https://doi.org/10.56975/ijcrt.v13i8.292526

IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Orchid Sustainable Use In Thailand

K. Thammasiri

Center for Gardening and Horticulture, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Yunnan 666303, China.

Abstract

Orchid sustainable use in Thailand started from tissue culture research in some universities in 1967. Later in 1972, orchid tissue culture business expanded rapidly to over 30 million plantlets and employed over 300 workers in 15 labs with about 2.4 million US dollars. The suitable protocols and low-cost tissue culture were developed, as well as conventional breeding program for outstanding cultivars for international markets by the government organizations, institutions, growers, and private companies. The export value started from less than one million US$ to about 82 million US$ in 2022. Major growing factors in natural growing habitats are concerned for appropriate production technology after tissue cultured plantlets. They are altitude, light, temperature, relative humidity, nutrients, and air movement. At present, saran houses constructed with cement poles, cement benches, galvanized pipes for hanging orchid baskets, and black netted nylon roof with 50-60% shade and open sides are developed for low cost, long lasting, and suitability for growing tropical orchids for cut-flower and potted orchids. The cultivation is mostly for many outstanding cultivars of pink-red, white, and yellow-green flowered dendrobiums and blue, pink, and yellow flowered vandaceous orchids which need hot and humid conditions. A complete cycle of orchid production which need breeding program, tissue culture, planting materials (mainly coconut husks, charcoal, and cement block), plastic containers, watering, fertilizer, pest control, post-harvest technology, and transport from farm to packaging houses are effectively implemented. Thailand is famous for exporting cut-flower orchids applying low-cost cultivation but high production. Orchids continue to dominate other ornamental crops in Thailand due to better technology know-how, suitable climatic conditions for dendrobiums and vandaceous orchids, experienced and skillful growers, and exporters, as well as their nationwide popularity. Apart from all these, orchids are a symbol of Thailand that reflects the country's pride internationally.

Keywords: Thailand, orchid tissue culture, a complete cycle of orchid production

INTRODUCTION

Thailand is situated in a hot and humid tropical zone of SoutheastAsiawitha currentpopulation of about 69million and a totallandarea of 128.4 millionacres. Thailandisthe 13th mostplant-richcountryintheworldafterBrazil, Colombia, China, Mexico, USSR, Indonesia, Venezuela, USA, Australia, India, Peru, and Malaysia (Cronquist, 1981). Tropicalecosystems, unlikethoseintemperatezones, providewiderniches and areabletosupport a muchlargervariety of plant, animal and microbespecies. Itisestimatedthatthereareapproximately 15,000 plantspeciesinThailandincluding 3,000 species of mushrooms and fungi, 633 species of ferns and about 1,200 species of orchids. Morethan 779 species of plantspossessactiveherbalingredientsusedfortraditionalmedicines (OEPP, 1996).

[a]E-mail: kanchitthammasiri@gmail.com

https://doi.org/10.56975/ijcrt.v13i8.292526

Orchids rank the highest among the several tropical ornamental crops, especially cut-flower crops, that are important to the Thai agriculture and economy (Thammasiri, 2015). Development of orchid biotechnology, namely tissue culture, breeding, and production technology, in Thailand started from tissue culture research in some universities in 1967. Later in 1972, orchid tissue culture business expanded rapidly to over 30 million plantlets and employ over 300 workers in 15 labs with about 2.4 million US$. The suitable protocols and low-cost tissue culture were developed, as well as conventional breeding program for outstanding cultivars for international markets by the government organizations, institutions, growers, and private companies. The export value started from less than one million US$ to about 82 million US$ in 2022. Major growing factors in natural growing habitats are concerned for appropriate production technology after tissue cultured plantlets. It is estimated that 54 percent of the orchids produced are exported and the rest 46 percent consumed in the domestic market. The export of cut-flower orchids (60 million US$) still predominates, but that of orchid plants has also been on a rapid increase, figuring at about 22 million US$ in 2022 (DITP, 2022; Department of Customs, 2022) (Figure 1).

