Expert Consultation on

Accelerating Export of Seed Spices: Challenges and Opportunities

22 November, 2021

Proceedings and Recommendations

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Organizers

Trust for Advancement of Agricultural Sciences (TAAS), New Delhi
Indian Council of Agricultural Research (ICAR), New Delhi
ICAR-National Research Centre of Seed Spices (ICAR-NRCSS), Ajmer
Indian Society of Seed Spices (ISSS), Ajmer
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Acronyms and Abbreviations

ADG	Assistant Director General
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APCoAB	Asia-Pacific Consortium on Agricultural Biotechnology and Bioresources
APEDA	Agricultural & Processed Food Products Export Development Authority
APMC	Agricultural Produce Market Committee
AU	Agricultural University
BIS	Bureau of Indian Standards
COVID	Corona Virus Disease
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
DA&SD	Directorate of Arecanut and Spices Development
DAPP&QS	Directorate of Plant Protection, Quarantine and Storage
DARE	Department of Agricultural Research and Education
DDG	Deputy Director General
DNA	Deoxyribonucleic Acid
DUS	Distinctness, Uniformity and Stability
EB	Electronic Beam
EIC	Export Inspection Council
ETO	Ethylene Oxide
EU	European Union
FPCs	Farmer Producer Companies
FPOs	Farmer Producer Organizations
FSSAI	Food Safety and Standards Authority of India
GAPs	Good Agricultural Practices
GDP	Gross Domestic Product
GHP	Good Hygienic Practices
GI	Geographic Indicators
GIS	Geographic Information System

GoI	Government of India
GS	Genomic Selection
ICAR	Indian Council of Agricultural Research
ICT	Information and Communication Technology
IISR	Indian Institute of Spices Research
ISSS	Indian Society of Seed Spices
IPM	Integrated Pest Management
IPNM	Integrated Plant Nutrient Management
IRR	Import Rejection Reports
ITC	Indian Tobacco Company
MAP	Medicinal and Aromatic Plants
MAS	Marker Assisted Selection
MRLs	Maximum Residue Limits
NABL	National Accreditation Board for Testing and Calibration Laboratories
NGOs	Non Governmental Organizations
NRCSS	National Research Centre on Seed Spices
PPV&FRA	Protection of Plant Varieties and Farmers' Rights Authority
R&D	Research and Development
RASFF	Rapid Alert System for Food and Feed
SABC	South Asia Biotechnology Centre
SHGs	Self Help Groups
SKNAU	Sri Karan Narendra Agricultural University
SKUAST-K	Sher-e-Kashmir University of Agriculture Science and Technology, Kashmir
SOP	Standard Operating Procedure
SPS	Sanitary and Phytosanitary
TAAS	Trust for Advancement in Agricultural Sciences
USD	US Dollars
USFSA	US Food and Drug Administration
VC	Vice Chancellor
WFP	World Food Prize
WTO	World Trade Organization

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BACKGROUND

India, 'The Land of Spices' is one of the largest producer, consumer and exporter of spices in the world. Spices are used in our everyday life in various ways. Ancient people such as the Egyptian, the Arab and the Roman made extensive use of spices, not only to add flavour to foods and beverages, but as medicines, disinfectants, incenses, stimulants and even as aphrodisiac agents. No wonder, they were sought after like gold and precious metals. Spices are various plant parts e.g., bud, fruit, seed, bark, rhizome, bulb and leaves. Indian spices are popular for their flavour and aroma. The varying climatic conditions in the country provide ample scope for the cultivation of a wide variety of spices. Presently, 63 spices out of 109 known the world over are being cultivated in various parts of India of which 20 are classified as seed spices. Seed spices are basically defined as vegetable products or mixtures thereof, free from extraneous matter, used for imparting aroma in foods. These are annual crops of which seeds are consumed as spice. Seed spices are important ingredients of any Indian and Asian cuisine. It imparts aroma and pungency to the dishes and provides peculiar taste to the finished foods. Besides importance in food industry, the seed spices are used in various pharmaceutical preparations and also in cosmetic industry. Indian seed spices are preferred in the international market because of their good fragrance, lustre and appearance. Seed spices occupy a prominent place in the total export basket of spices and play a significant role in our national economy. Export of seed spices during last two decades increased from INR 235 Crore in 2000-01 to INR 5,665 Crore in 2020-21 (Spice Board 2021) making 20 per cent of the total foreign earning from spice export. Thus, an increasing trend in export of seed spices has been observed in the last decade particularly to the Asian, Latin American and Middle Eastern countries. Almost all of the seed spices are cultivated in India and most of the states in India grow either one or more seed spices. India is thus the largest seed spices producing country in the world. But the major seed spices growing belt covered arid to semi-arid regions in states of Rajasthan and Gujarat.

It is known as "Seed Spices Bowl" contributing more than 80 per cent of total seed spices production in India.

In fact, during the COVID-19 Pandemic, export of total spices has crossed USD 3.5 billion. Export of spices attained an all-time record – a rise of 30 per cent in volume, 23 per cent in rupee term and 17 per cent in USD term of value compared to the previous year. As per the latest estimate by Spice Board of India for the year 2020-21, seed spices were grown in around 2.1 mha area with production of 2.06 mt. India exports 0.48 mt (23% of total seed spice production) of raw and value-added products of seed spices to more than 30 countries earned export revenue to the extent of INR 5,665 Crore which is 40 per cent more in quantity and 33 per cent more in value term as compared to previous year. However, concerted efforts are warranted in upgrading their productivity for exportable surplus at competitive international price and for improving extrinsic (cleanliness and complete freedom from extraneous material of any kind) and intrinsic (free from any toxic substance and residue, fungal spores, etc.) qualities to maintain a strong hold in the international market.

