



Vision 2030



राष्ट्रीय लीची अनुसंधान केन्द्र National Research Centre for Litchi

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सत्यमेव जयते

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SECRETARY & DIRECTOR-GENERAL

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Foreword

The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

National Research Centre for Litchi, Muzaffarpur has laid major emphasis on widening the narrow genetic resources base in the country through introduction and collection from the exotic and indigenous sources. The available germplasm will be characterized, evaluated for different purposes, conserved for posterity and utilized as breeding material, rootstock and for commercial cultivation. The suggested basic and strategic research programmes aim at developing technologies to

enhance the productivity and quality and facilitate processing and value addition including product refinement through overcoming the constraints in improving the quality of produce and value added products for increased net return from the domestic and export markets. Linkages with national and international organizations have been proposed to develop the NRC for Litchi as the centre of excellence for litchi in the country.

It is expected that the analytical approach and forward looking concepts presented in the '*Vision 2030*' document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.

Dated 28th June, 2011
New Delhi



(S. Ayyappan)

Preface

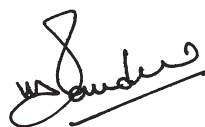
Research on litchi was started in the late eighties in India and only scanty research works have been done. Our country ranks second in terms of litchi production in the world after China. Litchi is grown extensively in the northern, eastern and north-eastern parts of the country particularly in the plains and foot hills enjoying subtropical climatic condition. With increasing population and its demand at National and International level, research needs are very much felt in India. In view of this, Indian Council of Agricultural Research established the National Research Centre for Litchi on 6th June, 2001 at Muzaffarpur, Bihar, to carry out mission oriented programmes including basic and strategic research on all aspects of litchi. Considering the National scenario of present level of production, its constraints and demand in future with the available resources, the Vision 2030 document has been prepared to execute effective research and development programmes.

To achieve the National goal of harnessing science and technology by interfacing the research and extension initiative for enhanced productivity, quality, processing and high valued new products for sustained growth of Indian litchi, we need to make concerted efforts for achieving the targets fixed. The Vision 2030 document of NRC for Litchi, Muzaffarpur, gives an overall view of present activities, its achievements, National and International scenario, issues and strategies with future thrusts, medium and long term plans with expected output and outcome, infrastructure requirement, HRD, budget and resource generation.

Effective implementation and successful completion of the proposed research programmes are expected to help not only to overcome the impediments in expanding the area under litchi cultivation but also to sustain quality production of fresh litchi fruits and processing for value added products to fulfill the ever increasing demand of litchi.

I am grateful to Dr. S. Ayyappan, Director General, Dr. H.P. Singh, DDG (Hort.), ICAR for their valuable suggestions. Thanks are also due to my colleagues Dr. S.D. Pandey, Pr. Scientist (Hort.) Dr. Awtar Singh, Pr. Scientist (Plant Breeding), and Dr. Sanjay Kumar Singh, Scientist (Hort.) for their help and assistance in preparation of the manuscript and document.

Dated 14th July, 2011
Muzaffarpur



(Vishal Nath)
Director
N.R.C. for Litchi,
Muzaffarpur

Preamble

Litchi (*Litchi chinensis* Sonn.) is an important commercial fruit crop with tremendous export potential and plays a significant role in our national economy. There has been ever increasing demand of litchi in domestic as well as international market. Owing to specific climatic requirement, the successful litchi cultivation is restricted in certain areas of the country.

Although, India is the second largest producer of litchi but its productivity in the country is quite high in comparison to its native country and still the scope of improvement do exist. Presently, it is grown in an area of 74,000 ha, with productivity level of 7.0 - 8.0 t/ha, out of which Bihar occupies more than 40% area and 50% production. The existing wide gap in the present productivity level and realizable yield needs to be addressed sincerely. In spite of its vast export potential, only a negligible quantity of the produce is being exported due to obvious reasons. Therefore, there is a need for increasing not only the production but also the proportion in export of quality litchi fruits vis-a-vis cost effective post harvest handling. The commercial level of processing and value addition and development of quality human resource in the country will further provide a boost to litchi industry. Very little attention on research and development had been paid on this crop in the past. The need of systematic research for identification of new potential areas, development/improvement of technologies for enhancing productivity and quality along with processing/value addition, development of varieties with high yield and processing value will be the main focus in years to come. With a view to emerge as a vibrant

Centre/Institution in India and to sustain comparative advantage in the changing scenario at global level in production, processing, product development and HRD, there is a need to develop the Vision 2030 document for the Centre to provide a road map for undertaking activities in the right direction to achieve targeted growth in litchi research and development. It would aim at addressing issues related to social justice, growth, food and nutrient security, competitiveness, relevance and coordination to develop and sustain India as leader in all aspects of litchi.