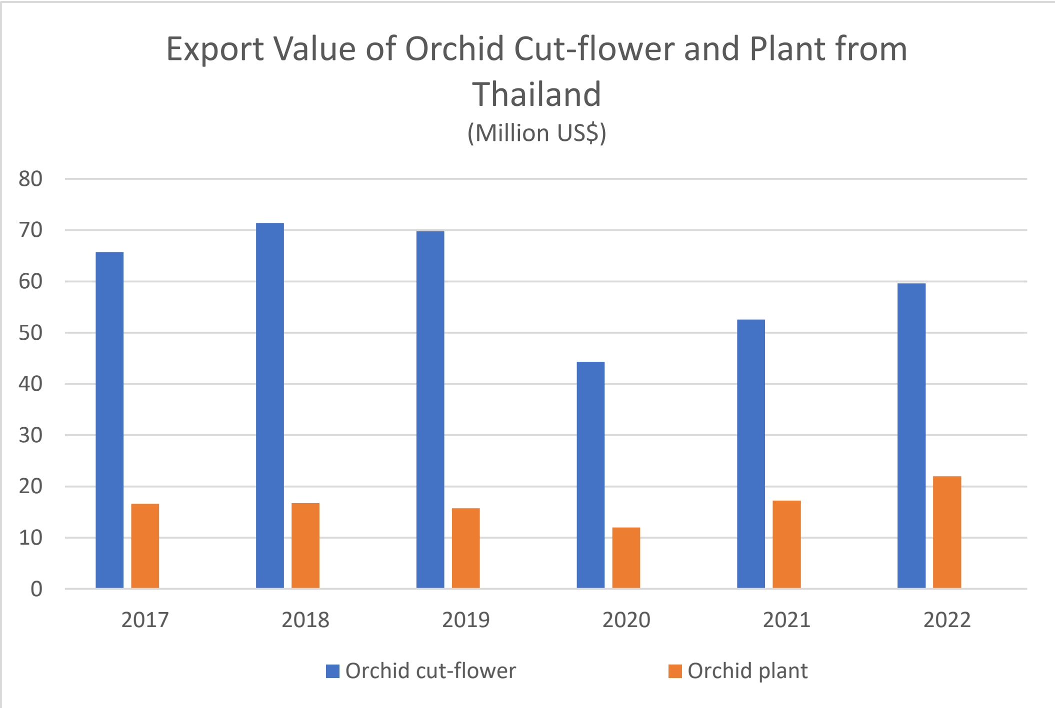

Figure 1. Export value of orchid cut-flower and plant from Thailand (2017-2022).

ORCHID TISSUE CULTURE

Tissue culture is an indispensable tool for the commercial production of elite plant selections because of low cost, uniformity, fast propagation, and high yield in a short period of time (Arditti and Ernst, 1993). It has been successfully carried out for many Thai orchid species. Mostcut-flowerorchids, *Dendrobium*, *Oncidium*, *Mokara*, *Aranda*, *Ascocenda*, and *Cattleya*alliancesarepropagatedsuccessfullythroughtissueculture. Within 1-2 years, oneyoungpseudobulbmultipliestoover 10,000 plantsfromthelaboratory and tissue cultured plantlets arereadytobegrowninthegreenhouse.