CHALLENGES AND OPPORTUNITIES

In the recent years due to growing awareness of consumers regarding safe and hygienic food, stringent quality checks are imposed by different countries on imported food material including seed spices. However, cultivation and post-harvest management practices of seed spices in our country are not always performed under rigorous hygienic conditions, which can lead to high microbial counts, consequently damaging the food in which they are used. Therefore, it is imperative to reduce the chances of microbial infestation of seed spices through measures of safe and clean cultivation packages and post-harvest handling operations. Thus, production of clean and safe produce is one of the biggest challenges in accelerating export of seed spices. Further, there is lack of organized marketing system to meet the domestic and international demand of clean and safe spices. The issue of pesticide residue above the maximum residue limits (MRLs), cross-contamination with allergens and insect-pest/microbial contamination during storage are some of the major challenges faced by exporters and farmers. In order to harness the potential of export in the world market, India would need reforms like product traceability, adoption of good agricultural practices (GAPs) and processing for value-addition. There is urgent need for restriction on use of chemicals and pesticides as these are banned in major importing countries. Also, there is need to switch to the organic cultivation using more of biofertilizers and biopesticides. The Spice Board India also needs to organize stakeholders' meetings for bilateral discussions, mutual collaboration and knowledge sharing among business partners. There is need to raise the issue in multilateral trade

forums such as the World Trade Organization (WTO). Single window approach for export control, traceability and laboratory testing is also need of the hour. It will make the export process more efficient. India should also have a comprehensive forward looking export policy which clearly lays down the measures to attain compliance with sanitary and phytosanitary (SPS) conditions and to create good infrastructure and marketing facilities. In fact, to remain a world leader, India must have the world class export infrastructure to assist the seed spice growers.

THE EXPERT CONSULTATION

In order to address the weaknesses and challenges and develop a 'Road Map' for enhancing export of seed spices, the Trust for Advancement in Agricultural sciences (TAAS) New Delhi, a 'Think Tank', in collaboration with ICAR-National Research Centre of Seed Spices (ICAR-NRCSS), Indian Society of Seed Spices (ISSS) and Spice Board India, Kochi organized an Expert Consultation on "Accelerating Export of Seed Spices: Challenges and Opportunities" on 22 November, 2021 in hybrid mode. A total of 91 participants from Central and State Governments, scientific institutions, State Agricultural Universities (SAUs), industries, non-governmental organizations (NGOs), entrepreneurs, policy makers and farmers attended. The main objectives of the Expert Consultation were: i) to discuss the strengths, weaknesses and the challenges concerning export of seed spices, ii) to explore technological options, strategies, and policies for enhancing production, processing and value addition of seed spices, and iii) to develop a 'Road Map' for promoting export of seed spices to remain globally competitive.

OPENING SESSION

Padma Bhushan **Dr RS Paroda**, Chairman, Trust for Advancement of Agricultural Sciences (TAAS), Former Secretary, DARE and Director General, ICAR chaired the Opening Session of Expert Consultation. At the outset, he mentioned that the purpose of this expert consultation is to understand the challenges and opportunities and develop strategies for for accelerating the export of seed spices. He emphasized that we should have a target of increasing the export of seed spices by at least ten times. The ICAR-NRCSS may take lead in organizing the industry/exporter–scientist meet once a year to know the problems faced by export industry and finding ways to address these in order to promote the export of seed spices.

Dr Bhag Mal, in his welcome address, warmly welcomed the Chief Guest, Dr T Mohapatra, Secretary DARE and DG, ICAR, Dr RS Paroda, Chair of the Session, Dr AK Singh, DDG (Horticultural Sciences), ICAR; Dr SK Vasal, a distinguished maize breeder and World Food Prize winner; Dr KV Prabhu, Chairman, PPV&FRA;

Dr NK Krishnakumar, Former DDG (Hort.) ICAR; Dr JS Sandhu, VC SKNAU, Jobner; Dr BR Choudhary, VC AU Jodhpur; Dr SN Saxena, Director, ICAR-NRCSS, Ajmer; eminent speakers, panelists, distinguished invitees and participants. He emphasized on the importance of the expert consultation on accelerating export of seed spices and mentioned about the importance of seed spices in national economy, trade and diverse challenges relating to export. He also highlighted on the need for greater attention on raw product traceability, better post-harvest management, improved processing, application of good agricultural practices (GAPs) and finding effective solutions for pesticide residue problems.

Dr SN Saxena, Director, ICAR-NRCSS introduced the agenda and set the context of the expert consultation meeting. He mentioned that agriculture is the backbone of country's gross domestic product (GDP) which is constituted by diverse agri-commodities and spices are one of them. History of spice production and trade is associated with history of our country. Since ancient times, India is known as land of spices and remains major centre of world spice trade. Indian spices are known for their flavour, taste and quality because of their typical growing climatic conditions. Among spices, seed spices constitute an important group of agricultural commodities and play a significant role in our national economy. This group of spices is confined to crops like coriander, cumin, fennel, fenugreek, *ajwain*, nigella, dill, celery, anise, caraway, etc. Seed spices are important exportable commodities and comprise 45 per cent area and 20 per cent production of total spices. India exports raw as well as value added products to nearly 70 countries in the world and earns more than USD 4 billion foreign exchange out of which the share of seed spices is about 20 per cent. Among 20 seed spice crops, cumin, coriander, fennel, fenugreek, dill and *ajwain* contribute more than 95 per cent towards area and production. In India, seed spices are manly grown in arid and semi-arid regions. Earlier seed spice export was very negligible but in the past two decades, quantum jump in export has been recorded. In 2019-20, India exported 23-25 per cent of total seed spice produce. Although world demand of seed spices is increasing at the rate of 8-10 per cent annually but some tough competitions and stringent regulations/criteria of quality standards such as allergens, microbial counts, and pesticide residue are major challenges for export. Shifting of seed spices in non-traditional areas such as Madhya Pradesh which proved out as major producer of coriander has opened new vista for quality production of seed spices. The meeting aims to address certain challenges in maintaining India's prime position in international spice trade. He further mentioned that important concerns are: I) enhancing productivity, ii) clean and safe produce- free from harmful chemicals, microorganisms, toxins, and other adulterants; and iii) post-harvest management and value addition. Demand of such value-added products such as curry powders, spice oil and oleoresin is increasing day by day contributing 12-16 per cent of