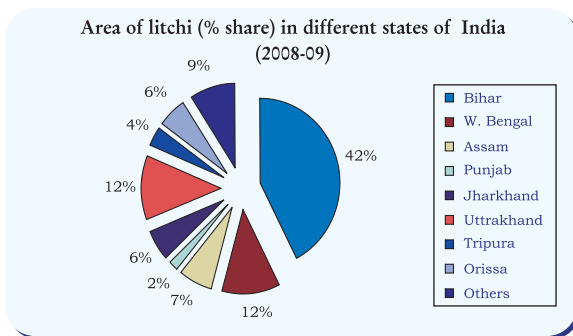
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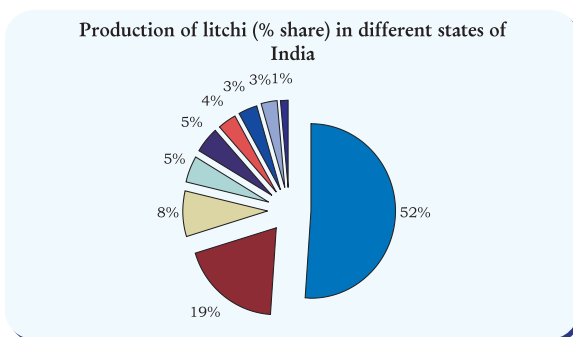
Litchi scenario in India

Litchi is an evergreen subtropical fruit, known for its deliciously flavored juicy aril with high nutritive value and refreshing taste. The cultivation of Litchi is restricted to very few countries in the world with a total area 7,73,000 ha and production of 23,37,000 tonnes. India and China account for 91 per cent of the world litchi production. In India, the commercial cultivation of litchi is restricted in the northern part, particularly in the foothills of Himalayas from Tripura to Jammu & Kashmir and Gangetic plains. According to National Horticulture Board, about 4,83,000 MT of litchi is produced annually from 74, 000 hectares of land in our country. The climatic requirements of this crop are exacting in nature, therefore, making production limited to few states. There is a sizeable increase in acreage and production of litchi in India over the years. Cultivation of litchi has increased from 69,000 ha in 2007-08 to 74,000 ha in 2009-10. In terms of production, it has increased from 4,18,000 MT to

4,83,000 during the same period. The total production of litchi is concentrated mainly in Bihar, West Bengal, Uttarakhand, Assam and Jharkhand and to a smaller extent in Tripura, Punjab, and Orissa. In India, Bihar is the leading state in litchi production and during 2009-10 the state has produced 215.13 thousand tonnes, followed by West Bengal (74.9 thousand tonnes) and Assam (24.4 thousand tonnes). In other states, production ranges from 11.9 thousand tonnes in Orissa to 16.5 thousand tonnes in Jharkhand. Most plantations of Litchi in Uttarakhand are young and yet to start bearing.



Litchi accounts for around one per cent of the total area under fruits in the country, but it has a definite economic significance in its growing areas. Although the specific soil and climatic requirements of Litchi crop restrict its cultivation only to certain regions in the country, our productivity is the highest in the world next only to Taiwan. As per quantum of produce, India is the second largest producer of litchi in



the world next to China. Bihar accounts for major share of more than 50 per cent of the country's total production. The harvesting period extends from May to July in different parts of the country. Globally, the countries of southern hemisphere such as South Africa, Madagascar, Australia and Brazil harvest litchi during October to March whereas in northern hemisphere, the fruits are harvested between April to August. Approximately 90 per cent of the litchi produce is utilized as fresh, of which at least 25 per cent is subjected to post harvest losses at various stages. Usually, there is glut of fresh fruits in the market during harvesting season, which is of very short span of 15-20 days at one place. The litchi maturity in our country starts from Tripura followed by West Bengal, Jharkhand, Bihar, UP, Uttarkhand, Punjab and Himachal Pradesh. A meager quantity is exported, though, there is great demand and has lot of scope to increase the quantum of export, since the harvesting season is quite different in other parts of the world.

