight scales. The initial flowering period is

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from April 17 to 20 (Jiaozhou, Qingdao). The average fruit weight is 238.08 g. The fruit is nearly round in shape and the fruit shape index (L/D) is 0.93. The length of fruit stem is 3.17 cm. The fruit is fully bright red in color. The fruit surface is smooth with wax and good skin finish. The fruit flesh is light yellow, juicy and sweet. The fruit flesh texture is hard and crispy. The fruit firmness is 11.61 $kg \cdot cm^{-2}$. The total soluble solids content is 17.83%, and the titratable acid content is 0.28%. The trees are very productive and resistant to leaf diseases and apple canker. Suitable cultivation areas may cover many areas in China according to the results of the field trails, and this cultivar has high yield potential as the seedlings with branches can bear fruits next year after planting. The average yield of 3 years old Fuxing trees can achieve 1 504.60 kg per 666.7 m^2 on M_9T337 rootstocks. The time of fruit harvest is in late October in Shandong. The fruits have long storage life and shelf life, cold storage life is seven months and shelf life is over 240 days, and after storage the fruit aroma is quite strong. Spacing in the rows and between rows are (2.5−3.5) m×(3.5−4.5) m on vigorous rootstocks and (1.0−1.5) m×3.5 m on dwarf rootstocks. The suitable stocks are M_{26} interstock or M_9T337 rootstock. Suitable pollination varieties can be chosen from Fuji, Gala, *etc.* Trees should be trained as the high spindle or thin spindle system. It would be a good variety for the bagless cultivation.

Key words: Apple; New cultivar; Fuxing; Late-ripening; Bagless cultivation

多年来富士、嘎拉、金冠等品种是我国主栽苹果（*Malus domestica* Borkh.）品种，其中富士占栽培面积的70%以上[1]。富士品种需要通过套袋来解决果实着色[2]、病害及表光问题，增加了管理成本。选育拥有自主知识产权的苹果新品种是应对农村劳动力短缺、降低苹果生产成本、满足消费者日益增长的多样化需求的迫切需要[3]。

1 选育经过

2010年4月青岛农业大学苹果育种团队以新世界为母本、粉红佳人为父本进行人工授粉，获得2498粒杂交种子。次年春季将层积萌动的杂交种子播种到穴盘中，当杂种苗长至15 cm时，转移至大型育苗袋在温室内生长。2012年春季选取栽培性状明显的杂种苗，取其高节位芽嫁接到已经定植的M_{26}矮化中间砧木上[4]。2014年杂种树开始结果，编号为2010-W15-13Z-N3的品系所结的果实品质优良，未经套袋果面着色鲜红（图1）。经过2 a（年）评价，将该品系确定为优系。2016年将该优系高接到莱阳试验站和青岛农业大学胶州现代农业科技示范园大树，进行高接鉴定。同时，在陕西咸阳、山西运城、甘肃庆阳、河南商丘、山东烟台、青岛胶州等地进行区试和品比试验。2018年9月27日，通过了山东省品种审定委员会专家现场测产验收，2019年12月获得山东省林木良种证书（良种编号鲁S-SV-MD-013-2019），2020年6月获得农业农村部非主要农作

图1 晚熟苹果新品种福星

Fig. 1 A new late ripening apple cultivar Fuxing

物品种登记证书[登记编号：GPD苹果（2020）370015]，同年7月获得农业农村部植物新品种权证书（品种权号：CNA20184367.5）。

2　主要特征特性

2.1　植物学特征

福星树型为普通型，树势中庸，树姿开张。主干树皮灰褐色，皮面稍粗糙，多年生枝褐色，较光滑。皮孔数量多，叶片中大，椭圆形，平均叶长7.60 cm，叶宽4.75 cm，叶片较平整，叶缘两侧微抱合，叶缘锐锯齿；叶面光滑平展，叶色浓绿，叶背茸毛疏；叶柄长2.52 cm，基部有小托叶，叶柄基部淡红。叶芽近三角形，中尖，紧贴于茎上，鳞片紧，茸毛中。花芽中大，圆锥形，先端稍尖，鳞片较紧，茸毛少，花蕾粉色。