Recently, protocorm-like bodies (PLBs) were induced from shoot tips of *Grammatophyllumspeciosum.* The highest frequency of PLBs (93%) was observed on explants cultured on ½MS liquid medium containing 2% (w/v) sucrose without any plant growth regulators (PGRs). Tests with different carbon sources compared to sucrose revealed that maltose promoted the highest relative growth of *G. speciosum*PLBs (7-fold increase); while, trehalose and sucrose yielded 5-fold and 4-fold increases, respectively. In ½MS liquid medium, addition of 15 mg/l of chitosan promoted a 7-fold increase in PLB growth; while, 25 mg/l promoted a 4-fold increase. However, the relative growth rate in solid culture was significantly lower than that in liquid culture. In addition, chitosan supplementation in solid medium promoted shoot formation but not rooting. Plantlet regeneration was induced using a combination of NAA and BA supplementation in ½MS solid medium with optimum induction of shoot and root formation at 2.0 mg/l NAA and 1.0 mg/l BA. Using this protocol, approximately 8 months was required to obtain a hundred plantlets from one shoot tip. The plantlets showed no changes in ploidy when tested by flow cytometry (Sopalun et al., 2010) (Figure 2). In addition, *Paphiopedilum niveum*was able to be regenerated through embryogenesis from callus-derived protocorm-like bodies on modified Vacin and Went medium containing a combination of plant growth regulators (Kaewubon et al., 2010) (Figure 3).

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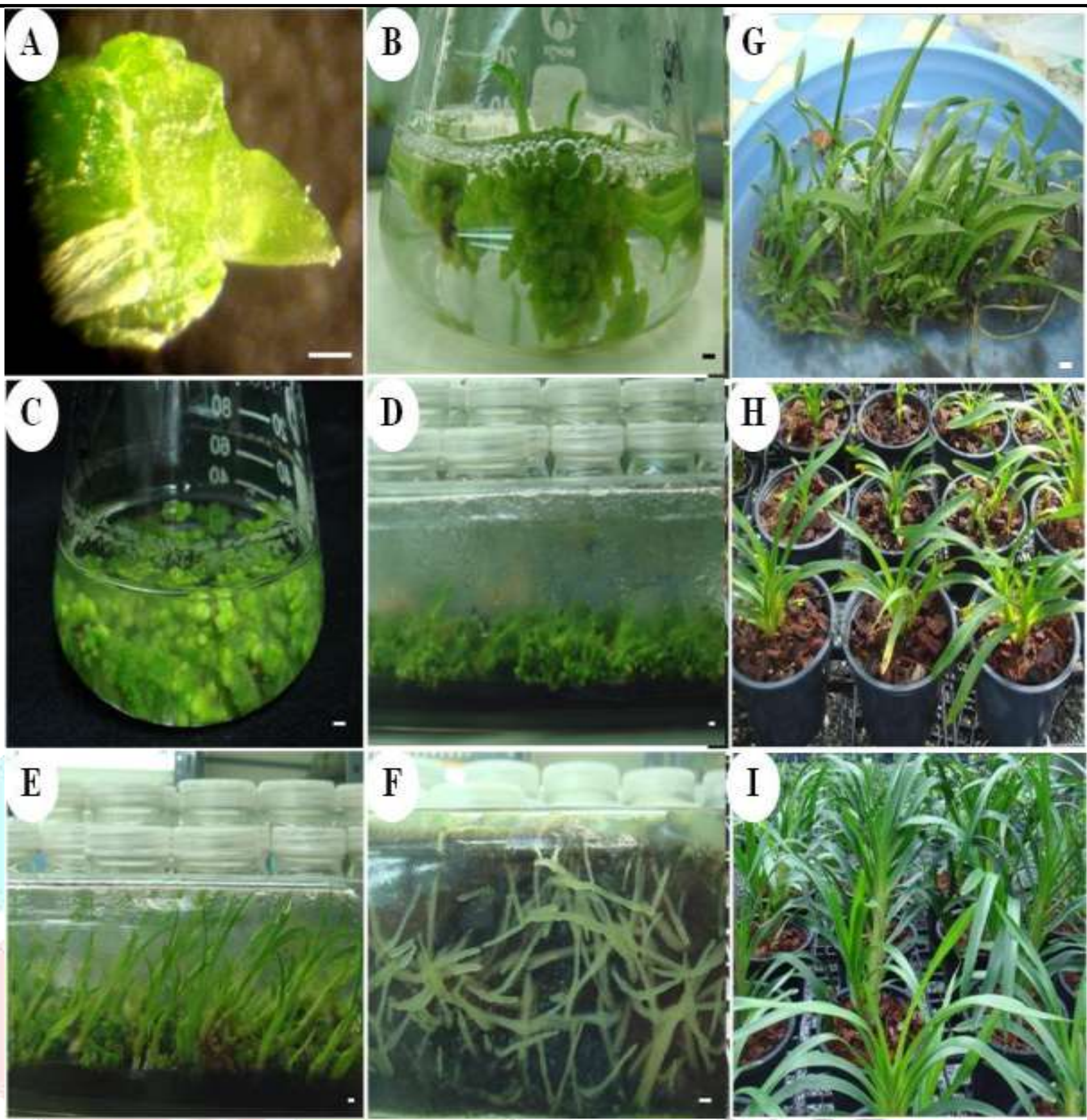
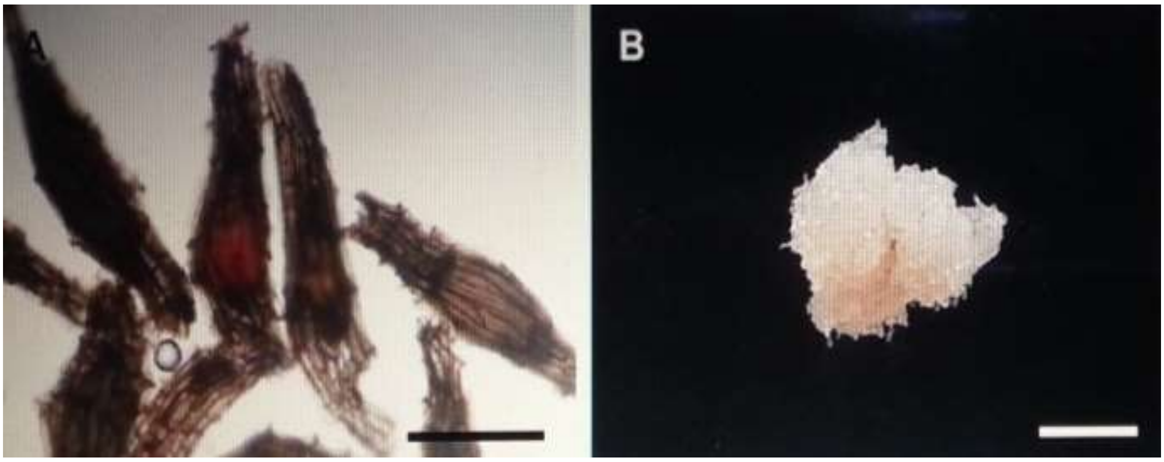