This can be further boost up by exploring the newer areas of litchi production in the southern part of the country where the fruits can be harvested during November-January and encouraging more area and improved production technologies in Tripura, Assam and other north eastern states where fruits can be harvested little early and send to International and domestic market at premium price.

Litchi scenario in Bihar

Litchi occupies an important place in the Horticulture landscape of Bihar owing to its geographic confinement and the magnitude of its share to the overall production in the country. The soil and the climatic conditions of north Bihar (almost 27 districts of the state) favour high yields with quality fruits of litchi. Muzaffarpur is the largest litchi producing district with a production of 86,000 MT followed by Vaishali (36, 498 MT), Samastipur (3500 MT) and Sitamarhi (20,518 MT). West Champaran, East Champaran and Katihar are other three districts having production of more than 30, 000 MT. Litchi is grown in an area of 31,000 hectare and production has been increasing over two per cent annually. Litchi of Bihar, particularly those belonging to the Shahi and China group of varieties, are in great demand in national market. Shahi fruits of extra large group fetch high price in international market too. However, the state is witnessing formidable loss in production because of faulty method of harvesting, lack of storage facility, mismanagement and mishandling of produce, loss in transit and more importantly, unsuitable and unscientific packaging. The ministry of commerce and industry has authorized the Indian Institute of Packaging (IIP), Hyderabad, an apex body, for promotion of marketing standards of litchi in the country which has yet to make impact.

Export and market potential of Litchi fruits

In recent years, export of litchi has increased to SAARC countries and UAE but there is excellent potential for export of litchi to GCC countries at competitive prices compared to Thailand, as India produces finest litchis in the world. India is also nearer to Gulf countries compared to Thailand and China. EU countries also import sizeable quantities of litchi but potential needs can be exploited by aggressive marketing and supplying better quality litchi having minimum pesticide, residues, etc. We have to exploit potentialities of export of organic litchi in foreign markets and government of Bihar has started promotion of organic litchi with brand 'JaiB'. Due to perishable nature of produce, establishment of pack houses, cool chain management, refer van transportation system,

new market outlets in speciality areas and establishing, a brand name for 'Bihar Litchi' will further strengthen the litchi industry.

Litchi producing areas in Gurdaspur and Hoshiarpur districts of Punjab are near to Amritsar International Airport. Export of litchi from this area can be enhanced by setting up of pack house in that area.

Technology for CA and MA storage of litchi are being standardized at NRCL and in due course of time it will be perfected so that shelf life of litchi can be extended. Then, litchi to nearer areas like Gulf countries can be sent by refer containers through MA cartons, if perfected. Residue analysis laboratory needs to be set up at least in Muzaffarpur, Bihar.

About NRCL

National Research Centre for Litchi (NRCL) was established on 6th June, 2001 at the fag end of IXth Plan by Ministry of Agriculture, Government of India under the aegis of Indian Council of Agricultural Research to act as a Nodal Centre to work exclusively on litchi Research and Development in India. The Centre started functioning from 2002 with first batch of two Scientists joined the Centre in March, 2002. The lease deed was signed on 25th June, 2002 between the ICAR and Government of Bihar to transfer 100 acres of land to the Centre at Mushahari, [on Muzaffarpur – Pusa Road], Muzaffarpur, Bihar. The Centre was strengthened during 2005 and onwards by redeploying scientific, technical and supporting staff along with administrative support and financial assistance for developing infrastructural facilities and to carry out the research work. The climate is typically subtropical with an average annual rainfall of 1100 - 1300 mm. Presently, the centre is addressing the issues related to basic and strategic research, quality human resource development, technology backstopping, policy planning, social justice, growth, food and nutritional security, competitiveness, relevance and co-ordination to develop and sustain India as leader on litchi.

