猕猴桃研究进展

Advances in *Actinidia* Research

黄宏文 主编

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内 容 简 介

本书以"98'中国国际猕猴桃研讨会暨第十次全国猕猴桃科研协作会"论文为基础，系统收集了当前国内外猕猴桃科研、生产及产业化发展的最新信息，同时收入了世界主要猕猴桃生产国及国内从事猕猴桃研究的知名专家对世界猕猴桃产业的现状、面对21世纪猕猴桃研究和利用的发展方向，以及我国猕猴桃科研和产业化发展对策进行深入分析与探讨的论文，对读者全面掌握国内外研究成果和发展动态，指导猕猴桃研究创新和产业化腾飞具有重要的学术意义。

全书分五个部分，囊括了猕猴桃科研、生产、种质资源、栽培、育种、采收与贮藏、生物技术、病虫害防治等内容，是农业院校师生及果树推广和管理工作者的一本不可多得的参考书籍。

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序

猕猴桃是本世纪由野生经驯化栽培成为大规模商品化生产、人类利用野生自然资源造福于己最成功的例子之一。1904 年新西兰人从我国引种猕猴桃，成功地进行了人工驯化栽培，至今已发展成世界范围栽培面积 10 万公顷、产量 100 万吨的水果产业。我国是世界猕猴桃产业的原始起源地，具有极为丰富的资源。但是我国对猕猴桃的经济价值认识较晚，直到 20 世纪 70 年代末才开始进行猕猴桃资源的系统研究和利用。1978 年农业部在河南信阳会议上拉开了我国系统研究猕猴桃资源的序幕，从此我国猕猴桃的研究和开发逐渐展开，并充分利用了自己的资源优势大步赶追世界先进水平，现已成为世界上栽培面积第一、产量第四的猕猴桃生产大国。虽然我们在科研水平、产业化质量和资源保护及可持续利用等诸多方面还存在一些不足，但我们毕竟用 20 年走完了西方 70 年的发展历程。我国的猕猴桃资源和近几十年的科研积累现在和将来一定会在世界猕猴桃产业的可持续发展中占据重要地位。

由黄宏文主编的《猕猴桃研究进展》一书共分五个部分：1. 世界主要猕猴桃生产国的科研和生产；2. 资源与品种区试及育种；3. 栽培技术与区域发展；4. 采收与贮藏；5. 生物技术与病虫害防治。该书在收录了“98’中国国际猕猴桃研讨会暨第十次全国猕猴桃科研协作会”的论文基础上，又特邀了世界主要猕猴桃生产国的知名专家对本国的科研、生产以及市场策略撰写综述，从而系统地提供了世界猕猴桃产业面向 21 世纪的科研、生产和市场发展趋势，也结合我国猕猴桃发展现状和存在问题，提出了我国猕猴桃科研重点、产业方向和市场策略。该书是一部难得的供从事猕猴桃科研、推广工作者和大专院校师生的参考书。

崔致学

1999 年 7 月于郑州

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ONWARDS 21_{st} CENTURY'S KIWIFRUIT INDUSTRY

猕猴桃的驯化栽培史

猕猴桃从自然野生资源到大规模商品化栽培的全过程至今仅90余年的历史，是20世纪果树栽培史上最成功驯化栽培的果树之一。1904年新西兰人从中国湖北宜昌引种美味猕猴桃（*Actinidia deliciosa* (A. Chev.) C. F. Liang et A. R. Ferguson），1905年育苗成功，当时称为中国醋栗（Chinese gooseberry）。以后的25年新西兰人基本完成了猕猴桃人工栽培所需的各主要技术环节，至1930年在新西兰出现了第一个猕猴桃商业化果园。50年代前后，在新西兰的普伦提湾形成了一定规模的果园栽培，1952年新西兰生产的中国醋栗出口英国成功并逐步打开了欧洲市场；1959年新西兰出于商业运作的需要，将中国醋栗改名为至今国际市场通称的"基维果"（kiwifruit，即以新西兰国鸟kiwi来命名的水果）。新西兰猕猴桃的大规模商业化栽培开始于1970年，由于高额利润回报的驱动，猕猴桃商业栽培很快发展到世界各地。从70年代至90年代初，世界范围的猕猴桃商业栽培生产飞速畸形发展，如新西兰在1983～1988五年内生产翻了五番；意大利从70年代初的零起点到90年代初跃居为世界栽培面积最大的（20 000 hm^2）猕猴桃生产国；同时，南美的智利和北美的美国也形成了相当的生产规模以至引爆了1992年世界范围的市场危机，市场价格平均下降四分之一，迫使世界猕猴桃产业进入调整期。目前，世界猕猴桃生产基本稳定在面积10万 hm^2、产量100万t的水平。中国是猕猴桃的原产地，具有得天独厚的自然资源，勤劳、智慧的中国人早在1200年前就开始利用猕猴桃，最早的文字记载始见于《诗经》，而且唐代以后历代编撰的本草类书籍大多有关于猕猴桃的记载，描述了植物学性状、药用、食用等用途；但由于历史上种种原因使我国的宝贵资源长期以来没有对我国民族的经济建设发挥作用。至70年代末，我国才开始进行猕猴桃资源的系统研究和利用，至今我国的猕猴桃业仍然处在产业化的低级水平。从历史中吸取教训将有利于我们制定面向21世纪的策略。