Figure 2. Establishment of *G. speciosum* micropropagation. (A) A shoot tip was excised under a stereo microscope. (B) PLBs were induced in ½MS liquid medium (2 months after culture). (C) PLBs were subcultured for multiplication (1 month after culture). (D) PLBs were cultured on ½MS solid medium supplemented with 0.05% (w/v) of activated charcoal, 2.0 mg/l NAA and 1.0 mg/l BA. (E) and (F) Shoots and roots were induced (3 months after culture). (G) Plantlets were removed from the bottle and washed with tap water. (H) Plantlets were transplanted to plastic pots filled with small pieces of coconut husk. (I) Plants grown 2 years in the saran house. Bar = 1 mm.



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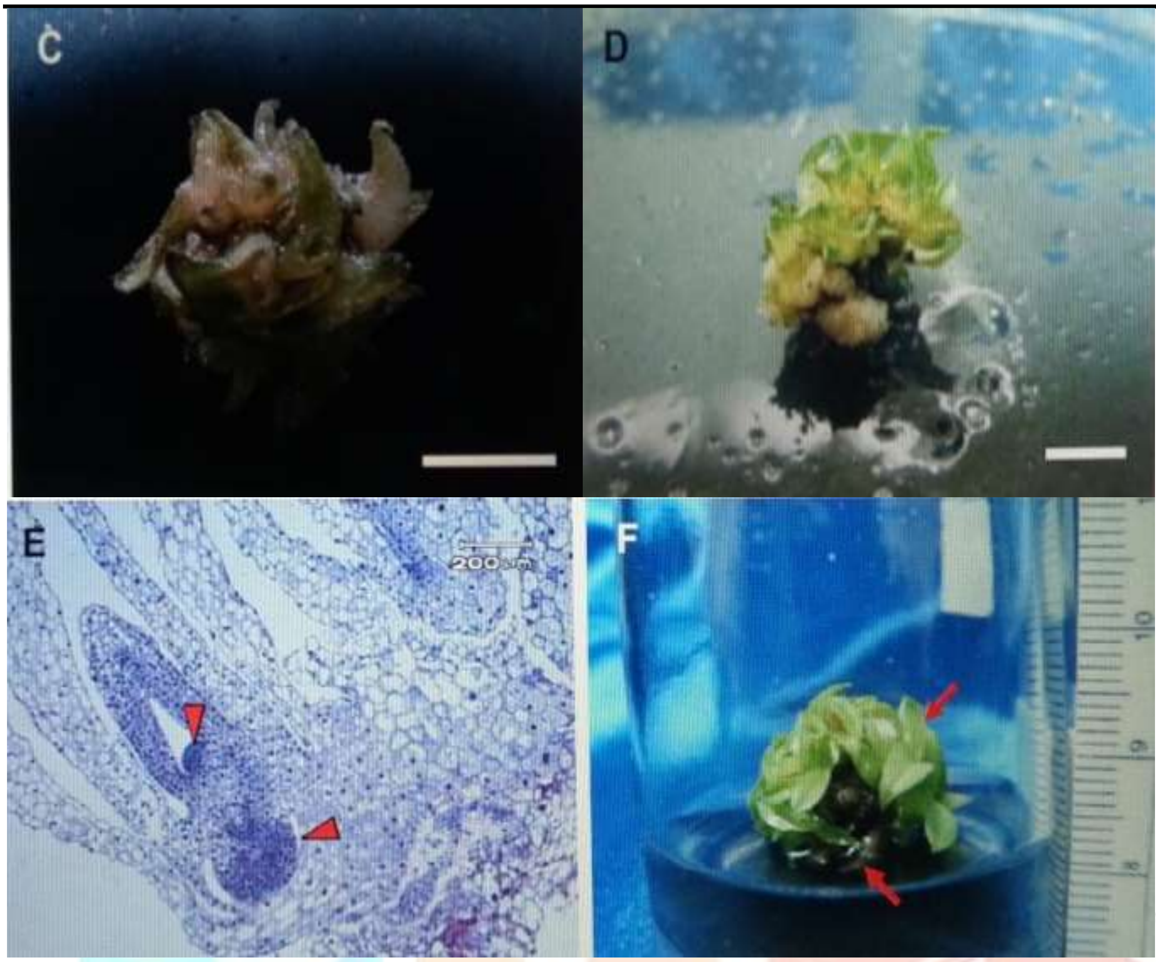

Figure 3.Plant regeneration from seed-derived calli of *Paphiopedilum niveum* (Rchb.f.) Pfitz. (A) Viable seeds for callus induction. (B) Mass of yellow callus with small protuberances. (C) Cluster of regenerated shoots on modified MS medium supplemented with 20 g/l banana homogenate. (D) Cluster of PLB-differentiated shoots and roots cultured on modified MS medium supplemented with 50 g/l banana homogenate. (E) Longitudinal section of a shoot cluster at the stage shown in D shoot (arrow) and root (arrowhead) apical meristems. These shoots connect with each other at their base. (F) PLB-derived plantlets with healthy shoots and roots (arrow) after 4 months of culture on modified MS medium supplemented with 50 g/l banana homogenate. Bars (in µM): A=250; B=1000; C=5000; D=6000; E=200.