Mandate

- Systematic collection, conservation, characterization, documentation and utilization of litchi cultivars/species



- Evolution of high quality cultivars for tropics and sub-tropics through breeding, genetic engineering/biotechnology and bio-informatics for domestic and export markets.
- Undertake basic, strategic and applied research to enhance productivity, processing and utility
- Develop center of excellence for litchi and act as repository/data base/ware house on litchi
- Act as center for HRD and capacity building in modern technology on all aspects of litchi
- Establish linkages with National and International organizations
- Set up referral laboratory for quality analysis and certification

Objectives

- Genetic resource management and crop improvement.
- Evolving high yielding and high quality varieties.
- Undertake basic, strategic and applied research for productivity and quality enhancement and profitability.
- Establish centre for HRD and provide consultancy services to end users.
- Act as centre of excellence for litchi related informations, quality analysis laboratory and certification unit.
- Establish linkages with National and International organisation in field of litchi research and development.



Progress of research at NRCL

The Centre has developed its research activities in 4 theme areas covering almost all aspects of litchi gene pool management and diversity creation, conservation and characterization, crop improvement, sustainable production system management and post harvest management.

Crop Improvement: The centre started working on genetic resource management with collection of forty seven (47) accessions of litchi from Bihar, Jharkhand, West Bengal and Uttarakhand. Characterization (including molecular) and documentation of litchi cultivars and related species from different agro-climatic zones are in progress. Longan (a related species of litchi) is performing well under Muzaffarpur conditions as 15 % plants flowered in the 3rd year of its planting and its fruit matures in August. However, the quality of longan fruit and its acceptability needs to be properly addressed. 24 superior clones of litchi



High density planting of Litchi

and 10 of pummelo were identified and are under evaluation. Eight hundred seedlings of Shahi and China cultivars of litchi are under evaluation for search of some positive variants. Precocious gene harnessing and provincial populations are other focussed areas in crop improvement of litchi.

Crop Production: Plantation of different litchi cultivars in 20.0 ha of land under different experiments along with 1.0 ha as mother block has been completed at research farm of the Centre. Package of practices for higher production of quality litchi fruits by foliar application of Planofix @2.5ml/10 litre of water or NAA 20 mg/litre of water, one week after fruit set significantly checked the fruit drop. Spray of 4.0 %KMnO₄ delayed colour break by 5 days in litchi cv. Shahi. Three sprays of Borax @ 4.0g/litre of water during fruit development stage at 15 days interval maintaining moisture level in the soil has been standardized for checking the fruit cracking and quality improvement. Technique for tree architecture/canopy management by pruning of non selective twigs every year after harvest and opening central portion to maximize solar energy utilization has been standardized and disseminated to the litchi growers. Application of GA₃ (75ppm and 50ppm) and MH (25ppm) during October showed early initiation of flowering panicle and conversion of some vegetative flushes into mixed flowering panicle in comparison to control.

Inter space utilization protocol for young non-bearing litchi orchards in form of different models have been developed. This includes Model 1: Litchi based cropping system with banana which has showed better potentiality for quality production for three consecutive years. Model 2: *Okra- Gladiolus* crop rotation has been found to be the best in terms of net return and plant growth followed by *Cowpea-Potato-Onion* and *Cowpea-French bean-Okra* crop rotation. Reiterative pruning methods and rebuilding canopy for rejuvenation of old senile orchards (>40 years) has been standardized. The technology explains careful de-topping at 2-2.5 m height during the month of August followed by thinning of unwanted shoots after six months and applying nutrition as per schedule of developed plant (1000 : 500 : 500g NPK per plant per year



Intercropping with litchi

alongwith 80 kg FYM) resulted in enhanced production of quality fruits after 3 years. Riverbed soil + Vermi-compost (2:1) + fertilizers (DAP+MOP 5g each) showed healthy and vigorous saplings growth. Off season plant propagation through air layering has been standardized to reduce the post nursery maintenance cost. Annually 15000 quality plating materials are being raised and distributed by the centre's nursery to interested growers and various stakeholders.



Old senile litchi orchard



Reiteratively pruned litchi trees



New flushes in cut trees



Canopy development

Crop Protection: Major pests of litchi prevalent in the area have been identified, which include fruit borer, shoot borer, leaf miner, leaf roller, mite, bark eating caterpillar, leaf eating weevil, bug. Some minor pests like mealy bug, mealy scale, mango hopper, grass hopper and field crickets (young plants) have also been noticed in litchi orchards. *Trichogramma chilonis* @ 50,000/ha and application of Nimbecidine @ 0.5%, Cypermethrin @ 0.005% + Nimbecidine @ 0.5% and Cypermethrin + Nuvan have been found effective in minimizing the damage caused by fruit borer. Lower percentage (5.3%) of damaged fruits at harvest was recorded using pheromone trap + Tricho card @ 50000/ha and *Kamdhenu Keet Niyantarak* sprays followed by pheromone trap + Tricho card + Nimbecidine when sprayed at specified time.

