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ANNUAL REPORT 2018-19



National Horticultural Research and Development Foundation
New Delhi

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Contents

Preface	vii
1. Introduction	1
2. The Mandate	2
3. The Infrastructure	4
4. Executive Summary	7
5. The Recommendations	8
6. Apex Committees	11
Management	11
Scientific Advisory	12
7. Awards / Prize	13
4th NHRDF Award	13
KVK Prize	14
8A. Research Achievements	15
Field Studies	15
Onion	15
Plant Genetic Resources and Crop Improvement	15
Crop Production System Management	18
Plant Health Management	20
Post-Harvest Management	26
Garlic	26
Plant Genetic Resources and Crop Improvement	26
Crop Production System Management	27
Plant Health Management	27
Post Harvest Management	28
Tomato	29
Crop Production System Management	29

Okra & Tomato	29
Plant Health Management	29
Dolichos Bean	29
Plant Genetic & Crop Improvement	29
8B. Laboratories Studies/ Services	30
Studies	30
Biocontrol	30
Entomology	31
NHRDF Honey	31
Mushroom	31
Pesticide Residue Analysis	32
Plant Pathology	32
Plant Physiology	32
Seed Testing	32
Soil Testing and Biochemistry	32
9. Agriculture Economics	33
10. Projects Implemented	35
11. Transfer of Technology	36
12. Major Activities - Krishi Vigyan Kendra, Delhi	53
13. Seed and Planting Materials	57
14. Publications	59
15. Administrations	62
16. Human Resource Development	64
17. Finance and Accounts	69
Tables	
Table 1 : Seed Produced of different crops and distributed during 2018-19	58
Table 2 : Cost of production of onion seed crop during 2018-19	73
Table 3 : Cost of production of onion bulb during <i>kharif</i> 2018	75
Table 4 : Cost of production of <i>rabi</i> onion bulb during 2018-19	77
Table 5 : Cost of production of garlic during 2018-19	79
Table 6 : Cost of production of potato during 2018-19	80
Table 7 : Area, Production and Productivity of Onion in different states during 2018-19	81
Table 8 : Area, Production and Productivity of Potato in different states during 2018-19	82
Table 9 : Area, Production and Productivity of Garlic in different states during 2018-19	83
Table 10 : Month wise onion export during 2015-16 to 2018-19	84
Table 11 : Onion importing countries during 2018-19	84

Table 12 : Garlic importing countries during 2018-19	85
Table 13 : Potato importing countries during 2018-19	86

Annexures

Annexure I : Members of Managing Committee	88
Annexure II : Members of Scientific Advisory Committee	90
Annexure III : Officers and Staff of NHRDF Centres	91
Annexure IV : Present Officer In-Charges of NHRDF centers	96
Annexure V : Meteorological Data	99
Acronyms	101
Onion and Garlic Varieties	103

Colour Plates

Colour Plate No. 1 : Onion Genotypes under ICAR - AINRPOG Testing	9
Colour Plate No. 2 : Garlic Genotypes under ICAR - AINRPOG Testing	10
Colour Plate No. 3 : National and State Level Seminars	42
Colour Plate No. 4 : Trainings Imparted to Agriculture/Horticulture Officials and Farmers	46
Colour Plate No. 5 : Farmer's Group Visited to NHRDF Centers	47
Colour Plate No. 6 : Field Days	48
Colour Plate No. 7 : Participated in Exhibitions /Farmer's Fair	49
Colour Plate No. 8 : Laiddown of Foundation Stone of Biocontrol Lab and Water Pound	50
Colour Plate No. 9 : Higher Official Visited to NHRDF Offices	51

Preface



It is a matter of great privilege to present the 41st Annual Report of the National Horticultural Research and Development Foundation (NHRDF) for the year 2018-19. The report includes research and developmental activities carried out at NHRDF Regional Research Stations/ laboratories having state of the art facilities, Krishi Vigyan Kendra, Seed Production, Distribution Centers and implementation of various projects.

During the year, NHRDF conducted various research trials on different crops under ICAR-All India Network Research Project on Onion and Garlic (AINRPOG) and ICAR-All India Coordinated Research Project on Vegetable Crops (AICRP-VC) on a number of aspects, viz. Plant Genetic Resources and Crop Improvement, Crop Production System Management, Plant Health Management, Post-Harvest Management as well as Seed Production Technology of onion, garlic, okra, tomato, chilli and French bean. The quality seeds of improved and notified varieties of vegetable crops, especially onion, garlic, potato, drumstick, chilli, tomato, okra, cowpea and cluster bean were produced and distributed to farming community across the country.

NHRDF imparted training on improved production technology of onion and garlic to agriculture/horticulture officers, field functionaries as well as farmers from India and abroad. We also successfully executed various projects granted by different agencies in the country and achieved the objectives therein. Besides these, the cost of cultivation for major onion, garlic and potato growing states, based on the surveys for inputs and rates of produce in local markets done by NHRDF centers, have been derived and presented in the report.

The apex committee like Managing Committee and Scientific Advisory Committee of NHRDF have been the principal guiding forces behind carrying out the activities in right direction which resulted in substantial progress of NHRDF. I dually acknowledge the support and guidance of these committees and profusely thank them on behalf of NHRDF.

