

# Value Chain on Production of Food Grade Nutraceuticals for Use as Natural Antioxidants and Food Colorants

## ENVIRONMENTAL AND SOCIAL SAFEGUARDS MANAGEMENT

### A. Basic information / Project data

#### 1. Project Details:

Title of proposal	<b>Value chain on production of food-grade nutraceuticals for use as natural antioxidants and food colorants</b>
Component code	5056 (Component 2, PCS)
Name of CPI	<b>Dr Suresh Walia</b>
Name of CoPIs	Dr Jitender Kumar Dr N.A. Shakil Dr Dolly Wattal Dhar Dr Sunil Pabbi Dr Pritam Kalia Dr Charanjeet Kaur Dr. Romesh Rana Dr. Ravinder Raina
Lead Centre	Indian Agricultural Research Institute, New Delhi-110 012
Mailing Address	Principal Scientist Division of Agricultural Chemicals I.A.R.I., New Delhi-110 012
Consortium partners	Telephone No 011-25841390(O) 011-27862158 (R) 09868723959(M) Fax: 011-25843272 E.Mail: suresh_walia@yahoo.com ; <a href="mailto:sureshwalia@gmail.com">sureshwalia@gmail.com</a> <b>Research Institute</b> i) Dr YS Parmar University of Horticulture & Forestry (YSPUHF), Nauni, Solan (HP) <b>Industry</b> ii) Agri Food Parks Limited, B-196, 48/A Parvati Industrial, Estate Pune-Satara Road, Pune – 411 009 iii) Ozone Biotech Plot no. 6, 14/3, Mathura Road, Faridabad-121 003 (Haryana) iv) Balaji Crop Care Pvt Ltd, 101 Jayabharathi Tower, Dwarkapuram Hyderabad 500060

- 2. Proposed date of start** Feb. 13, 2009
- 3. Planned duration** 3 years 4.5 months
- 4. Project cost** 629.6962 Lakhs
- 5. Project objectives:**
1. Protocol optimization for extraction and processing of food grade nutraceuticals and food colorants from vegetables, fruits, non-food crops and microalgae
  2. Isolation, chemical characterization, analysis and evaluation of active ingredients for anti-oxidant and other nutritional properties
  3. Development of analytical protocols for quantification of nutraceuticals in technical materials and finished products
  4. Development of innovative formulations of nutraceuticals with extended shelf life
  5. Scale-up, transfer and sharing of know-how with industry and other stakeholders

## **6. Brief project description:**

Nutraceutical-rich vegetables and fruits are an important component of a healthy diet. Several micro-algae are also recognized as a potential source of naturally occurring colorants finding application as antioxidants and food supplements. These materials are rich source of bioactive flavonoides, carotenoides, anthocyanins, vitamins, and other polyphenolics. Such compounds provide health benefits of disease prevention through antioxidant activity and reduced disease risks. Since perishable vegetables and fruits and light sensitive nutraceuticals have a limited shelf life, these run the risk of getting spoilt beyond a specific time. Excessive quantities of nutraceutical-rich fruits/ vegetables must therefore, be processed and converted into value added nutraceuticals. Such products can be used to prepare nutrition rich fortified functional foods/fusion foods

There has been an explosion of consumer interest in the health enhancing role of physiologically-active specific nutraceuticals. Such products include food supplements, dietary supplements, value-added processed foods as well as non-food supplements such as tablets, soft gels, capsules etc. In the past few years, emphasis has been laid on the use of nutraceuticals as anti-oxidants for the management of malnutrition, heart ailments, diabetes, cancer and other physical disorders. Natural food colorants are also in great demand as these make foods more attractive and acceptable. At present Indian food supplement market is estimated around Rs 45000 crore of which nutraceuticals also referred to as fast moving health goods (FMHG) has a 6 % share.

Large varieties of dietary supplements and functional foods available in the market are mostly imported. Country therefore, needs to augment all sources at its command to increase production of indigenous nutraceuticals and fusion foods not only to meet domestic demand but also cater to international markets. This can be made possible only if we produce quality materials meeting international specifications as substandard products have no place in the quality conscience international markets. Further we need

to develop world-class quality extraction, isolation procedures and analytical methodologies as per international standards and specifications.

The proposed project "Value chain on production of food-grade nutraceuticals for use as natural antioxidant and food colorants" aims at investigating three vegetable crops (tomato, carrot, chilli), a non-food plant *Stevia rebaudiana*, and a micro-algal species *Spirulina* to prospect for nutraceuticals, food supplements and natural colorants.

The research programme and activities will be centered on five objectives. The first objective aims at undertaking studies on protocol optimization for extraction and isolation of food grade nutraceuticals and food colorants from vegetables, fruits, a non-food crop like Stevia and microalgae. It will encourage farmers to grow high value nutraceutical-rich vegetables, fruits and other crops. The second objective aims at isolation and purification of potential antioxidants and food colorants and their analysis by modern chromatographic (Column, prep-HPLC) and spectral (NMR, MS) techniques. The ingredients will then be evaluated for anti-oxidant and other nutritional properties. Third objective will be centered around development of analytical protocols for quantification of nutraceuticals (antioxidants and food colorants) in finished /fusion products. The last two objectives will lay emphasis on development of innovative formulations, fusion products and functional foods with extended shelf life. Bench-scale know-how developed will be scaled up for large scale production of nutraceuticals and fusion products.