ORCHID BREEDING

There are many outstanding intraspecific, interspecific, and intergeneric hybrids using Thai orchid species as parents (Thammasiri, 2016). This will encourage people to grow hybrids instead of wild Thai orchid species. *Dendrobium* (Figures 4 and 5), *Vanda*, *Rhynchostylis* (Figures 6 and 7), *Ascocentrum*, *Aerides*,etc. are popular genera for breeding new outstanding cultivars with good horticultural characteristics**.**

Atthebeginning, theintroducedspecies*Dendrobiumsuperbiens*,the hybrid *Dendrobium*Pompadour and otherdendrobiumswereusedasparentsforhybridization. Selections of offspringwereconducted carefully and furthermicropropagationwas carriedouttomake a largecommercialscale growing possible. *Dendrobium*Pramot ‘No.1’ and ‘No.3’, *Dendrobium*Waipahu, *Dendrobium*Intuwong, *Dendrobium*Ekapol ‘PandaNo.1’, ‘PandaNo.2’, *Dendrobium*Sonia ‘No.16’, ‘No.17’, and ‘No.28’ providegoodexamples of successful*Dendrobium*breeding.

*Vanda*Rothschildiana (*Vandacoerulea* x*Vandasanderiana*) wasadoptedasthefirst*Vanda*cut-flowercultivarabout50 yearsago. Ittook 6 yearsfromseedlingtoflowering and produceda lowyield. Later, *Vanda*Varavuth (*Vanda*Lenavat x *Vandacoerulea*) wasregisteredin 1973. Ittookonly 4 yearstoflower. Further, *Vanda*Wirat (*Vanda*MadameRatana x *Vandacoerulea*) and *Vanda*Mahakkaphongs (*Vanda*Boonchoo x *Vandacoerulea*) wereregisteredin 1979 and 1982, respectively. Bothcultivarstook 3 yearstoflower, producedbrightpurpleflowers and longsprays and a highyield of 8-10 spraysperyear.

Apartfrom*Dendrobium* and *Vanda*, otherorchidsusedforself, intraspecific, interspecific and intergenerichybridizationincludedindigenousThaiorchidspecies, as for examples,*Ascocentrum*spp., *Aerides*spp., *Rhynchostylis*spp., etc., and someintroducedgenera, suchas*Cattleya*, *Mokara*, *Ascocenda*, *Aranda*, and *Renanthera*.

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https://doi.org/10.56975/ijcrt.v13i8.292526

Figure4.*Dendrobium cruentum*hybrids.

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Figure 5. New *Dendrobium* hybrid for cut-flowers.

Figure 6. A hybrid between *Rhynchostylis gigantea* (white) X *Vanda coerulea.*

https://doi.org/10.56975/ijcrt.v13i8.292526

Figure 7. New vandaceous hybrids for cut-flowers.

ORCHID PRODUCTION TECHNOLOGY

Asexualpropagationbydivisionorcuttingisalsopracticedbutmainlyas a hobby and notforlargescaleproductionbecausemultiplicationisslowerinsuchcases. Thismethodis, however, unavoidablyusedwhentissueculturefailstowork.

Greenhouses

Air movementisthekeyfactorforsuccessfulorchidgrowing. Mostgreenhousesareopenatthesidestofacilitateproperaircirculation and alsotopreventheataccumulationduetothehightemperature of 30-40°C duringthe day. GreenhousesfororchidgrowinginThailandweremade of teakwoodduringthe earlyperiod. Theylastedover twenty years and wereresistanttotermites. Roofs, made of about 1inch thickteakwoodstripsspaced 1 inchapartallowed 50 percentsunlighttopenetratein a sufficientquantityasrequiredbytheorchids. Later, due to steepescalationinteakwoodprices and shortages, otherhardwoodswereused, butduetotheirhigh-costorchidgrowingremainedanexpensiveproposition. Bamboowerealsousedforshading of orchids. Theylastedonly 2-3 years.

