

## 优质高产抗逆板栗新品种燕凤的选育

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**摘要:**燕凤是从燕山板栗实生大树群体中选育出来的新品种,具有优质、高产、抗逆性强等优良特性。坚果深褐色,色泽明亮;果肉淡黄色,肉质糯、香、甜,可溶性固形物含量(w)19%以上。在河北省迁西县9月上旬成熟,为早中熟品种。结果母枝平均抽生果枝数2.7条,结果枝率70.6%,每结果枝刺苞数2.3个,每苞果粒数2.8个,平均单粒质量8.1 g。嫁接后第2年开始结果,8年生单株产量3.6 kg,折合产量3 024.0 kg·hm<sup>-2</sup>,连续结果能力强。耐贮性强,适宜炒食、制作冰栗等。抗旱,耐瘠薄,高抗红蜘蛛,稳定性和适应性良好。适宜在燕山板栗产区及与此生态类型相似区域种植。

**关键词:**板栗;新品种;燕凤;抗逆;优质;高产

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### A new Chinese chestnut cultivar Yanfeng with top quality, high yield and excellent stress resistance

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**Abstract:** Yanfeng is a new chestnut cultivar selected through seedling selection. In 2006, the mother tree was found in Qianxi county, Hebei province by our research group, which was determined to be the superior strain after evaluation. In the spring of 2007, the strong juvenile branches of the mother tree were collected and grafted to the Variety Breeding Nursery of Hebei Normal University of Science and Technology, and the main cultivar Yanshanzaofeng was used as the control. Since 2015, regional trials have been carried out in three sites of Hebei province (including Funing, Qianxi and Qian'an). After eight years of trial and investigation, the superior strain showed obviously desirable characteristics such as high quality, high yield and strong resistance. In December 2023, it was approved by Hebei Forest Variety Certification Committee and officially named as Yanfeng. This cultivar is of medium height. The tree is vigorous with spreading tree gesture. The annual branches are brown, and lenticels are small and moderately dense. Leaves are long elliptical and dark green, with 18.9 cm in length and 6.8 cm in width. After grafting for 6 years, the average numbers of male inflorescence and female flowers on

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mixed flower branches are 11.4 and 2.3, respectively. The shape of burs is oval, with coarse spines of medium density and length. The average weight of a single bur is 39.2 g. The nuts have puce and glossy shells. The faint yellow flesh of nut shows the quality of strong glutinousness, aroma and sweetness. Soluble solids content is above 19%. And the contents of mineral elements per 1 kg of nuts are 510 mg magnesium, 142 mg calcium, 12 mg iron, 6 mg zinc, 73.4 mg manganese, 2.6 mg copper, 3030 mg potassium, 786 mg phosphorus and 14 mg sodium. The fruit development period is 90 days. It matures in early September in Qianxi county, which belongs to the early-mid maturing variety. The average number of fruit branches produced by an original bearing-shoot is 2.7, and the proportion of fruit branches is 70.6%. Each fruit branch has an average of 2.3 burs. Each bur contains an average of 2.8 nuts. The weight of single nut is 8.1 g. After grafting, this variety begins to bear fruits in the 2<sup>nd</sup> year, and begins to produce abundantly and steadily in the 5<sup>th</sup> year. The average yield per tree in the 8<sup>th</sup> year is 3.6 kg, equivalent to a yield of 3 024.0 kg · hm<sup>-2</sup>, which is higher than the check cultivar Yanshanzaofeng. It has a strong capacity for continuous fruiting, and can produce stable and high yields in successive years under no fertilization condition. The nut has good storage resistance and can be used for stir-frying, making ice chestnuts, etc. Yanfeng is resistant to dry and barren soil. It is able to maintain normal growth in extremely dry parks and years. It is also resistant to red mite, with good stability and adaptability. Suitable cultivation areas are in the Yanshan mountains and areas similar to this ecotype. Orchards should be chosen on gneiss or granite weathered soil. The spacing in the rows and spacing between rows are (2-3) m × (3-4) m. Yanzi and Yanbao are appropriate pollination cultivars for Yanfeng.

**Key words:** Chestnut; New cultivar; Yanfeng; Stress resistance; High quality; High yield

板栗是原产中国的优势经济林树种,但现阶段生产上存在品种混杂<sup>[1]</sup>、良种化程度低等问题<sup>[2]</sup>。虽然选育出的板栗品种已超过300个,但这些品种的生产适应性仍有待提高,未来的育种方向应当是在丰产的基础上,更加注重品质育种,同时重视抗性强良种的选育<sup>[3]</sup>。因此,河北科技师范学院以优质、高产、抗逆为选种目标,自20世纪90年代开始,在实生资源丰富的河北地区广泛开展选种工作。

