

# EFFORTS OF ECARDS-NEPAL FOR THE DEVELOPMENT OF CITRUS IN NEPAL

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## Brief Introduction of ECARDS-Nepal

Environment, Culture, Agriculture, Research and Development Society, Nepal (ECARDS-Nepal) was established in 1991 as a non-profit, non-governmental and nonsectarian social development organization. Its goal is to improve the socio-economic conditions of poor Nepalese farmers through better management of natural resources. The mission of ECARDS-Nepal is to empower the people by improving the socio-economic conditions of the local communities through better management of available resources in compliance with the national development efforts.

ECARDS-Nepal is celebrating 25th anniversary in this year. ECARDS-Nepal has been involved in the facilitation of different development programmes covering a wide range of sectors since its establishment. It has been involved for the implementation and facilitation of **149 programmes** (140 completed and 9 on-going) covering all the 75 districts of the country. The summary of the overall programme implementation by ECARDS-Nepal is given in Figure-1.

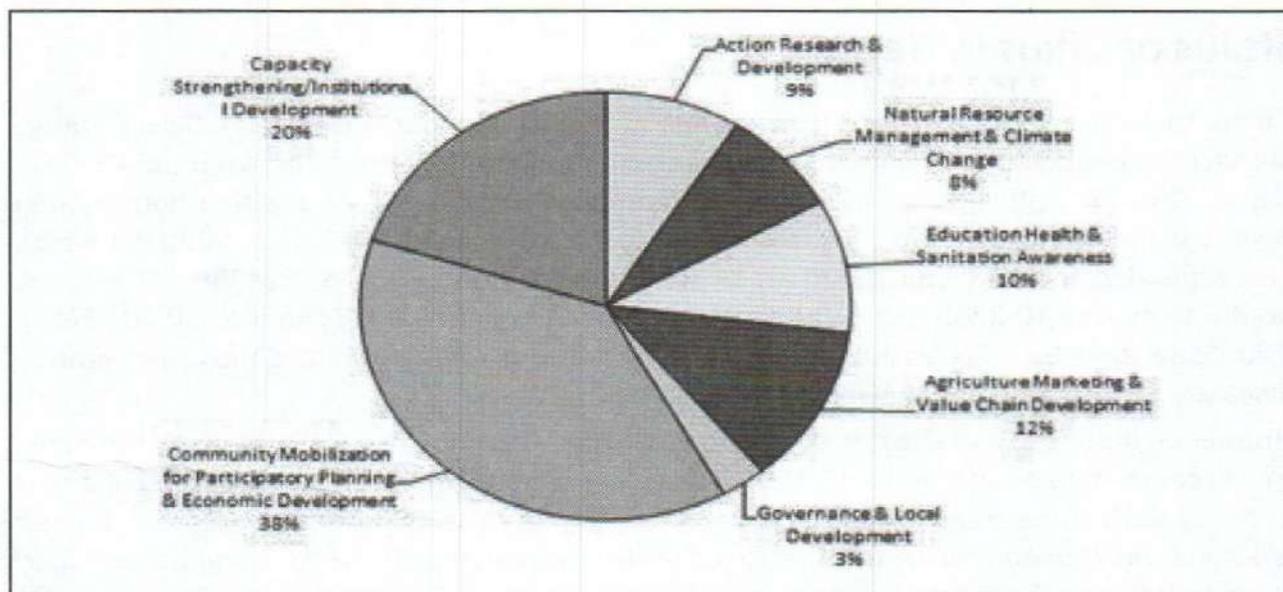


Figure 1. Summary of Completed Programmes

## Partnership

ECARDS-Nepal has been working in partnership with different organization and institutions. Major organizations/institutions that ECARDS-Nepal has been in partnership are as follows.

Government Organizations	UN Agencies	Donor Agencies	Academic Institutions	INGOs	District level organizations
<ul style="list-style-type: none"> <li>• Department of Agriculture</li> <li>• Department of Livestock Development</li> <li>• Department of Forestry</li> <li>• Department of Irrigation</li> <li>• NARDF</li> </ul>	FAO WFP UN Habitat ILO IFAD UNICEF UNDP	World Bank ADB EU GIZ SDC DFID ICIMOD	TU University of Bordeaux II, France IVIA, Spain	Plan International Heifer International Caritas Mercy Corps Helvetas Action Aid World Vision Helen Keller International Namste -No-kai	CBOS NGOs Cooperatives (More than 135 such organisations of project districts)

**Beneficiaries of programmes implemented by ECARDS-Nepal:** Since its establishment, ECARDS-Nepal has provided service to the **330 thousands Households (HH)**. During this periods more than 250 cooperatives have been promoted, more than 8,500 groups formed and mobilized in more than 1,000 VDCs from 75 districts. However, the programmes were more concentrated in the Far Western Development Region. Among the total service provided households, more than 60 percent belong to poor or disadvantaged communities and households lead by women.