2.2　果实经济性状

福星果实近圆形，平均单果质量238.08 g，果形指数0.93，未套袋时果面鲜红色，果面平滑光洁，果梗较长，风味酸甜，汁液多，可溶性固形物含量（w，后同）为17.83%，可滴定酸含量为0.28%，果肉黄白色、致密，硬度为11.61 kg·cm^{-2}。果实发育期为180 d左右，在山东省10月下旬成熟，无采前落果现象，晚采有糖心。果实贮藏性好，存储（0~4 ℃）至第二年5月中旬果肉硬度为8.13 kg·cm^{-2}，香气依然浓郁。福星鲜食加工兼用，鲜榨果汁米黄色，香气浓郁，口感润滑、柔和，较甜，维生素C含量（ρ）为263.85 mg·L^{-1}（表1）。

表1　2017年和2018年福星在不同栽植区域的果实品质性状

Table 1　Fruits quality traits of Fuxing apple in different planting districts in 2017 and 2018

品种 Cultivar	栽培区域 Districts	硬度 Firmness/（kg·cm^{-2}）		w（可溶性固形物）Soluble solid content/%		w（可滴定酸）Titratable acid content/%		果肉颜色 Fruit flesh color	果肉质地 Flesh texture	风味 Flavour
		2017	2018	2017	2018	2017	2018			
福星 Fuxing	莱西 Laixi	11.61	11.60	17.91	17.82	0.26	0.29	黄白 Yellowish-white	硬脆 Hard and crispy	酸甜 Sour and sweet
	莱州 Laizhou	11.63	11.59	17.88	17.84	0.30	0.26			
	荣成 Rongcheng	11.62	11.63	17.66	17.82	0.28	0.27			
粉红佳人 Cripps Pink	莱西 Laixi	9.25	9.05	14.71	14.65	0.45	0.44	乳白 Ivory	松脆 Crisp	甜酸 Sweet and sour
	莱州 Laizhou	9.04	9.24	14.77	14.82	0.42	0.46			
	荣成 Rongcheng	9.18	9.20	14.64	14.78	0.48	0.45			

2.3　生长结果习性

福星幼树生长旺盛，萌芽率和成枝率高；以短果枝结果为主，连续结果能力强，无大小年结果现象；有良好的丰产性，以M$_9$T337为砧木的3年生树平均单株产量9.52 kg，折合666.7 m^{2}产量为1 504.60 kg。

2.4　物候期

在山东省胶州市，福星花芽萌动期是4月1日，叶芽萌动期是4月10日，初花期4月17—20日，盛花期在4月21—25日，落花期在4月29日，果实成熟期在10月20—25日，落叶期在11月30日—12月1日，营养生长期220 d。

2.5　适应性及抗病性

果实及树体在田间表现出较好的抗病性，尤其抗炭疽叶枯病、早期落叶病、腐烂病等。

3　栽培技术要点

3.1　栽植密度及授粉品种

福星采用嫁接繁殖，乔化砧木宜采用八棱海棠（*M. robusta* Rehd.）或山定子（*M. baccata* Borkh.）等，栽植株行距一般为（2.5~3.5）m×（3.5~4.5）m；矮化砧木可以采用M$_9$T337自根砧或者M$_{26}$、M$_9$矮化中间砧木，栽植株行距一般为（1.0~1.5）m×3.5 m。福星自花坐果率低，需配置授粉树，以富士、嘎拉和新红星等品种为宜。

3.2　整形修剪

乔化树宜采用自由纺锤形或小冠疏层形，矮化树宜采用高纺锤形。幼树期以轻剪长放为主，春季可通过涂抹发枝素促发分枝，充分利用中长果枝结果。进入结果盛期后利用中短果枝结果，应及时更新结果枝。

3.3　花果管理

福星较易成花，自然坐果率高，若采用壁蜂传粉或者人工授粉，可显著提高坐果率。为提高果实质量和维持树势，提倡疏花疏果。

3.4　肥水管理

福星幼树期要施足基肥，以有机肥为主，辅以追

肥，及时灌水，促进幼树营养生长和成花。进入盛果期以后每年要施有机肥，及时追肥，注意氮、磷、钾的合理搭配；灌水应掌握随旱随灌的原则，保证芽前水和萌动水，在果实膨大期适当灌溉。

3.5 适宜区域

福星苹果适应性强，在苹果栽培适区均可栽植。目前在新疆阿克苏和伊犁，陕西洛川和咸阳，山西运城，甘肃庆阳，河南商丘，山东烟台、青岛及威海等地区栽植均表现优良。

3.6 病虫害防治

按常规防治苹果常见病虫害，注意防治红蜘蛛、金纹细蛾、苹果轮纹病等。

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