total spice export and it stood at number four after chilli, cumin, and mint products. Other important issues needing attention are establishment of strong value-chain, marketing providing benefit to the spice growers.

Dr AK Singh in his special remarks, highlighted that seed spices as special agri-commodity by nature being "high value low volume crops", are the most remunerative commodities of the arid and semi-arid regions of India. The essence and aroma of Indian spices are well recognized throughout the world. They are nature's gift to humankind and add flavour to our food in addition to having preservative, nutraceutical and medicinal value. Seed spices are mainly cultivated by marginal farmers and the cultivation is scattered. Over the period, through technological interventions, the production and productivity have gone up even in non-traditional areas. Seed spices fit quite well with other crops and crop cycles. Currently, the demand is rising but climate change is posing major problems. Importers' restrictions, value addition and losses in flavouring compounds are other challenges. These challenges can be managed by innovative crop production technologies and post-harvest management. During pandemic, the popularity and demand of seed spices has increased and a sharp rise in export of cumin and coriander has been observed. Cumin is a risky crop and its cultivation often faces both biotic and abiotic stress related problems, yet the farmers prefer to grow because of expected high profit. The productivity of these crops could be enhanced by field demonstrations and information dissemination, maximizing input use efficiency by following GAPs, use of biofertilizers and mechanization in seed spice production. The major constraint is that farmers are not adopting recommended cultivation practices and sanitary and phytosanitary approaches which need to be addressed properly for production of clean and safe produce. New emerging markets such as China and other countries are major competitors and pose real threat for their export. He cited the example of ginger for which India had the monopoly earlier but recently Vietnam and Cambodia have emerged major competitors. Among others, he mentioned the need for understanding global market, quality consciousness and creation of enabling policy framework.

Dr T Mohapatra stressed upon understanding demand and supply of seed spices, and also the challenges and opportunities in seed spices export. Despite COVID-19 pandemic, agriculture, in general, and spices, in particular, assumed greater relevance and resulted in better production. India has done fairly well in spice sector. Post-harvest care is very much critical and crucial for clean and safe production of spices. Quality concern has increased among consumers. There is need to create appropriate storage for the produce and use block chain technology during post-harvest processing. The efficient traceability issue needs to be addressed adequately at the policy level. He emphasized upon the need to establish well equipped testing laboratories to meet the global standards.

Pathogen contamination is serious issue and aflatoxins, allergens, and microbial load during storage of seed spices need to be adequately addressed. This limitation in future might affect our export. Since quality is a major concern in seed spices, there must be provision of referral labs to issue sanitary and phytosanitary (SPS) certificate. Trained human resource is necessary for efficient post-harvest management, processing, and value-addition to tackle obvious quality challenges besides adoption of good agronomic practices (GAPs). Emphasis needs to be given on volatiles, nutraceutical properties and new innovations for which adequate funding is needed. There is good scope of production of organic spices which have low nutrient demand. Availability of quality seed is another important issue for which use of seed portals integrated with popular mobile app like YONO must be made. Protected cultivation has tremendous scope in production of leafy seed spices and thus, needs to be promoted.

Dr RS Paroda while concluding the Opening Session remarked that essentially, there is a dire need for processing and value-addition in seed spices before their export. He also emphasized on developing suitable strategies for enhancing the export of spices from the current 3-times in recent years, to ten times in the near future. FPOs in seed spices should be encouraged in which institutes, NGOs and youths should work together. Youth (men and women) need to be motivated to learn modern techniques and ICT tools and linked as 'paid agents' to help farmers, traders and research organizations. CSR funds may also be utilized for promoting extension and research activities. The ICAR-NRCSS should work in close collaboration with SAUs and other research institutes to provide a complete package for farmers of Rajasthan and Gujarat especially which are major seed spice growing states. There is an urgent need to establish an accredited lab for quality analysis of export-oriented seed spices as well as certification of pesticides below maximum residue limits (MRLs).

THEMATIC PRESENTATIONS

Technical Session on “Thematic Presentations” was chaired by **Dr AK Singh**. In all, three technical presentations were made, viz., i) Export Scenario of Indian Seed Spices by Dr K Nirmal Babu, ii) Future Strategies for the Seed Spice Export by Shri RK Menon, and iii) Production and Potential of Seed Spices: Challenges and Opportunities by Dr SN Saxena.