The technical materials, processes and products so developed will be transferred to industry for possible commercialization. The project will be implemented by IARI, New Delhi (Lead Centre), and the consortium partners such as YSPUHF Solan, and Agri Food Park Ltd. Pune, Ozone Biotech Ltd, Faridabad and Balaji Crop Care Private Limited Hyderabad. Consortium partners have been carefully chosen for smooth conduct and manageability of the sub project. IARI is the premier institute excelling in Agriculture and its Division of Agricultural Chemicals has pioneered in developmental aspects of bioactive natural products from plants. Divisions of Post Harvest Technology and Division of Microbiology (CCUBGA) have excelled in their respective fields and had contributed significantly towards development of high-value vegetable, fruit and microalgal products. YSPUHF attributes its competence by virtue of their leadership in Stevia and chilli cultivation and production of bioactive ingredients from these plants.

The total funds sanctioned are **Rs 629. 6962 lakh**

#### **7. Environmental category issues in the sub-project - B**

- Social
- Environmental

#### **8. Safeguard policies triggered (World Bank policies)      Annexure I and II**

<b>Safeguard policies triggered (World Bank policies)</b>	<b>Yes</b>	<b>No</b>
Environmental Assessment (OP/BP 4.01)	[x]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[x]

Pest Management (OP 4.09)	[ ]	[x]
Cultural Property (draft OP 4.11-OPN 11.03 -)	[ ]	[x]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[x]
Indigenous Peoples (OD 4.20)	[ ]	[x]
Forests (OP/BP 4.36)	[ ]	[x]
Safety of Dams (OP/BP 4.37)	[ ]	[x]
Projects in Disputed Areas (OP/BP 7.60)	[ ]	[x]
Projects on International Waterways (OP/BP 7.50)	[ ]	[x]

## B. Risk analysis and related issues

Given the present status of nutraceuticals and food industry as a well accepted consumer marketed commodities, we do not anticipate any adverse effects of the project. Technically the project aims to increase nutraceutical production through use of environmentally neutral improved varieties by adopting modern scientific tools. However, some anticipated risks are highlighted below.

- Adoption of package of practices for production of nutraceuticals may be a problem if the production cost of food grade nutraceuticals is higher.
- Emergence of new market for nutraceuticals, food colorants and value added products in future.
- Consumers response may not be overwhelming, without very active promotional exercise.
- Prospects and potential for expanding the production will depend upon the capacity of the domestic market and the success of the activities to promote nutraceutical properties of vegetables, fruits, and microalgae
- Production and marketing of nutraceuticals-rich vegetables, antioxidants, food colorants and value added fusion products may be difficult, unless the prices are competitive..

**9. Impact assessment:** Adequately addressed.

## **10. Potential indirect and/ or long-term Impacts due to anticipated future activities in the project areas (assessment of anticipated conflict/ complimentarily with the current as well as those proposed for the next five years in the areas of activities of the sub-project):**

- Indigenously produced nutraceutical products based on antioxidants and food colorants will be available for domestic production and export
- Backward and forward linkages with different stakeholders in the value chain for The production of nutraceuticals-rich vegetables and nutraceuticals will help lead Better public-private cooperation, entrepreneurship development and sustainability.

- Stakeholders empowerment through increased income and employment generation
- Increased number of trained/ skilled human resources in the emerging area of antioxidants and food colorants
- Techno–economically feasible business plans for each of the selected vegetable, fruit or non-food nutraceuticals and products fortified with such phytochemicals
- Rural entrepreneurship will help in reducing migration to urban areas through enhanced employment and income generation.

**11. Identify the key stakeholders and describe mechanisms for consultation with and to them done/ disclosure so far done including pre-project consultations with stake holders workshop before formulating the full proposal, discussing the full proposal with some stakeholders before submission to the PIU:**

Research institutions, Government agencies, farmers, rural men and women, food industry and processing units, nutraceutical producers, and non-government organizations (NGOs) engaged in agricultural upliftment and providing nutrition security to our vast population, are the key stakeholders for this project. Preliminary discussions and brain-storming sessions were held with consortium partners and other stakeholders before organizing stakeholder’s workshop. They were made aware about NAIP project objectives, expected outputs and impact. Social scientist, economists and expert nutritionists were also consulted to organize and develop the research proposal.