## 1 选育经过

2006年,河北科技师范学院板栗育种团队和迁西县板栗产业研究发展中心在迁西县洒河桥镇安家峪村进行考察时,当地农户推荐了1株实生栗树,经团队初步综合评价后定为初选优系。2007年春季,采集母树上1年生健壮枝条嫁接到河北科技师范院校内品种选育圃,以生产上主栽品种燕山早丰为对照进行复选。2015年开始分别在河北省抚宁县、迁西县和迁安市等地进行区域试验。多年试验及观测结果表明,该优系具有丰产性强、产量高的明显性状特点;坚果美观,糯性,香、甜,耐贮性强;抗旱,耐瘠薄。采用SSR标记进行品种间的DNA多态性比较鉴定,结果表明,该品系与燕丽、燕山早丰、大板

红、燕龙、燕紫5个对照品种DNA存在差异(图1)。2023年12月通过河北省林木品种审定委员会审定,命名为燕凤(图2),良种编号:冀S-SV-CM-009-2024。

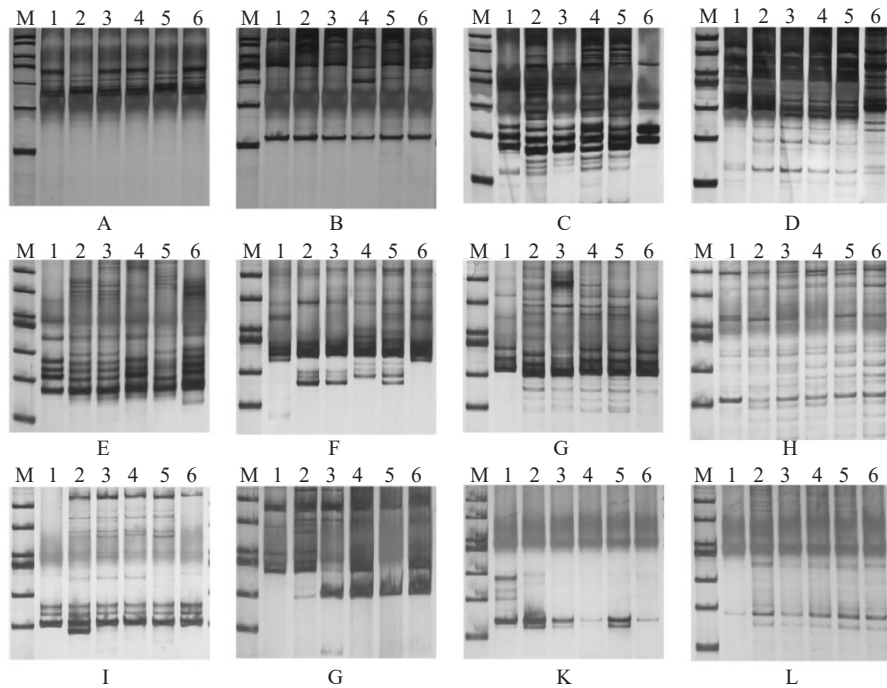
## 2 主要性状

### 2.1 植物学特征

树体高度中等,树姿开张。1年生枝褐色,皮孔小、圆形、密度中等。叶片长椭圆形,平均长度18.9 cm、宽度6.8 cm,浓绿色,叶背茸毛稠密,叶姿平展,先端急尖,锯齿浅而大。燕凤嫁接6 a(年)后,混合花枝雄花序平均11.4个,雌花数平均2.3个;结果枝长度31.2 cm,粗度0.9 cm,尾枝长7.6 cm。刺苞椭圆形,平均单苞质量39.2 g,刺苞长7.2 cm、宽5.5 cm、高4.8 cm;刺束粗、中等密度和长度、硬,黄绿色,刺束分支角小,成熟时“十字”裂。坚果椭圆形,深褐色,色泽明亮,果尖突出,茸毛稀疏,筋线不明显,底座中等,接线平滑。

### 2.2 经济特性

坚果果肉淡黄色,质地细腻,糯性、甜、香,可溶性固形物含量(w)19%以上;耐贮性强。结果母枝平均抽生果枝数2.7条,结果枝率70.6%,每结果枝苞数2.3



M. DNA Marker; 1. 燕丽; 2. 燕山早丰; 3. 大阪红; 4. 燕龙; 5. 燕紫; 6. 燕凤; A~L. SSR 标记引物 (ICMA0034、ICMA004、ICMA008a、ICMA009a、ICMA005、ICMA006s、ICMA007、BPPCT016、CSCAT14、CSCAT41、SSrQrZAG4、SSrQrZAG5)。

M. DNA Marker; 1. Yanli; 2. Yanshanzaofeng; 3. Dabanhong; 4. Yanlong; 5. Yanzi; 6. Yanfeng; A-L. Primers of SSR marker (ICMA0034, ICMA004, ICMA008a, ICMA009a, ICMA005, ICMA006s, ICMA007, BPPCT016, CSCAT14, CSCAT41, SSrQrZAG4, SSrQrZAG5).