Dr K Nirmal Babu, Former Director ICAR-IISR, Kozhikode presented various dimensions of seed spices He highlighted that India exports 10-15 per cent of its spices to over 130 countries and earns USD 4 billion annually and the rest is consumed in domestic market. To increase the export up to USD 10 billion by 2030, the target should be to increase the export by another 10 per cent and for this, exportable quality seed spices surplus should be available on competitive

rate. Minor seed spices also have great potential and thus, R&D in these crops also need to be accelerated. He discussed in detail the trends in import of seed spices in the last one decade, total spice scenario in India and elsewhere, major problems of farmers, pesticides and food safety issues, maximum residue limits (MRLs), green alternative technologies, and protected cultivation, etc. He further emphasized on some important issues, such as: i) breeding of climate resilient cumin varieties, other seed spices for identified chemical constituents; ii) enrichment of varietal wealth; iii) nutritional and chemo-profiling of all existing genotypes; iv) maintaining genetic purity; v) seed priming and pelleting for hastening germination and better seedling establishment; vi) use of geographic information system (GIS) to identify and tagging of newer areas and information communication technology (ICT) and database management; vii) organizing annual working group meeting of seed spices; viii) promoting seed spice based cropping system; ix) focusing on heavy metal contamination and its remedies; x) promoting protected cultivation for leafy coriander and fenugreek production; xi) promoting mechanization, packing, processing, cryo-grinding, storage, etc.; xii) adoption of GAPs; xiii) exploiting alternative use of spices such as nutraceutical and medicinal properties; xiv) creating awareness among farmers about green alternative chemicals; and xv) popularizing seed village concept and production of true to types breeder seeds. He also mentioned about biological control, need of micro-irrigation, awareness of bio-efficacy and residue data, farmers' cooperatives, SHGs and FPOs, and enhancing extension program, etc.

Dr SN Saxena discussed about R&D in seed spices sector over two decades including technological interventions made by ICAR-NRCSS, Ajmer and their impact on the growth of seed spices sector. He highlighted NRCSS technologies such as improved varieties of seed spices, seed priming and pelleting, nursery raising of seed spices, line sowing with raised bed, mulching, drip fertigation and other precision farming practices, intercropping with vegetables and fruit orchards, eco-friendly plant protection technologies, biological management of cumin blight, pesticide free cumin production technology, protected cultivation, off-season coriander production technology, post-harvest processing for value addition in the form of cryogenic grinding, essential and total oil extraction technology. He highlighted about role of the Centre in producing truthfully labelled seeds of improved NRCSS varieties through Farmers Participatory Seed Production program, availability of seed portal at NRCSS website for online availability of quality seeds to the farmers all over the country. He emphasized on: i) value-addition and novel product development, processing technologies for commercial exploitation such as spray-drying, cryogenic-grinding, improved green oil extraction technologies; ii) need to identify novel sterilization techniques like electronic beam (EB) irradiation (cold irradiation) and their standardization in seed spices iii) need to develop production technologies for clean, safe and pesticide free seed spices; iv) shift

from quantity to quality; v) need to strengthen the research on seed spices as medicinal and aromatic plants (MAP), its characterization, and their exploitation as a potential source of natural antioxidants, essential oil and oleoresins for developing health promoting nutraceutical and value-added products; vi) need to promote crop diversification; vii) development of complete organic package for production of premium quality organic seed spices; viii) GI tagging needed in case of Nagori Pan *methi,* Haroti coriander, fennel of Sirohi, cumin of Barmer, etc.; ix) strict compliance of GAPs, SPS, good hygienic practices (GHP) standards; x) research on packaging materials and methods for better hygiene and storability; xi) availability of state-of-the-art National Accreditation Board for Testing and Calibration Laboratories (NABL), accredited quality analysis laboratories in major growing areas; and xii) need to improve infrastructure and investment in organized sector. He also appeals private sector to make investment on creating state of the art NABL accredited quality analysis laboratory at NRCSS Ajmer for benefit of seed spice growers of Rajasthan.

Shri RK Menon, Chairperson, World Spice Organization, Kochi stated about export scenario of spices. He mentioned that India is the largest exporter of spices. He elaborated about export scenario of cumin, coriander, fenugreek; major challenges faced, and how to overcome these challenges. He informed that export target of seed spices was 3.6 billion USD in 2020-21 with future target of 5.00 billion USD in 2022-23 and 10.0 billion USD in 2030. Major importers of cumin are China, Bangladesh, USA, Egypt, UK and Saudi Arabia whereas Sri Lanka, Malaysia and UAE imports coriander. He further emphasized that for export of seed spices, the important points which need attention are: i) MRLs is a major concern, hence need to focus on adoption of green technologies to overcome pesticide residue problem and harmonization of standards; ii) improving intrinsic quality of produce; iii) essential labelled claim; iv) decrease in coriander export due to low oil quality and large number of competitors like Bulgaria, Ukraine Canada having superior oil quality; v) strengthening of market intelligence; vi) increased demand of fenugreek due to its nutraceutical properties in recent times; vii) strengthening of database for more market update; viii) development of climate resilient varieties; ix) need to follow and adopt codex standards in seed spices; x) capacity building program and intensive training on GAPs; xi) technological interventions and disruptions-agri practices and processing; and x) need to address control of pyrrolizidine alkaloids and issue with regard to ethylene oxide (ETO) and chlorpyriphos.

PANEL DISCUSSION

The panel discussion on “Expert Consultation on Accelerating Export of Seed Spices: Challenges and Opportunities” was moderated by Dr RS Paroda. Seven

out of ten panelists, namely, Drs JS Sandhu, BR Choudhary, Bhagirath Choudhary, Homey Cheriyan, Sanjeev Bisht, Sreedhar Kaluva and AB Rema Shree made their interventions and have provided useful suggestions for the way forward. Drs SK Malhotra, Abhimanyu Kumar, and Vikramaditya Pandey couldn't make it to participate.