## Status of Citrus in Nepal

Citrus fruits are very important fruit crops in Nepal. Mandarin (Suntala), Sweet orange (Junar), Lime (Kagati) and Lemon (Nibuwa) are the major citrus fruits grown in mid hills of Nepal. They are cultivated in 62 out of 75 districts. Citrus have first position both in area coverage and total production. The total area under citrus was 20673 ha in 2000/01 which has expanded to 38987 ha by 2013/14 with annual production of 224356 MT but the productivity was 10.23Mt/ha in 2000/01 and now it is only 8.8 MT/ha (NCDP 2013/14). It is decreasing by 2.5% within this period. It is due to wide spread of most devastating diseases like Huanglongbing (Greening) and Phytophthora.

Huanglongbing (HLB) disease is a systemic disease. Once it infects the plant, the infected tree becomes totally unproductive. HLB is the most serious and destructive disease of citrus in Nepal and causes huge economic damage every year. The vector spreading this disease is known as *Diaphorinacitri* that carries the disease causing bacteria *Candidatus Liberibacter asiaticus*. Furthermore there is a chance of spreading HLB and other systemic diseases through scions taken from the mother plant without confirming that it is free of them. Since the HLB is the vector transmitted disease, it requires production of saplings inside insect proof screen house.

Mandarin and sweet orange trees of seedling origin are susceptible to *Phytophthora* while grafted on Trifoliate orange (*Poncirus trifoliata*) rootstock are resistant to it. Citrus trees of seedling origin start bearing fruits at least at the age of 6-7 years while grafted trees do so at the age of 3-4 years. They are true to mother plant and uniform in all other horticultural characteristics. They are also tolerant to another devastating disease -Tristeza.

Considering these facts, major citrus growing countries of the world have been cultivating citrus grafted on *Poncirus trifoliata* and similar other rootstocks for last 150 years. Nepal is still in transitional stage in terms of replacing seedlings by grafted saplings. The Government of Nepal has recommended establishing citrus nurseries above 10000m altitude and encouraging produce grafted saplings on *P. trifoliata*. Mainly "Twig Grafting" is practiced so far in Nepal while more advanced budding technology is widely applied in the world.

The annual demand in citrus saplings of good quality is about 7 lakh in the country according to NCDP. About 98.7% of citrus saplings are produced by 185 private nurseries and only 1.3% are produced by 3 government nurseries. Out of these saplings only less than 25% are so called grafted and 75% are of seedling origin. There are 4 types of nursery systems practiced in Nepal; a) Open field nursery- saplings grown in the field, b) Open field nursery- saplings grown in poly-pots, c) Screen house nursery- saplings grown in the field and d) Screen house nursery- saplings grown in poly-pots. There is a problem of supplying of good quality grafted saplings in required number. Obviously the saplings produced by budding on *P. trifoliata* grown in poly-pot in screen house nursery management system are of best quality.

## Efforts of ECARDS-Nepal

Realizing the need of introduction of new technologies for citrus development in the country, ECARDS-Nepal tried to find out the ways to introduce the advanced technology from leading citrus growing countries of the world. Eminent French Scientists Prof. J.M. Bove and M. Garnier were contacted to support ECARDS-Nepal in this endeavor. Embassy of France in Nepal gave suggestion to utilize the facilities along with the land of Banepa Municipality that was being used by French Embassy for the promotion of agriculture. The project "Enhancing food security in Kavre through citrus rehabilitation" was implemented under the food security program with the financial help of Nepal food security project, jointly operated by Ministry of Agriculture and Cooperatives and French Embassy in Kathmandu. It has transferred the recent technologies from the leading citrus growing countries of the world such as Brazil, Spain and France for producing high quality citrus saplings and nursery management.

Different stake holders have contributed directly or indirectly in this endeavor. First of all Banepa municipality has provided the land to ECARDS-Nepal to use for research and development of citrus. Dr. Surendra Bode Shrestha former mayor of Banepa Municipality, Mr. Rudra Devkota then chairperson of ECARDS-Nepal had contributed to make the long term agreement between these two organisations. Prof. J.M. Bove from INRA Bordeaux France and French Ambassador Dr. Ambrossini and Dr. Chiranjivi Regmi from NAST were able to mobilize financial and technical support for citrus rehabilitation project in Kavre from the French government through Ministry of Agriculture under Food Security Programme. ECARDS-Nepal developed facilities for screen house nursery, got its manpower trained in Saopaulo, Brazil on budding technology and screen house nursery management system. National Citrus Research Programme (NCRP), Paripatle, Dhankuta under the leadership of Dr. K.P. Paudyal had selected some mother plants, J-90 was one of them. Expert team comprising of Prof. J.M. Bove INRA, France, Dr. Nuria Duran-Villa, IVIA, Spain, Dr. C. Regmi, NAST, Dr. K.P. Paudyal, NCRP, Mr. L.N. Deoju NCDP and Mr. R. Devkota ECARDS-Nepal decided the tree J-90 as mother plant for propagation. The tree was tested for Huanglongbing (Greening) in PCR laboratory of NAST and in the Laboratoire Cellulaire et Moléculaire, INRA, Bordeaux France in the laboratory of IVIA, Spain under the leadership of Dr. Nuria Duran Villa. After the verification that the J-90 was free of all these pathogen, the scions were collected and budded on the already grown *Poncirus*. After growing for