世界各国猕猴桃产业概况及研究动向

最近统计资料，目前世界猕猴桃栽培面积约为10万 hm^2、产量100万t。栽培面积最大国依次为：中国（41 400 hm^2）；意大利（19 000 hm^2）；新西兰（10 329 hm^2）；智利（8500 hm^2）；法国（5000 hm^2）；希腊（4000 hm^2）；日本（3700 hm^2）；美国（2500 hm^2）。产量依次为：新西兰（220 895 t）；意大利（203 000 t）；智利（130 000 t）；中国（87 940 t）；法国（60 000 t）；希腊（50 000 t）；日本（47 000 t）；美国（38 000 t）。产量的格局将在今后几年因中国新

建果园进入结果期而改变。以目前中国的栽培面积，其产量会在近几年内超过新西兰。制定中国猕猴桃产品的国内外市场策略已成为当务之急。围绕猕猴桃产业，世界各主要猕猴桃生产国均投入了相当大的科研经费为猕猴桃产业的健康、可持续发展提供支撑，以新西兰为例：1996～1997 年度国家(占 62%)投入和大企业(占 38%)投入猕猴桃科研经费为 930 万美元。意大利、智利等国也有相当大的科技投入。当前世界猕猴桃科学研究和技术开发的重点为：围绕市场竞争的果实品质控制技术、遗传资源与育种、分子生物学有关的基础研究、果实发育生理与采收指标、采后生理与贮藏运输、栽培技术及病虫害防治。以可持续利用为导向的资源研究和以品种改良为目标的育种研究仍是各国关注的重点，因为自 1924 年新西兰人 Hayward Wright 选育出 Hayward 品种以来，世界的猕猴桃产业主要依赖这一品种，至今仍然占中国以外世界栽培面积的 95%以上。各国的猕猴桃研究者认识到这种将一个世界性果树产业建立在单一品种栽培的危险性，狭小的遗传基础势必因遗传均质性带来整个产业的脆弱性。新西兰自 70 年代以来建立起一个占地5～6hm^2、包括猕猴桃属 21 个种、300 份种质资源的资源圃；意大利和法国也建立了小规模的资源圃。我国凭借丰富的资源优势，在 80 年代资源调查收集的基础上分别在广西桂林、湖北武汉和江西庐山等地建立了猕猴桃资源圃，其中中国科学院武汉植物研究所的猕猴桃资源圃收集保存了 51 个种(变种)的 800 余份种质资源。猕猴桃新品种改良的育种研究以新西兰的规模最大，每年耗资 250 万美元，占地 25 hm^2，现有各类育种群体的实生苗 4 万株。最近育出的美味猕猴桃新品种 Tomua 和中华猕猴桃新品种 Hort16A 开始投入商业化栽培，进行品种结构调整。而且，在利用软枣猕猴桃、紫果猕猴桃的种间杂交育种和两性品种育种上取得了重要进展。