Dr BR Chaudhary, VC, AU, Jodhpur highlighted the need for greater efforts on research and development on seed spices and emphasized upon the need for interface between producers and exporters at frequent intervals. Such interfaces may be organized by the Indian Society of Seed Spices (ISSS) and other similar organizations at frequent intervals. This will greatly help in promoting the cultivation and quality production with focus on enhancing the export of seed spices

Dr JS Sandhu, VC, SKNAU, Jobner emphasized that there are ample opportunities for expansion of seed spices export from India and in near future, we need to focus on capturing more share in international market of seed spices. He enumerated requirement of eco-region-wise focus to delineate export zones for different seed spices as they are concentrated in specific locations, maintenance breeding, strong crop-wise breeding program, and need of networking of scientists from different institutions for different seed spices crops. He highlighted some key points, such as: i) requirement of export zone demarcation in seed spices crops on the lines of grapes so that farmers can be educated and made aware about standard operating procedure (SOP) to produce the export-oriented products; ii) need to popularize good agriculture practices (GAPs) particularly to sort out the weed infestation in seed spices production; iii) maintenance breeding and DUS testing essentially required to provide quality planting materials; iv) requirement of strong and collaborative breeding programs in seed spices crops; and v) need for long term seed storage study without infestation and chemical requirement.

Dr Bhagirath Choudhary, SABC, Jodhpur emphasized on development of location based production hub for different seed spices crops to get higher productivity and quality, for example- fennel production in Sirohi, cumin and *isabgol* production in Barmer and Jaisalmer, etc. There is urgent need for organic certification of produce, as the biological agents available in the market are having mixture of different pesticides and chemicals. Farmers are using very high doses of chemicals in seed treatments and undertake crop sprays and thus, use of these chemicals hamper the export potential of seed spices. Mechanization in seed spices is needed particularly for sowing, weed management and harvesting to bring down the cost of production. Concerted research efforts are needed for development and identification of weedicides for major seed spice crops as manual weeding increases the cost of production. Only 'Raft' is regularly recommended as pre-emergence herbicide. The issue of pyrrolidizine alkaloids (PA) in seed spices due to presence of weeds also needs to be addressed. Other

points raised by him included lack of proper extension services and effective weed control, seed treatment under controlled conditions, and non-availability of biopesticides.

Dr Homey Cheriyan, Director, Directorate of Arecanut and Spices Development, Kozhikode observed that unless technology reaches the end users, nothing tangible can be obtained. He expressed concern that agricultural extension program in the country is very poor which needs proper attention. He further observed that country is supplying only raw spices for export whereas we need to go for value-addition as well. There is need to take-up certified seed production. Also, there is need to have continuous interaction among all stakeholders.

Dr AB Rema Shree, Director (Research), Spices Board India, Kochi stated that considering the wide use of spices and their significant global demand, it is imperative to improve and strengthen the quality and safety of Indian spices for enhancing their wide acceptance in domestic and international markets. In seed spices, low awareness of the stakeholders, including producers, traders and exporters about the requirements of domestic and international market poses a serious challenge. Poor compliance with hygienic practices is one of the major issues observed across the entire value chain in seed spices, i.e., production, storage, transportation, market yards and pre-processing stages. Some important challenges include: i) improper drying of spices in the open with potential contamination due to birds, animals, rodents and dust and dirt, ii) lack of facilities and equipment at farm level, iii) contamination through packaging material, etc. and iv) indiscriminate pesticide usage, including the use of banned pesticides. Cumin specifically has the problem of high use of pesticide mancozeb. Aflatoxin contamination and thrips/aphids' infestation are also important issues to be addressed. In coriander, excessive use of chemicals to address the problems of wilt, stem gall and aphid and weeds pose problems. Rodent excreta and dead insects of same size as coriander are also seen to be important issues to be dealt appropriately.

Based on the data from US Food and Drug Administration (USFDA) Import Rejection Reports (IRR) and EU-Rapid Alert System for Food and Feed (RASFF) over the last three years, it is observed that the two most important causes of rejection faced by seed spices exported from India are presence of *Salmonella* and aflatoxins above the maximum permitted limit. In addition, dirt and filth, inadequate labelling and absence of health certificates are also important causes of export rejections of Indian seed spices in the EU and US. Presence of pesticide residues is another major cause for export rejection in seed spices, especially in Indian spices exported to Japan. Rejections in cumin, fennel and coriander exported from India to Japan have occurred due to the presence of pesticides like profenofos, iprobenfos and triazophos. Adulteration with cheaper products and

chemicals, targeting financial benefit, is yet another issue noted in seed spices. In the past few years, adulteration of cumin using fake cumin made from grass, other seeds, stone powder, clay, etc. which greatly resemble the appearance of original cumin seeds, have been reported. Production of safe seed spices, in terms of reduced pesticide residues and other contaminants, should be our goal in this sector. To a large extent, this can be achieved by forming / supporting farmer producer organizations (FPOs) at community level with dissemination of updated scientific and regulatory information, and providing them with adequate infrastructure and processing machinery. Impact of climate change and required measures for mitigating these be studied thoroughly to develop sustainable and effective models for mitigation and resilient production systems in the sector thereby boosting the export. To mitigate the effects of climate change, effective systems are needed for accurate, technology-based weather forecast and information dissemination to the growers enabling them to take the right decisions on farm operations based on varying climatic conditions.

Dr. Sanjeev Bisht, Vice President - Spices & Aqua at ITC Limited expressed that with the corporate support, we can increase production of seed spices in the country by 20 per cent while closely working with farmers. He also emphasized that there is need to take utmost care of international standards of trade/export.

Dr. Sreedhar Kaluva, Deputy General Manager-Procurement at Olam Agro India Limited made some important observations and stated that there is need to explore on priority the seed spices cultivation with limited water availability. Also, he expressed that the farmers producing seed spices need to be connected with markets both domestic and international in order to harness the maximum benefits.