Presently, nettednylon, called “saran”(Figures 8 and 9), isusedforshading, atthetop and sides of greenhouses, alsoknownas “saranhouses”. The saranlastsover 5 years and distributesuniformsunlightwith 30-80 percentshadingdependinguponthenet. There are manyadvantagestosaran, including, verylowprice, easeofinstallationorremoval, lightweight, and lowlabourinput. Galvanizedpipesareusedforpoles, and galvanizedstringsorplasticcoatedwirestoholdthesaran in place. Theserust-proofconstructionmaterialshelpmaintainthegreenhouseforlongperiods.

Figure8.An orchid saran houses.

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Figure9. Growing *Dendrobium* for cut-flowers.

Plantingmaterials and containers

Plantingmaterials and containershavebeengraduallyimprovedforproducinghighyield and qualityflowersat a lowcost. The locallyavailable, inexpensive, coconuthusksarewidely and successfullyused, especiallyfor*Dendrobium*cut-flowerproduction. Thesearecut and compactedinto 24x32 squarecentimeterblocksorcuttofitinsmallorlargepots orjustcutlongitudinallyintochunks and putonthetableinthegreenhouses(Figure 10). The coconuthuskslastforabout 3 yearsdependingonmoisturecontent.
Old*Dendrobium*pseudobulbsfromoldcoconuthuskplantingmaterialscanbecutintoeachpseudobulb and usedas a starterfornewshootsinnewplantingmaterials. Nowsaday. cementblocksarereplacedforcoconuthuskblocksinmanyorchidfarms(Figure11).

Figure10.Growing orchids using coconut husks and charcoal with different sizes (Top) and growing Dendrobium cut-flowers in 24x32 square centimeter blocks (Bottom).

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Figure 11.Growing *Dendrobium* for cut-flowers on cement blocks, watering with sprinkler system.

Orchidswithlarge-roots, suchas*Vanda*, *Aranda*, *Ascocenda*, *Mokara* and *Arranthera*needgoodaeration and drainagewhichisprovidedbycharcoal and osmundaorbyusinglarge-sizeplantingmaterials. Also, basketorclaypotswithmoreholesatthesidearerecommendedforlarge-rootedorchidstoensuregoodaerationanddrainage(Figure 12).

Figure 12. Growing vandaceous orchids in plastic baskets.

Small-rootedorchids, suchas*Dendrobium*, *Oncidium* and *Cattleya*needclaypotswithholesonthesides and filledwithcharcoalorcoconuthusks. Charcoal and osmunda, whicharemoreexpensive and alsorarelyavailable, have beenreplacedbycoconuthusks. Coconuthusks (althoughcheaper) cannotbeusedtogrowlarge-rootedorchids. Theycanbeusedtogrowonlysmall-rootedorchids. Alternately, thesearegrownon 24x32 squarecentimeterblocks of coconuthusks. Claypotsareusedforpot-plantsales, whilecoconuthuskblocksareusedforgrowingcut-flowerorchids.

Use of plasticpots, especiallydesignedforgrowingorchids, or of foamaspotting medium and support, hasalsobeenused successfully(Figure 13). Theyreducetheinvestmentcost and weight of themedia and containersforgrowingorchids.

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Figure 13. Growing orchids in pieces of foam as planting materials (Left). Foam does not stop root growth (Right).

Waterresources
Thailanddoesnothaveproblems of watershortagebecausemostorchidgrowingareas, locatedintheCentral Plains, arelowlandswithhighundergroundwaterlevel. Ponds, canals and riversarealsoscatteredallovertheare a. Thusthereisnoproblem of waterwhichisessentialfororchidgrowing. The orchidgrowerspumpthewaterdirectlyfromthenaturalwaterresourcestothefarm, orpumptothereservoirinthefarmpriortoirrigatetotheorchidplants. Rainwaterhasthebestqualityfollowedbyriverwater, canalwater and tapwater.