我国猕猴桃产业的现状及问题

我国虽然用 20 年建立了相当规模的猕猴桃产业，但产业的现状和质量不容乐观。特别是产品质量差，在国际市场没有竞争力将成为制约产业健康发展的主要问题，以占全国产量一半以上的生产大省陕西为例：进入 90 年代后陕西生产的“秦美”猕猴桃开始销往国内各地，仅几年后受国外进口果的冲击和自身品质差、1995 年就出现了“地摊贱卖”的局面。我国猕猴桃产业主要存在如下问题：1) 市场策略缺乏，以至整个产业处于无序状态。这突出表现在我国生产的猕猴桃产品既缺乏国际竞争力无法外销，又忽视了国内市场的培育和开拓，销售体系和相关基础设施的建设也大大滞后于商品市场运作的要求，特别缺乏利用中国独特的自然资源创国际品牌的意识，以至同样质量的国内产品和进口产品的价格相差几倍至十几倍。2)生产发展缺乏统一规划，在一定程度上处于盲目状态。陕西省自 90 年代以来的“一哄而起”发展带来的后果如不尽快研究解决，将在今后几年更加被动，而且由此带来一系列诸如生产区划、品种结构、栽培技术和贮运销售规范的滞后问题。3) 研究和发展投入不足、针对性差、缺乏连续性，以至科技对产业的贡献率低。以支撑产业的主栽品种研究为例，至今仍缺乏一个全局性的育种和品种区试计划，导致了目前整个产业的品种结构不合理，优良品种栽培少，而一般品种却大面积推广。充分认识我国猕猴桃产业所面临的问题，将有利于我们制定发展策略和迎接未来的挑战。

面向21世纪的发展趋势

未来果树产业以质量为主导的产品多样化趋势将越来越明显的体现在国内外市场的激烈竞争中，猕猴桃产业的健康、可持续发展将更多地依赖科技的进步：① 围绕品牌占领市场的新品种改良竞争将在中国、新西兰、意大利等国之间进行。就目前状况，中国的资源优势虽然逐步在失去，但仍占有重要的地位，新西兰则具备先进技术和较多育种材料的先决条件。② 无化学污染的"绿色果品"或"有机果品"将成为市场主导，由此将导致整个生产方式的全面改变，新西兰优质果仍将在一段时间内主导世界市场。③ 以迎合消费者多样化的需求和进一步开拓市场的需要，目前基本上单一鲜果为主的市场将被多种产品所代替，这方面在一段时期内欧美主要生产国将凭着技术的先进而领先。④ 随着整体的技术进步，高效的果园管理和包装贮运将在包括中国在内的发展中国家广泛应用，生产成本的降低可使猕猴桃种植者有稳定的投资回报。⑤ 科技投入对产业的支撑将更加明显地反映在市场效益上，这方面新西兰产业由于国家稳定的科技投入的支持将在一段时期内处于明显优势。

全面充分地认识国内外猕猴桃产业的现状和未来的发展趋势，制定我国面向21世纪的产业规划将有利于我国猕猴桃的健康和可持续发展。

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1999年4月于中国科学院武汉植物研究所
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世界主要猕猴桃生产国的科研和生产

RECENT CHANGES IN THE NEW ZEALAND KIWIFRUIT INDUSTRY

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Abstract The New Zealand kiwifruit industry has made a good recovery from the depressed trading conditions that affected kiwifruit industries of most countries at the beginning of this decade. The total area planted has decreased but orchard productivity has increased, and changes in harvesting and postharvest procedures have lead to more consistent fruit quality at the same time as a reduction in costs. Industry structures have changed to allow for more efficient marketing. The ZESPRI™ branding has already assisted sales and promotion and should help maintain the premium that New Zealand kiwifruit enjoy in overseas markets. The development and release of the cultivar 'Hort16A' (a selection of *Actinidia chinensis*) is probably the most fundamental change to the industry since 'Hayward' (*A. deliciosa*) became the dominant cultivar on the export market.

1. The kiwifruit industry in New Zealand

1.1 New Zealand's market share

During the last 15 years, the New Zealand kiwifruit industry has had to respond to increased competition, particularly from California, Chile and Italy, in its key markets. New Zealand is no longer the largest producer of kiwifruit in the world—that position has been held by Italy for most of the last decade. However, New Zealand is still the dominant player in world kiwifruit trade, partly because its production is almost entirely for export and because local consumption is insignificant. It also puts the most effort into the promotion of kiwifruit. Furthermore, kiwifruit contribute uniquely to the New Zealand economy, being the sixth or seventh most valuable export. Currently, kiwifruit exports are worth more to New Zealand than apple exports, although the relative positions of the two crops can change according to marketing conditions.