PARTICIPANTS' VIEWS

Dr KV Prabhu, Chairman, PPV&FRA, New Delhi, stated that the major obstacle which hampered Indian seed spices export particularly in EU and USA is higher content of pesticide residue and varietal impurity. The majority of Indian seed spices consignments are having mixes of different varieties which is due to mixing of large number of seed lots in one by exporting agencies and lack of quality planting materials for crop production. He highlighted that majority of seed spices growers are using genetically impure seeds which is due to not following seed quality regulations. The importing countries are rejecting the consignments based on variation in principal constitution of essential oils which was due to varietal admixtures. In order to enhance seed spices export and avoid rejection of exported consignments, there is need to focus on providing pure and

better-quality seed and planting materials to farmers. This would require strong maintenance breeding program to produce both nucleus and breeder seeds of different improved varieties. He also highlighted the need to register seed spices varieties under PPV&FR Act, 2001 as there is lack of registration currently by the public organizations whereas majority of seed spices samples received for registration by the Authority are coming from farmers. Also, there is need to deploy more breeders for development of specific trait targeted high yielding varieties. The important suggestions made by him were: i) development of strong maintenance breeding program to purify the existing varieties and make available the quality planting materials to farmers, ii) need of target-oriented strong breeding programs for the development of new varieties; and iii) registration of seed spices varieties with PPV&FRA.

Dr NK Krishnakumar, Former DDG (Hort.) ICAR opined that there is need to have policy reforms to enhance export of seed spices. He also emphasized to reduce pesticide use in these crops through integrated pest management. He stressed on the need to prioritise region-wise export of specific crops and highlighted that: i) policy decision should be such that the seed spices production from Rajasthan may be used for export purpose while production from Gujarat for domestic consumption; ii) crop-wise agro-ecological zones need to be developed for higher yield and quality; iii) there is need to identify new niche of production to maintain the production under changing climate conditions; iv) use of hermetic bags to avoid insect infestation in these aromatic products as storage bags are the major source of aflatoxin contamination; v) traceability of contamination in seed spices crops; vi) development of produce as per the country-wise export standards; vii) need to segregate products farmer-wise as practiced in other crops so that contamination and pesticide residue can be traced back to sources; and viii) promote export through posting of one agriculture expert in the embassy of importing countries. He further stressed that farmers are using same packaging materials for different crops, for example, groundnut bags are generally used for storage of cumin which must be avoided.

Dr Surinder K Vasal, World Food Prize laureate stressed that there is an urgent requirement to evaluate the medicinal value of seed spice to protect human life from COVID-19 like situations. He further emphasized that most of seed spices crops are out-crossing in nature, and hence to create more variability, there is requirement of large number of hybridization programs so that more varieties can be developed. Hybrid technologies may be employed in improvement of seed spices that are cross-pollinated for which strong collaboration with private sector is absolutely necessary.

Dr MM Anwar, Former, Director, ICAR-NRCSS emphasized that social science research involving statisticians, economists and extension personnel needs to

be taken-up in seed spices crops. There is urgent need to strengthen farmer producer organizations (FPOs). GI tagging of popular varieties and traceability of contamination should be our priority. He focused on points such as: i) reduction of toxicity in seed spices through popularization of integrated pest/disease management practices; ii) development of varieties for high bioactive compounds, develop metabolic profiling of seed spices crops and also quantification of different metabolites present in different varieties of seed spices; and iii) development of export house for seed spices and inclusion of nanotechnology towards development of antimicrobial products from essential oil of seed spices.

Dr Umesh Srivastava, Former ADG (Hort.) ICAR and Consultant, TAAS expressed concern about Indian products facing rejections and bans in key markets. He emphasised that most of these are related to non-compliance with food safety and health standards. Contamination with food bacteria and use of banned chemicals by the importing country's food laws are major reasons for rejection of export consignments. With the remedial measures to production, marketing, processing and policy constraints, it is right time to accord high attention to quality production abiding international standards. At all stages of supply chain, precaution is needed to tap available opportunities in high demand markets. To retain global reputation, India must bring in reforms like product traceability, adoption of GAPs and processing techniques. There is an urgent need for restrictions on use pesticides banned in importing countries. Also, we need to switch to the organic cultivation of seed spices adopting biofertilizers and green inputs. Spice Board India should organise stakeholders' meetings for bilateral discussions and knowledge sharing among business partners.

Dr JL Karihaloo, Former Coordinator, APCoAB, APAARI expressed the need to work on improvement in essential oils and other quality traits through breeding, agronomy, and post-harvest handling; and giving greater attention to the research work on high value temperate spices like asafoetida, saffron and other herbs.

Dr VA Parthasarathy, Former Director, ICAR-IISR, Kozhikode remarked that issues relating to volatiles and post-harvest management need to be addressed appropriately. Since spices are used for the flavor and aroma, there is need to identifying an ideotype with better chemical profile so as to develop new varieties.

Dr. Mir G. Hassan, Assistant Professor (Plant Pathology), SKUAST-Kashmir, Srinagar emphasized that *kalazeera*/*syah-zeera*, saffron, and Kashmiri chilli are generally grown organically and are excellent in quality. Concerted efforts need to be made to find international market for these products.

Dr. Shailesh Shah, Cumin Exporter from Gujarat remarked that Indian agri-produce value growth and farmers' gain depend on: i) APMC market needing

improvements to avoid food contamination; ii) pesticide distribution and control on adulteration; iii) good farming practices, aggressive adoption of FPO module by the farmers; iv) safe storage practices; and v) yield and variety certification process. He further stated that pesticides cannot be a state subject as most developing countries use pesticides under established policies of Central Government or an independent authority. Currently, sale of the farm products is controlled by a few traders and bureaucrats through APMC market with several anomalies which need be looked into judiciously. Also, Spices Board India should take up the project for new product development, wherein they may involve private companies, and introduce the new items, like m*arjoram,* thyme, parsley, rosemary, laurel leaves, and ani seeds, etc. For this, Spice Board India should have a team of selected subject experts, FPOs and leading exporters which may procure data on trade, and consumption globally and region-wise. This would make India stronger and would help maintain country's share in international market.