18 months the budded saplings were transferred to field and finally the orchard was established in 2006. The trees started fruiting on third year of plantation although the fruits were only about 40-50/tree. Gradually the number of fruits increased and reached 200-250/tree this year.

## ECARDS-Nepal - Capability

- Screen House Technology – Although, glass houses and simple plastic tunnels were in use in citrus nurseries, standard screen houses for citrus nursery management were not in practice in Nepal. Different types of designs with different size and shape and double door system structures used in screen house nursery management system of Brazil, France and Spain were studied and standardized for Nepalese context and constructed accordingly. These screen houses served and serving as the models that have been adopted by other institutions including Fruit Development Directorate, Kirtipur.
- Soil media for rootstock – Soil media for growing rootstock seedlings determines the growth and development. The soil media composed of forest soil and sand in 1:1 ratio developed by NAST, was found most suitable for screen house citrus nursery management system. It can be used by other nurseries too.
- Size and height of poly bags – Polybags used so far to grow root stock and grafted plants are ..... but ECARDS-Nepal adopted polybags of 50 cm height with 10 cm in diameter. These polybags are suitable to grow rootstock up to 1 m height on which scions are easily budded and success rate is increased.
- Budding technology– Twig grafting or so called shoot tip grafting is being used to produce grafted citrus saplings by government as well as private nurseries in Nepal. The height of grafting on root stock is about 10 cm which is considered as very low in international practice as the rootstock is buried during plantation and the purpose of growing grafted saplings is lost. Most importantly, budding technology was introduced by sending two technicians to Brazil. It allows to graft ( Budding) at 25-35 cm height that is appropriate for plantation. It has the capacity of producing 10-15 thousand disease free grafted saplings every year. It has already distributed more than 3 thousands of healthy saplings in Kavre district. This is the only one screen house nursery developed by NGO in the country.
- Screen house citrus nursery management technology – Screen house must be made of special screen, the roof must be white and, there must be definite temperature and moisture regime inside the screen house and definite sanitary and before entering the screen house, arrangement of benches and polybags with plants to perform activities to take care the plants. All these aspects have been optimized in the screen house system developed by ECARDS-Nepal in Banepa. It has adopted the budding technology nursery management practices for the first time in Nepal. This can serve as the model for other nursery owners too. It has developed and maintained the facilities for screen house management of citrus nursery. Any nursery owner may visit this nursery system and learn lessons to improve their nurseries.
- Demonstration orchard – ECARDS-Nepal has managed the demonstration orchard in 8 ropani at Banepa farm. It is the best orchard in terms of accessibility to show the uniformity of trees, early fruit bearing, true to type of quality of fruits and resistance of trees to phytophthora and convince farmers that the grafted plants are better than seedlings.

- Maintenance of mother plants- It has been maintaining and propagating mother plant J-90 selected by NCRP. This line could be recommended as the variety of Suntala since the performance is found very suitable in Kavre and other districts.
- Orchard management practices- It is applying recommended orchard management practices such as cultivation of orchard during winter, use of organic fertilizer and chemical fertilizers and pesticides. These practices can be adopted by the citrus growers to assure the economically viable productivity for long term.
- Production and supply of grafted saplings- ECARDS-Nepal is producing and supplying thousands of grafted saplings. The performance of orchards established with saplings produced in this nursery is highly appreciated by farmers and the demand in saplings is increasing every year.
- Transfer of technology - ECARDS-Nepal has capable human resources starting from skilled workers, technicians and experts working together. This team has already given trainings to farmers and nursery owners in the past and still ready to do so. The team is also ready to provide any type of technical support rendered by the concerned for the development of citrus nursery and orchard management practices.

## Future Plan

ECARDS-Nepal is planning for the following;

- Develop and maintain facilities at Banepa as the Technological Hub for citrus
- Maintain and expand , screen house nursery system at Banepa Farm as the model for producing citrus saplings of good quality
- Establish at least one such nursery in each development region
- Produce at least 30000 grafted saplings /year and supply to the farmers
- Provide technical services on request to the farmers.
- Conduct joint research projects in different fields of citriculture
- Develop cooperation with other organizations to carryout joint project/sponsored projects for technology transfer

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