It is difficult to quote precise statistics because production has been changing so

rapidly from year to year, production figures for China have also not been included. The trends, however, are unmistakable. In 1983, total world kiwifruit production from commercial orchards was 81 500 tonnes, of which New Zealand produced almost 60%. By 1990～1992, world production had increased more than tenfold to 840 000 tonnes, of which New Zealand's share had fallen to about 30%. By 1997, world production had further increased to just over one million tonnes but New Zealand's share had again dropped, this time to about 25%. Although kiwifruit production worldwide has increased remarkably over the last fifteen years, it still represents less than 1% of total fresh fruit production.

1.2 Kiwifruit orchards in New Zealand

The rapid increases in total production inevitably led to reduced market prices and hence reduced returns to growers in all countries producing kiwifruit. The New Zealand industry was hard hit. From 1987～1991, the area planted in kiwifruit in New Zealand had remained stable at a maximum of about 15 800 ha but since then has fallen to an almost constant 10 400 planted hectares.

The Bay of Plenty was the original centre of the kiwifruit industry in New Zealand but during the boom years, kiwifruit were also planted in other areas. Some of these areas were only marginally suitable and other crops were more profitable; with the reduction in total plantings, the industry has consolidated back to the Bay ot Plenty which now has about 80% of the total New Zealand plantings.

The decline in the number of growers is even more dramatic; in 1990 there were just over 4100 growers, in 1997 some 1800 growers. There was a disproportionately large loss of those growers who had orchards of 2 ha or smaller, and there has therefore been consolidation within the industry with the average kiwifruit production per grower increasing by 50% between 1992 and 1997. The average orchard size in 1997 was 5.7 ha producing 31 300 trays. Many orchard owners now lease their orchards to orchard management companies or contract out aspects of management and harvesting and therefore have reduced input into kiwifruit growing.

1.3 New Zealand production and exports

New Zealand kiwifruit production and export sales has now stabilised at about 60 million trays per year, although there are some fluctuations from year to year, largely depending on the weather and trading conditions. This is equivalent to about 200 000 tonnes of fruit as the New Zealand standard tray (the unit usually quoted in industry statistics) contains a minimum of 3.6 kg fruit. Export destinations can also vary accordingly to economic changes and currency strengths. Currently about 20% of the New Zealand crops goes to Germany, 30%～35% to other European countries, 20%～25% to Japan, about 10% to other Asian countries and about 5% to the United States.

Although kiwifruit are exported to some 60 countries and much emphasis is placed on developing new markets, almost 80% of the crop is still exported to two destinations: Europe and Japan. Kiwifruit sales in Europe are markedly affected by weather conditions in Italy, and hence the size of the Italian crop, and the abundance of other summer fruit. Although New Zealand and Italy are in opposing hemispheres there can be competition between them at both ends of their respective marketing seasons. In Europe, during the kiwifruit marketing season from May to November/December New Zealand has nearly 80% of the total market.

1.4 Returns to growers

Returns to growers have fluctuated greatly since 1992, with a low of $NZ 3.85 per tray that year to a projected high of $NZ 6.412 in 1998 ($NZ 1=c. $US 0.55). More significantly, when yields per hectare, fruit losses, other costs and currency fluctuations are taken into account, the orchard gate returns for growers over the period 1992～1997 have ranged between $NZ 3000 and $NZ 18 200 per hectare. Correcting for inflation, these returns are considerably lower than those enjoyed during the years 1980 to 1985, but the New Zealand industry has recovered from the disastrously low prices worldwide for kiwifruit in 1992 faster than have the industries of most other countries.

2. Recent changes in orchard management

Orchard productivity has increased markedly over the past five years from about 4600 trays (16.6 tonnes) per hectare of export quality fruit to more than 6000 trays (21.6 tonnes) per hectare, although this does vary according to the season. Going further back in time, it is difficult to distinguish increases in productivity due to better management from increases due to young orchards achieving full production as the vines mature. Furthermore, the orchards removed during the years up to 1994 would have generally been those that were less productive. Increases in productivity have compensated, in part, for the decline in average returns per tray.

2.1 Training systems and canopy management

T-bar and pergola systems are essentially the only two systems now used and the other systems tested in the 1980s are no longer popular. On T-bar systems, low wires are commonly used to provide additional support to the canes to minimise the effects of wind and tractor damage. There has been a noticeable conversion of canopies from T-bars to pergola systems to enhance productivity and to reduce fruit damage. It is likely that *A. chinensis* cultivars will be generally grown on pergola systems.

Growers are paying more attention to canopy management to ensure maximum light