Dr Laxmi Kant, Principal, Dayanand College, Ajmer emphasized on the need to identify new markets to promote the export of seed spices. He also stressed that we should identify the new areas and countries where people do not know much about importance of seed spices that are also having medicinal values. He gave the example that kiwi and dragon fruits are now becoming popular in India due to their nutritional/medicinal properties.

CONCLUDING REMARKS

In concluding remarks, **Dr AK Singh** appreciated the achievements of ICAR-NRC Seed Spices and emphasized on the use of block-chain technology for transparency, ensuring quality, and promoting the export of seed spices. He also highlighted on the importance of purity of seed; avoiding contamination due to use of same gunny bag for different commodities, adopting a policy of one district one product, and promoting protected cultivation, etc.

Dr RS Paroda, in his concluding remarks, emphasized on farmer centric approach in every facet of seed spice production and export so that farmers may get benefit of the export opportunities in seed spices. He opined to develop a 'Strategy Paper' encompassing all facets of seed spices. There is urgent need to develop strategy for India to remain world leader in seed spices export, with production target of 4-5 billion USD in next 2-3 years, and 6-7 billion USD by 2030. He further stressed that need-based policy support by GoI is urgently required. Export-related facilities including accredited laboratories for quality testing, pesticide residue analysis, and developing organic products, etc. either by GoI or private sector need to be created. There is need to link farmers with international market and apprise them with quality requirements of the importing countries wherein private companies

along with research institutes like NRCSS and IISR should play an important role. Also, we need to popularise seed spices for their medicinal properties which are important for health and immunity.

The expert consultation ended with a vote of thanks by **Dr Krishna Kant** to the chairs/co-chairs, speakers, panelists, distinguished invitees and participants.

KEY RECOMMENDATIONS

Based on thematic presentations, panel discussion and general viewpoint of participants, the following important recommendations had emerged as a 'Road Map' for enhancing export of seed spices:

I. Strategy and Policy

1. India needs to embrace a comprehensive long-term agro-export policy while addressing the issues affecting agriculture exports. It must comply with the SPS conditions for key export markets, through establishment of good infrastructure and marketing facilities. It also needs to target increase of export of spices from current USD 4 billion to around USD 10 billion. For export promotion of agricultural products, including spices, there is an urgent need to have position of one agricultural attaché created in the embassies especially in major importing countries.
2. Enabling environment is critical for scaling innovations linked to production, processing and export of seed spices, besides provision for DNA fingerprinting of germplasm, its registration including that of released varieties; patenting of technologies; documentation of indigenous traditional knowledge (ITK); and linking seed spices producers with market for maximization of profit.
3. In view of improving product quality and the rise in product safety, traceability related facilities adhering to sanitary and phytosanitary (SPS) requirement would be necessary. For traceability of aflatoxins, allergens, microbial load and other pesticides during storage, required provision of accredited laboratories become a high priority.
4. Effective weather forecasting and good knowledge dissemination to seed spices growers for optimizing production and processing under optimal conditions. To ensure this, strengthening and better funding of institutions engaged in research on seed spices is needed, including creation of required trained human resource. The ICAR may also consider creating, on priority, a separate Coordinated Network Project on Seed Spices under the National Research Centre on Seed Spices (NRCSS) with establishment of centers in Madhya Pradesh and Haryana. This will improve farmers' condition in the major seed spices producing states of Rajasthan and Gujarat.

5. For finding solutions to the constraints of farmers, there is need to organize them in the form of farmer self-help groups/cooperatives/farmer producer companies (FPCs) through voluntary groups (about 15- 20 active farmers). These producer companies could thus get linked directly to the market including those in other countries. These FPCs will function more effectively to promote export of good quality seed spices, provided incentives are given by the Government in a well-planned manner.
6. A 'Strategy Paper' addressing the current status, challenges and opportunities, specific research and development needs, trade related matters including export, traceability, post-harvest management and value addition, need for good agronomic practices (GAPs), pesticide residue related problems, enhancing production of food quality, spices, etc. would help in defining a clear 'Road Map' to accelerate production and export of seed spices. It will also reveal ways to remain world leader in the export of seed spices, for which the export has to increase exponentially from current USD 4-5 billion to around USD 6-7 billion by 2030.
7. Currently, multiple agencies like Spice Board India, Export Inspection Council (EIC), Agricultural & Processed Food Products Export Development Authority (APEDA), Directorate of Plant Protection, Quarantine and Storage (DPP&QS), National Accreditation Board for Testing and Calibration Laboratories (NABL), Bureau of Indian Standards (BIS), Food Safety and Standards Authority of India (FSSAI) are involved in the export of seed spices. Hence, for ease of business, it will be better to have a "single window system" created.

II. Research and Development

8. Greater thrust is needed on widening the genetic base, germplasm enhancement through pre-breeding while using resistance/tolerance to biotic and abiotic stresses, and exploiting available landraces for varietal improvement in each of the seed spices crop. Also, greater use of biotechnology related techniques such as marker-assisted selection (MAS), genomic selection (GS), genome editing (CRISPR/Cas9) would be highly rewarding. Efforts are also needed to develop varieties that are adapted to climate change. The possibility of developing hybrids in some cross-pollinated crops needs to be explored with a view to enhance productivity.
9. Production and availability of genetically pure seeds have to be ensured to maintain uniformity of the produce. Also, there is need to maintain minimum seed standards, adopt required isolation distance, and use seed priming and pelleting for improving germination. Further, efforts on maintenance breeding are needed to ensure good quality nucleus and breeder seed production.