Post Harvest Management including Value Addition: Protocol for litchi wine and litchi nut is developed. The process of wine making from litchi fruits yielding 11.5% alcohol has been standardized in collaboration with CTCRI-RS, Bhubaneswar. Physico-chemical studies of litchi fruits during fruit development stage revealed that last week of May is the best time for harvesting. Effect of chemicals and PGR on fruit drop and cracking revealed that KMnO_4 (2.0 & 4.0 %) and CaNO_3 (1.0 %) delayed the colour break stage by 4 days and increased the fruit retention by 18.0 and 26.0 per cent, respectively. Covering the canopy with 30% green and 50% white shade net has extended the harvesting period in Shahi litchi by almost 16 days.

For improving water use efficiency, various measures have been taken up. 10 ha of farm area has been brought under drip irrigation



Litchi Nut



Litchi Wine

networking. Mechanization has been introduced in Litchi. Now the harvesting of litchi fruits are being done by Litchi harvester cum pruner platform.

So far 60, 000 litchi gootee have been sold to the farmers as propagule and 17.5 tonnes of potato seed tubers are produced at research farm. One national seminar was organized on “Production, processing” marketing and export of litchi for economic prosperity” during 08-11th June, 2008. Recently, Two National Consultations were also organized on 01-02 September, 2008 and 2nd September, 2009 on production of quality fruits for exprt and on strategies for research in Litchi, respectively.

The scientists at the centre have written 2 books and 5 technical bulletins. The centre has developed protocol for commercialization of litchi wine, Rejuvenation of old senile litchi orchards, integrated management of insect pests (fruit borers) of litchi and Litchi based cropping system for young orchards.

The centre has been able to impart many training programmes, for farmers and extension functionaries, students and state officers. The scientists have been able to attract funds from various agencies like NHB, FAO, etc. and the centre has been an active partner in various network projects such as AMAAS, IPR, UNEP-GEF, etc.



NRCL 2030

Under the above mentioned background, National Research Central for Litchi will have to play an important role in the transfer of production, protection and PHM technologies specially tailored for the need of farmers of the litchi growing states. India can withstand the competition only by increasing productivity and reducing cost of production of quality and export oriented produce. The envisaged increased share of value added products of litchi in the export basket of fruits needs scientific packaging and processing facilities both on farm and outside.

Mission

The mission of National Research Centre for Litchi is to harness science and technology by interfacing research and extension activities for enhanced quality production, productivity, processing and diversification for sustained litchi production, industry and trade.

Vision

To develop this centre as centre of excellence in the field of research, extension and training, at par to any best institute in the world for providing livelihood security and economic prosperity of litchi growers and traders.

Focus

The main focus on researchable areas to accomplish vision is:

- Systematic collection, conservation, characterization and documentation of litchi germplasm for future use in Crop Improvement programmes.
- Evolving high quality cultivars for tropics and subtropics through selective breeding and harnessing genetic engineering and bio-informatics for domestic and export market.

- Undertake basic and strategic research to enhance productivity, processing qualities and value addition along with off season cultivation of litchi.
- Develop centre as an centre of excellence for litchi research and act as repository/data base on litchi.
- Act as centre for HRD and capacity building in modern technology on all aspects of litchi and also consultancy services provider.
- Establish linkages with National and International organizations working on Litchi.
- Set up a referral laboratory for quality analysis and certification of new cultivar of litchis.

IMPACT ASSESSMENT

Growth

The technologies developed in areas of production and protection brought about enormous benefits through increased production and productivity per unit area. Ray of hope in terms of identification of new areas may lead to area expansion in non-traditional areas. The production technologies have a bearing on the cost of production and quality in terms of nutritive value and also in terms of export promotion. Apart from the direct economic benefits, the technologies made impact indirectly in the form of pollution control and improved ecosystem. The research achievements made so far have necessitated further refinement of research work to plug the gap between the technology developed and the changing needs. They also opened new avenues for further research.