图 1 燕凤与 5 个对照品种的分子标记图谱

Fig. 1 The SSR molecular markers map of Yanfeng with five control cultivars



图 2 板栗新品种燕凤

Fig. 2 A new Chinese chestnut cultivar Yanfeng

个, 出实率 39.8%, 每苞果粒数 2.8 个, 单粒质量 8.1 g, 8 年生单株产量 3.6 kg, 折合产量 3 024.0 kg · hm<sup>-2</sup>, 高于对照燕山早丰(表 1)。

2.3 品质特性

每 100 g 坚果含有水分 52.8 g, 淀粉 27.1 g, 蛋白质 8.9 g, 脂肪 0.8 g, 可溶性糖 8.22 g, 灰分 0.96 g; 每

表 1 经济特性对比

Table 1 Comparisons on economic characteristics

品种 Cultivar	结果枝数 Number of fruit branches	每结果枝苞数 Number of burs per fruit branch	每苞粒数 Number of nuts per bur	单粒质量 Average mass per nut/g	单株产量 Yield per plant/kg	折合产量 Yield/ (kg · hm <sup>-2</sup> )
燕凤 Yanfeng	72.2	2.3	2.8	8.1	3.6	3 024.0
燕山早丰 Yanshanzaofeng	72.9	2.4	2.3	7.3	2.8	2 345.0

1 kg 坚果矿质元素含量为镁 510 mg、钙 142 mg、铁 12 mg、锌 6 mg、锰 73.4 mg、铜 2.6 mg、钾 3030 mg、磷 786 mg、钠 14 mg。

## 2.4 物候期

燕凤在河北迁西县,萌芽期4月22日,展叶期4月28日,雄花盛花期6月10日,雌花盛花期6月17日,果树成熟期9月上旬,落叶期10月底至11月初,发育期90 d左右,为早中熟品种。

## 2.5 结果习性

燕凤嫁接后第2年开始结果,第5年开始丰产稳产,6年生单株产量可超过3.6 kg,每公顷产量3000 kg以上,连续结果能力强,无大小年,产量高,无肥水条件下可连年稳产高产(表2)。

## 2.6 抗逆特性

抗逆性强,抗旱,耐瘠薄。在极度干旱的园区和年份,能够保持正常生长。在现有品种常出现势弱

表2 稳产性对比

Table 2 Comparisons on yield stability

品种 Cultivar	嫁接后第5年 5 <sup>th</sup> year after grafting		嫁接后第6年 6 <sup>th</sup> year after grafting		嫁接后第8年 8 <sup>th</sup> year after grafting	
	平均单株产量 Average yield per plant/kg	折合产量 Yield/(kg·hm <sup>2</sup> )	平均单株产量 Average yield per plant/kg	折合产量 Yield/(kg·hm <sup>2</sup> )	平均单株产量 Average yield per plant/kg	折合产量 Yield/(kg·hm <sup>2</sup> )
燕凤 Yanfeng	3.3	2 711.5	3.7	3 072.0	3.6	3 024.0
燕山早丰 Yanshanzaofeng	2.3	1 970.0	2.8	2 345.0	3.4	2 796.5

早衰的干旱片麻岩陡坡山地种植,不出现早衰现象。高抗红蜘蛛,稳定性和适应性良好(表3)。

表3 抗逆特性对比

Table 3 Comparisons on stress resistance

品种 Cultivar	抗旱性 Drought resistance	红蜘蛛抗性 Resistance to red mite
燕凤 Yanfeng	强 Strong	高抗 High resistant
燕山早丰 Yanshanzaofeng	中 Medium	中抗 Moderate resistant

## 3 栽培技术要点

适宜在燕山板栗产区及与此生态类型相似的区域种植,以片麻岩、花岗岩风化的土壤栽植为宜。建议栽植密度2 m×3 m或3 m×4 m;嫁接5 a以上,开始逐年间伐。授粉树品种可选用燕紫<sup>[4]</sup>、燕宝<sup>[5]</sup>等。树形宜采用开心形、多主开心形或主干疏层形。幼树注重夏季修剪,进行年内多次摘心,增加分枝数量,加快树体整形。冬季修剪只采用疏剪方式,不进行短截。幼树只疏除个别徒长枝,其余枝条保留缓放,以果压冠;成龄树采用“抓大放小”修剪方法<sup>[6]</sup>,疏除过高过密的、交叉重叠的大枝或中枝,其余小枝不修剪,控制树体高度在3~5 m。

## 4 综合评价

燕凤树势强健,树姿开张;结果早,产量高,连续结果能力强;坚果甜香糯,品质优良;抗旱性强,耐瘠薄,适宜在燕山板栗产区及与此生态类型相似区域

种植。

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