**12. Chronology of meetings/ activities held in connection with preparation of the concept note and full proposal**

S.N o.	Date	Programme & Location	Participants	Remarks
1.	30.10.2007 24.05 2008	Concept note preparation meetings at IARI, New Delhi	All associates of consortia from IARI	Presentation of the concept notes by the CPIs and discussion about preparation of concept note
2.	25.05.2008	Meeting with Joint Director (Research) IARI	PI's of selected consortium projects from IARI	Selection of concept proposal at IARI level
3.	29 Aug 2008	On-line submission of concept note	-	-

4.	21 Aug. 2008	Provisional selection of the concept note for full project proposal by NAIP	-	-
5.	27 Aug.2008	One-day stake-holder meet at IARI to develop the research proposal	All Co-PIs of the project	Discussion about consortium partners and preparation of research proposal
6.	25-27 Sept. 2008	Three-day pre-stakeholder meeting & 1 <sup>st</sup> Expert Group Meeting held at NAARM, Hyderabad	CPIs of provisionally selected consortia	Sensitization workshop and presentation of project proposal before the expert group
7	6-7 Nov. 2008	2 <sup>nd</sup> Expert Group Meeting in the area of High Value Extracts, Functional Foods, Grains etc	CPI and all Co-PIs of the project	Presentation of project proposal before the expert group
8	17-18 Nov.2008	RPC meeting at Krishi Anusandhan Bhawan, New Delhi	CPI and Co-PIs	Presentation and discussion on the full research proposal
9	25 Nov. 2008	Cost Committee Meeting	CPI and Co-PIs	Discussion on cost and budget estimates
10	6 Jan. 2009	PMC Meeting	Members of PMC	Final project approval

### 13. Measures to address the issue

Farmer's education and training on the production and use of nutraceutical-rich vegetables and fruits will be conducted for the participating farmers in the sub-project. Awareness of risk-related factors will be addressed to the stakeholders Efforts will be made to develop know-how for the extraction of nutraceuticals from vegetables, fruits, non-food crops, microalgae etc. Antioxidants and food colorants so developed will be utilized to produce fortified food products for domestic use and export.

### 14. Consultation/ disclosures to be done in future

The consultation/ disclosures will be done as per NAIP guidelines depending on the progress of the project. Information about launch workshop, training, demonstration programmes and workshops on various themes relevant to nutraceutical and functional food production and utilization will be announced beforehand for

information of the stakeholders and the general masses. The project findings (brochures/ CDs/ videos/ relevant literatures) will be disclosed from time to time and necessary feed back will be collected for further improvement and better implementation. Annual reports will be put on the web site and annual stakeholder workshops wherever feasible. Assistance of different related organizations will be taken.

- i) Dissemination of information about nutrition rich vegetables, fruits, nutraceutical products, and functional foods and their utilization through extension services and other partners to farmers.
- ii) Demonstration of new product preparations to stakeholders.
- iii) Transfer of technology for the production of nutraceuticals, food colorants, and functional food to food industry and other stakeholders.
- iv) Popularization through information dissemination on use of developed products to the consumers.
- v) Information dissemination through mass and print media on food and environmental safety.
- vi) NGOs may play a role along with the rural social institutions in imparting skills to small-scale entrepreneurs and farmers for production of nutraceuticals rich vegetables, fruits, algae and other non-food crops.

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**Consortium PI**

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**National Coordinator**

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**National Director**

## Annexure I

### Environmental safeguards: Activities, issues, impact and mitigation measures

Activities	Issues	Anticipated level of impacts		Mitigation measures (Negative impacts)
		Positive	Negative	
Fine tuning of production technologies for nutraceuticals-rich vegetables	Development of nutraceuticals and food colorants	4	--	NA
Development and optimization of Extraction technologies	Isolation of antioxidants and food colorants	2	--	NA
Upscaling of identified products/formulations for commercial production	Nutraceutical formulations	2	--	NA
Value addition in vegetables, fruits, Stevia and microalgae	Nutraceutical based management modules	4	--	NA
Pest control measures and food safety	Pest-free vegetables, fruits nutraceuticals and functional foods	--	2	Instead of unsafe synthetic pesticides, botanical and biopesticides will be used to control vegetable/fruit pests
Set-up of public-private linkage for commercial production of nutraceuticals, food colorants and functional foods	Income and employment enhancement via entrepreneurship development	5	--	NA
Determining the status of nutraceuticals and processed products and crop productivity	Branding of nutraceuticals and their processed products	5	--	NA

## Annexure II

### Social safeguards: Activities, issues, impact and mitigation measures

Activities	Issues	Anticipated level of impacts		Mitigation measures (Negative impacts)
		Positive	Negative	
Baseline survey of target regions for nutraceutical-rich vegetable production	Information on income and employment status of vegetable & fruit growers	2	--	--
Economics and assessment of consumer acceptance of nutraceuticals and value added functional foods	Consumer awareness and adoption level; promotion and marketing	2	--	--
Sensitizing relevant agencies for promotion and use of antioxidants and food colorants in fortified foods, documentation, and policy analysis	Enhanced use of nutraceuticals for food safety through media and extension activities	4	--	--
Popularization of value-added produce from vegetables, fruits, non-food crops and microalgae	Nutritive vegetables, fruits, nutraceuticals and their value-added products	4	--	--
Evaluation of socio-economic and environmental impacts of the interventions for uptake plan	Socio-economic and environmental impacts information	4	--	--