Crop Improvement

This crop is the least exploited for genetic improvement because of its narrow genetic base. The Centre has collected 47 germplasm/cultivars and maintained them in the field gene bank but the hunt is on to collect maximum number of germplasm of litchi and allied species from indigenous and exotic sources for evaluation and further utilization in

crop improvement programmes. The germplasm is being characterized using morphological and molecular markers. The clonal and seedling selection are the other areas where efforts are being made to have tangible results. Breeding efficiency of litchi and longan can also be improved by Marker Assisted selection by combining heterosis characters and selection of closely linked target gene at early stage.

Crop production

Standardization of agro-techniques with highest input use efficiency through constellations of different components in the form of integrated nutrient, water, weed and insect-pest disease management has been aimed for quality production. Cheaper and faster method of plant regeneration using hardier root stock would be the focus in plant propagation and nursery management in litchi. Plant canopy architecture management to convert solar energy into chemical energy, leading to tree longevity and high quality fruit production has to be tendered. The technique for rejuvenation of old senile orchards has been standardized with farmers participation and is being adopted by the farmers. The effect of plant growth regulators/chemicals on fruit set, fruit drop, seed abortion, extending harvesting period and quality of fruits is required to be standardized and the Centre has made a significant progress in this direction.

Organic farming, litchi based farming systems and protected cultivation of litchi are also important fields to be investigated. The horizontal and vertical expansion in the production of litchi can be achieved via increased productivity per unit area and expanding litchi cultivation in non-traditional area, but potential locations in the country. These will increase total production and also the availability of fruits for a longer period, particularly during off season.

Crop protection

Crop protection strategies evolved by the Centre are being adopted by the growers, but they still require refinement and standardization in an integrated management mode. Forecasting models for different major insect pests need to be evolved for residue free and quality litchi production.

Post harvest Management and Value addition

Proper harvesting in timeframe, handling, packaging and storage methodologies are to be perfected for extending availability of fruits and long distance transport and overseas markets to avoid post harvest losses and seasonal gluts in the market. Consumer acceptable, cost effective value added products from litchi will be another thrust area in years to come.

Input-output Assessment

Introduction and evaluation of varieties from litchi growing countries of the world are needed at the initial stage to increase the genetic variability for further development. Adequate efforts are required to evaluate more and more cultivars in different agro-ecological regions of the country for area expansion under non-traditional belts. Hybrids, which generally have higher yields of quality fruits are lacking in this crop. Use of rootstocks and grafting techniques needs to be standardized in Indian context for the litchi crop. Research inputs on disease and pest have resulted in reducing the pre and post-harvest losses. Association and role of mycorrhiza in context of litchi needs to be ascertained. Research input on maturity standards, handling, storage (pre-cooling and cold storage) and packaging have yielded commensurate results. Retention of bright red colour during long storage needs concerted research efforts.

Major bottlenecks

- Narrow genetic base a major bottleneck for litchi improvement.
- Low production and productivity of quality fruits in litchi.
- Availability of fruits for very short span (duration) with high post harvest losses.
- Lack of quality planting materials in litchi along with scientific knowledge.
- Short shelf life and lack of information on proper storage environment.

- Very low level of processing, value addition and export of fresh and processed litchi.
- Affinity for fresh produces vis-a-vis inefficient product diversification and dissemination.
- Low level of institutional support, infrastructure and human resource development programme.

To meet the growing demand, we have to orient our programmes to enhance production, which can be achieved by expanding area under cultivation even in the non traditional area and by increasing productivity per unit area by adopting advanced production technologies. For this purpose, the production of quality planting materials at cheaper rates is to be geared up through different government and registered nurseries to make plants available in time.

Majority of litchi plantations have become very old and senile which would also require rejuvenation for quality fruit production. Post harvest handling and management will require greater attention for this highly perishable commodity. Infrastructural support has to be provided to accommodate the fruits for their longevity and availability for a longer period in the market. Present trends of harvesting/grading/packaging would require greater emphasis by bringing about mechanization for observing strict phyto-sanitary measures to compete with the world market.