Fertilizers
Orchidgrowersuseliquidfertilizeronce a week. The ratio 1:1:1 fertilizerisusedingeneral. The ratio 1:2:1 fertilizerisusedtostimulatefloweringandhighpotassiumwillbeappliedforhighqualityflowers.

Pestcontrol
Inordertomeetinternationalstandardsforgoodhealth,aswellasquality of orchidplants and flowers, prophylacticspraysarecarried outperiodically. Variousdiseases,insects, and viruses, which attackorchidsinThailandhavebeenidentified and controlmeasureshave beenestablished.

Production, postharvest, and packagingtechnology
Usefulresearchonpostharvesttechnologyforthelast 15 yearshashelpedtoensurethatorchidcut-flowers and plantsarrive at their destinations fresh and havelongvase-life.
ThaiPackagingCenterwasestablishedunderthe ThailandInstitute of Scientific and TechnologicalResearch (TISTR) toimprovepackaging, decreaselosses, increaseexportefficiency and upgradepackagingstandards, particularly of orchidfreshflowers.Efficientmedia and concernedgovernmentalorganizationshavebeeninstrumentalindissemination of informationontechnologytotheorchidgrowers and exporters.

Secrets of Success (Thammasiri, 1997)
The key factors responsible for success of orchid production and trade vis-a-vis economy in Thailand may be summarized as below:

1. Favorable climates.
2. Availability of good quality water in plenty.
3. Leadership in adoption and popularization of orchid cultivation.
4. Richness of indigenous orchid genetic resources.
5. Improved production technology, greenhouses, containers, postharvest processing, quality control, packaging and transport and their application in orchid trade.
6. Efficient communication networks.
7. International acceptance vis-a-vis maintenance of standards.

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https://doi.org/10.56975/ijcrt.v13i8.292526

CONCLUSIONS

Thai orchid cultivation for the international markets has a bright future. The export values are high and quite stable. Orchids will continue to dominate other ornamental crops in Thailand due to better technology know-how in orchid cultivation, suitable climatic conditions, experienced and skillful growers and exporters as well as their nation-wide popularity.

The orchid cultivation in Thailand is a good example of sustainable use for an ornamental crop, which does not fall in the category of staple food, to have become the major crop of this country. It took a long time to be accepted gradually but firmly for earning high income and thereby enhancing the agrarian economy which can follow suit.

Literature cited

Arditti, J. and R. Ernst. 1993. Micropropagation of orchids. John Wiley & Sons, Inc., New York.

Cronquist, A. 1981. Anintegratedsystem of classification of floweringplants.ColumbiaUniv.Press,NY.

Department of International Trade Promotion. 2022. Data onimport-export of orchids. Ministry of Agriculture and Cooperatives, Bangkok, Thailand.

Department of Customs. 2022. Data onimport-export of ornamentalcrops. Ministry of Finance, Bangkok, Thailand.

Kaewubon, P., S. Sangdam, K. Thammasiri, and U. Meesawat. 2010. Plant regeneration through somatic embryogenesis from callus-derived PLBs of tropical slipper orchid (*Paphiopedilum niveum*(Rchb. f.) Pfitz.). Floriculture and Ornamental Biotechnology 4 (Special Issue 1): 29-35.

OEPP. 1996. Thailand's biodiversity. Ministry of Science, Technology and Environment, Bangkok, Thailand.

Sopalun, K., K. Thammasiri, and K. Ishikawa. 2010. Micropropagation of the Thai orchid *Grammatophyllumspeciosum*lume. Plant Cells, Tissue & Organ Culture 101: 143-150.

Thammasiri, K. 1997. OrchidsinThailand: A successstory. APAARI, FAO. AngkorPublishers (P.) Ltd., New Delhi.

Thammasiri, K. 2015. Currentstatus of orchidproductioninThailand. ActaHorticulturae. 1078: 25-33.

Thammasiri, K. 2016. Thaiorchidgeneticresources and theirimprovement. Horticulturae. 2(3): 1-13.