Improving seed replacement rate (SRR) of improved varieties of seed spices would greatly help in increasing production and productivity.

10. Among the seed spices, cumin is the most important crop. However, it faces a major challenge of biotic and abiotic stresses. There is urgent need to develop varieties possessing multiple resistance to replace the current dominance of single cumin old variety GC-4. The present genetic base in cumin is quite narrow and for widening the variability, there is need to utilize non-conventional breeding approaches including mutation breeding and *in vitro* mutagenesis. There is also need to focus on searching the source of resistance for blight disease, and yellowing and reddening and use these in breeding programs. The studies on inheritance of complex traits like yield, quality, diseases and pests in cumin need to be intensified. In coriander, there is need to breed both table and processing purpose varieties. For this, the existing variability in coriander needs to be utilized for evolving improved hybrids.
11. Weed management is a major problem in seed spices especially when sown through broadcasting to replace manual weeding with suitable newer techniques. Also, there is need to develop herbicide tolerant varieties or use post-emergence herbicides.
12. Agro-eco-region specific approach for the production of seed spices is urgently warranted. Also, there is need to identify new niche for the expansion of area for increased production. For this, the use of geographic information system (GIS) will be helpful for scientific land use planning.
13. For seed spices, it will be more desirable to adopt organic agriculture using integrated plant nutrient management (IPNM) and integrated pest management (IPM) approach. In this context, there is a need to create public awareness among the people.
14. Greater attention is required to promote good agronomic practices (GAPs) such as: use of good quality seed, nursery raising, line sowing, mulching, drip-irrigation, inter-cropping, protected cultivation and eco-friendly plant protection technologies. Mechanization for sowing, weed management and harvesting would ensure clean and safe production. Also, post-harvest processing, viz., grading, sorting, packing, labelling and safe storage need to be promoted. Use of spray drying, cryogenic grinding, improved green oil extraction technology, and the production of value-added products instead of export of raw seeds would benefit the producers and exporters.
15. The envisaged increase in share of value-added products in the export basket of seed spices needs strengthening of processing facilities both on-farm and

off-farm. Custom hiring centres for seed processing at district level need to be created in seed spice growing states like Rajasthan and Gujarat.

16. There is urgent need to keep close eyes on global competitors, importing countries, and their quality standards through market intelligence. The markets in European countries and the United States provide greater opportunity for Indian seed spices. Hence, long-term export policy targeting these countries would accelerate export of seed spices.
17. To maintain and promote India's reputation in the global market, there is an urgent need to discourage use of those chemicals and pesticides that are banned in other countries where seed spices are exported.

Annexure I

Technical Program

Monday, 22 NOVEMBER, 2021 (14.00-17.30 HRS)

14.00-15.00	**OPENING SESSION**	
Chair : RS Paroda, Chairman, TAAS, New Delhi		
14.00-14.05	**Welcome**	**Bhag Mal**, Secretary, TAAS
14.05-14.15	**Setting the Context**	**SN Saxena**, Director, ICAR-NRCSS
14.15-14.25	**Special Remarks**	**Anand Kumar Singh**, DDG (HS), ICAR
14.25-14.45	**Address by Chief Guest**	**T Mohapatra**, Secy, DARE & DG, ICAR
14.45-15.00	**Chairman's Remarks**	**RS Paroda**
15.00-15.45	**THEMATIC SESSION** **Challenges and Opportunities in Seed Spices Export**	
Chair : Anand Kumar Singh, DDG (HS), ICAR		
15.00-15.15	Export Scenario of Indian Seed Spices vs World	**K Nirmal Babu**, Former Director, ICAR-IISR, Kozhikode
15.15- 15.30	Production and Potential of Seed Spices: Challenges and Opportunities	**SN Saxena**, Director, ICAR-NRCSS Ajmer
15.30-15.45	Future Strategy for Seed Spices Export	**R K Menon**, World Spices Organization, Kochi
15.45-17.00	**PANEL DISCUSSION** **Way Forward for Accelerating Export of Seed Spices**	
Co-Chairs : Dr RS Paroda, Chairman, TAAS **: Anand Kumar Singh**, DDG (HS), ICAR		
	Panelists	
	SK Malhotra, Agriculture Commissioner, GoI	
	BR Choudhary, VC, AU, Jodhpur	

	Abhimanyu Kumar, Horticulture Commissioner, Govt. of Rajasthan **JS Sandhu**, VC, SKNAU, Jobner **Bhagirath Chaudhary**, SABC, Jodhpur **Vikramaditya Pandey**, ADG (HS) **Homey Cheriyan**, Director DASD, Kozhikode **A.B. Rema Shree**, Director, Spice Board, Kochi **Sanjeev Bisht**, Vice President, Spices and Aqua Business, ITC Ltd **Sreedhar Kaluva**, DGM, Olem Spices	
17.00-17.15	**General Discussion**	
17.15-17.25	**CONCLUDING REMARKS**	
	Anand Kumar Singh, DDG (HS) **RS Paroda**, Chairman, TAAS	
17.25-17.30	Vote of Thanks	**Krishna Kant**, General Secretary, Indian Society of Seed Spices, Ajmer

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Expert Consultation
on
Accelerating Export of Seed Spices:
Challenges and Opportunities
Monday, 22 November, 2021 : 14.00-17.30 hrs
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