Our main competitors in the global market are Thailand, Mauritius, Madagascar and China. We have to make this commodity remunerative to producers by promoting it through organized marketing, export and processing. At present, the global share of our country in litchi is negligible, which is essentially to be increased, based on its strength i.e. the quality. We need to pay attention on evolving/developing varieties suitable for processing and export, separately. Export and processing of horticultural produce is growing at a slow pace of 15% and 10%, respectively, which requires to be raised to 25 and 30%, respectively, by 2030 in general and 8-10 % by 2030 in Litchi. This would minimize the

post harvest losses to a greater extent and increase the income and employment.

Still there lies vast scope in income and employment generation by way of establishing good nursery, mechanization in production, processing, packaging of fruits, transportation of fruits and value added products or litchi based blended products and their marketing at distant and different outlets.

It is negligibly exploited at post harvest level for processing and value addition of the fruits produced in India, such as making litchi nuts (raisins), canned fruits/juices, squash or other fruit drinks, jam, jelly and even wines, which can reduce the post harvest losses and marketing problems on account of increased production. Therefore, for making the products internationally acceptable, the identified techniques are to be perfected to increase the export potential.



Strategy and Framework

Issues

- Development of less sweet having high aril content cultivars for export purposes.
- Enhancing litchi production and productivity (per unit area and time)
- Reducing cost of litchi production and processing (pre and post harvest stage)
- Exploitation of marginal and degraded lands in traditional and non-traditional areas for commercial cultivation and maintaining the eco-system.
- Integrating litchi in farming system approach including agro-forestry or social forestry.
- Technology assessment, release, refinement and transfer to beneficiaries.
- Post Harvest Technology for litchi fresh fruits and market intelligence.
- Human resource development
- Developing NRCL as Center of Excellence for R & D on all aspects of litchi.

Strategies

- Germplasm collection, conservation, characterization, evaluation and documentation.
- Selection/improvement of cultivars through traditional and modern tools (biotech, bio-informatics, genetic engineering) for higher quality production and productivity.
- Litchi cultivation in social and agro-forestry and diversified farming system approach.
- Extending intensive cultivation in nontraditional areas.

- Improved integrated management system for nutrients, water, insect pests and diseases.
- Sustainable and economical production/protection/management system through natural resource management.
- Development of models for forewarning against natural/biological disaster.
- Developing of models for forecasting litchi production
- Mechanized farming system in litchi.
- Multiplication of quality certified planting materials for timely availability
- Litchi marketing research intelligence and infrastructure
- Simple, low cost and high recovery technology for processing of litchi along with packaging.
- Linkages with litchi related National and International organizations through networking and collaboration.
- Creating and maintaining database on all aspects of litchi.

Challenges

Litchi production is currently limited to a few states in particular locality in the country. Recently, few other states have shown interest for promoting litchi cultivation. There expansion could not be taken up firmly because of the constraints like the specific climatic and soil requirements of the commercially exploited varieties, which are limited or few in number and secondly public and private sector not coming full heartedly in support of its expansion. Inadequate institutional and infrastructural support also have been the weaknesses to harness the built in opportunities in litchi. The new Centre (NRC for Litchi) has been established at Muzaffarpur, Bihar under the aegis of ICAR to provide leadership and coordinate R & D activities of litchi in the country. Under this situation coupled with insufficient manpower and inadequate support at the grass root level, popularizing modern production technologies/promotion of litchi cultivation is a challenging task. Despite the advantages of litchi, constant product refinement and development of newer areas are imperative for sustaining.

Harnessing Science

National Research Centre for Litchi (NRCL) is committed to harness the scientific inputs for increasing productivity, enhancing input use efficiency, and reducing pre and post harvest losses, minimizing risk of climatic vagaries, improving quality of litchi through time tested conventional as well as advanced techniques and empowered human resource development.

Litchi improvement programmes aim at developing elite varieties or hybrid through conventional breeding and biotechnological tools. Biotechnology tools will be used for quick identification of marker characters which will shorten breeding cycle. Longan and Rambutan sp. can be used for development of new variety of litchi by intercrossing and hybrid vigour programme.

Canopy architecture, HDP will be standardized for best utilization of natural resources viz. light, water, soil strata and in built micro-climate. Stress physiology, off season flowering pattern and biochemical changes during ripening of litchi fruits can be studied as part of basic and strategic research.

Potent and eco-friendly pesticide will be developed to control borers and mites affecting litchi.

New technologies to be developed for the utilization of by-products like skin (peel) and stones, which are biodegradable and to be ploughed back to the agricultural system, generating lot of employment to the younger generation and income.

Post harvest losses of litchi fruits is estimated about 25 %. Sustained efforts can be made to develop integrated technology for packaging, transportation and storage by judicious use of low cost packaging /lining materials, refer vans, MAP and storage under air cooling system. High value processed products of litchi can be marketed to western world by fortifying litchi products with other food components having defined nutraceutical specifications.

Advanced and communicative technology would be employed for dissemination of knowledge and technologies developed on litchi. Risk analysis and disaster management, market intelligence will be employed to support litchi growers / farmers.



Epilogue

The National Research Centre for Litchi has formulated its research activities and strategies under wide perspective. It will function in close collaboration with National and International institutes working on litchi research and development. It will also seek help of state departments and NGOs for effective transfer of technology for the benefits of the farmers/growers and also try to develop entrepreneurship. It proposes research to extend the research activities to grow litchi in non-traditional areas of the country under its coordinated programmes.

To meet the growing demand, we will orient our programmes to enhance production, which can be achieved by expanding area under litchi cultivation even in the non traditional regions like Karnataka, Kerala and Tamilnadu, etc. There is at least 25 per cent of total produce which is subjected to post harvest losses at various stages and there is glut of fresh fruits in market during harvesting season due to a very short span of 15-20 days of produce availability at a place. Post harvest handling and management will get greatest attention for this highly perishable commodity. Infrastructural support will be provided to accommodate the fruits for their longevity and availability for a longer period in the market. Present trends of harvesting/grading/packaging would require greater emphasis by bringing about mechanization for observing strict phyto-sanitary measures to compete with the world market.

A meager quantity of litchi is exported, and has lot of scope to increase the quantum of export, therefore an effort will be made to increase export to European/American country since the harvesting season is quite different in other parts of the world.

Production of quality planting materials at cheaper rates will remain our utmost priority through different government and registered nurseries to make plants available in time to the farmers/growers.

Majority of litchi plantations have become very old and senile which would also require rejuvenation for quality fruit production.

Efforts will be made to transform National Research Centre for Litchi to be farmer friendly addressing needs of the farmers with least resources support. The institute would strive hard to address all those vagaries of monsoon (drought or flood) which has negative impact on quality litchi production. The institute commits itself to the task of horticultural development through participatory means, imbining scientific spirit for changing global climatic conditions.



Annexure I : Strategic Framework

Goal	Approach	Performance Measure
Exploration, Collection, Conservation, evaluation and characterization of germplasms of Litchi	a) Collection of indigenous/exotic germplasm, their characterization, evaluation, documentation and utilization	Number of exploration made; Number of germplasm collected and characterized
	b) Evolving improved cultivars in litchi	Number of variants identified and variety of hybrid of litchi developed
	c) Evaluation of litchi cultivars for superior horticultural traits	Development of new variety of litchi
Enhancing productivity of litchi orchard	a) Quality planting material production under off season.	Number of plants multiplied during off season.
	b) Agro-technique for improved productivity; canopy architecture and HDP for efficient light interception and photosynthesis.	Technology development for tree frame under different density, pruning for light interception.
Development of sustainable technologies for improving soil and plant health, nutrient and water use efficiency, combating abiotic stress in litchi	a) Standardization of nutrient and water management, INM and fertigation schedule of litchi crop b) Development of protocol for organic farming. c) Varieties/technologies for standing abiotic stress, climate changes adaptation	Number of technology developed
Systematization of management practices for insect and disease management in litchi orchard.	a) Development of integrated disease and pest management protocols	IPM and IDM Packages developed

Enhancing self life, marketability and utilization of litchi fruits.	a) Development of pre and post harvesting protocols for minimizing post harvest losses	Protocols developed
	b) Value addition and product development	Value added products developed
	c) Management of post harvest diseases	Packages developed
Human resource development in frontier areas	a) Training of farmers and central / state govt. officials	Training conducted
	b) Conducting international training and research	Number of MOUs signed, personnel trained
Transfer of Technology	a) Ensuring availability of propagules of litchi b) Training of farmer about on farm multiplication of litchi plants.	Quality planting materials made available to mass production



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