The publication of NHRDF Annual Report is for the purpose of references and to impart technical know-how to researchers, extension workers, policy-planners, farmers and other stakeholders especially working on onion and garlic.

I appreciate and complement the members of Publication Committee, for their sincere efforts, and scientific, administrative, accounts and personnel staff of NHRDF for their valuable inputs to bring out this publication timely with high quality.

New Delhi
13th December, 2019

A handwritten signature in black ink, appearing to read 'P. K. Gupta', written over a horizontal line.

Dr P K Gupta
Director (Acting)

Introduction

The National Horticultural Research and Development Foundation (NHRDF) was established on 3rd November 1977 by NAFED and Associate Shippers and registered under the 'Societies Registration Act, 1860' XXI at New Delhi. The Head Office and registered office of NHRDF is located at "Bagwani Bhavan", 47, Pankha Road, Institutional Area, Janakpuri, New Delhi. The NHRDF is a voluntary centre of ICAR- All India Coordinated Research Project on Vegetable Crops (AICRP-VC) and ICAR-All India Network Research Project on Onion and Garlic (AINRPOG) of the Indian Council of Agricultural Research, New Delhi. It is also a National Level Agency under Mission for Integrated Development of Horticulture (MIDH) since its inception in 2005-06 and Residue Analysis Laboratory at Nashik is become the part of Monitoring of Pesticide Residue at National Level (MPRNL), Division of Plant Protection since 01 April 2018, Department of Agriculture and Cooperation and Farmers' Welfare (DAC&FW), Ministry of Agriculture and Farmers' Welfare, Government of India, New Delhi for monitoring pesticidal residues in different vegetables and fruits as per NABL scope.

The NHRDF provides services to farmers through research and developmental activities such as seed production of different crops, especially vegetables,



vermicompost, biopesticides and their distribution as well as other laboratory facilities. The NHRDF generates some revenues through these technical services to build-up revolving fund for further expansion of research and developmental activities of the NHRDF.

The research and developmental programmes were initially started on onion and later on garlic was included in the mandate crops. In view of vast export potential, the NHRDF has also extended its R & D programmes on other export-oriented vegetable crops like okra, tomato, frenchbean, cowpea, chilli, drumstick, brinjal and cucurbits.

02

Chapter

The Mandate

The mandate of the NHRDF is to:

- To undertake, carry on or help in the research and other scientific investigation in the growth and development of different varieties of various export oriented horticultural produce.
- To establish institutes, laboratories, research centres, model farms, and study teams for promoting better quality and higher yield of horticultural produce, better packaging, transport and shipping with a view to improve the life of the produce and carry on experiments in that behalf and provide funds for such work and to educate farmers and disseminate the knowledge and fruits derived by conducting training programmes, seminars etc.
- To investigate and carry on research for assessing demands of the agricultural produce of the Indian origin in foreign countries by conducting extensive survey and undertake research and development of horticultural produce with export potential and to motivate farmers to grow such varieties of horticultural produce with the object of further developing the horticultural export from India.
- To prepare, edit, print, publish and circulate books, papers and periodicals bearing upon the growth and development of horticultural produce or other scientific and research activities connected therewith, and to establish and maintain collections, libraries, statistics, scientific data and other information relating thereto.
- To appoint investigators to study in india or abroad administration and scientific problems in regard to the scientific research undertaken by the foundation.
- To apply to governments, public bodies, local authorities corporations and companies or other persons for and to accept grants of money, land donation, gifts, subscriptions and other assistance with a view to promoting the object of the society.
- To undertake and execute any trust which may be conducive to any of the objects of the society.
- To borrow or raise any money may be required by the Society upon such terms as may be deemed fit.
- To invest the money of the Society not required immediately in accordance with section 11(5) of income tax act, 1961.
- To purchase or take on lease or in exchange, hire or otherwise acquire any real and personal property and in particular any land, buildings, laboratories, machinery, plant, appliances and any rights of privileges necessary or convenient for the purposes of the society and to construct, erect alter, improve and maintain any building which may from time to time be required for the purpose of the Society and to manage, develop, sell, let, dispose off or mortgage or turn to account or otherwise deal with all or part of the said property.
- To pay all expenses preliminary or incidental to the formation of the society and its registration.

- To collect and disseminate statistical and other technical information in respect of the agriculture in all its aspects.
- To conduct all aspects of scientific research and development activities in the field of horticulture especially mentioned above or otherwise conducive to the objectives of the Society, provided, however that none of the activities of Society will be undertaken for profit, nor shall it involve any profit motive. Provided, however, that the Foundation may receive nominal service charges, to cover the cost of services wherever found necessary in the interest of maintaining the financial stability of National Horticultural Research and Development

Foundation. But the Foundation shall provide extended services to farmers in the form of research and development activities, namely seed development, vermi-compost, bio-pesticide production and distribution and other laboratory services for which the Foundation may collect revenue from the farmers so as to establish a revolving fund or credit to corpus fund for further expansion of research and developmental activities.

- To subscribe to any institute/organization by way of fee/ purchase of share towards membership wherever considered necessary for fulfilling the objective of National Horticultural Research and Development Foundation.

Vision

The vision of NHRDF is “Enriching Indian Horticulture by Developing and Disseminating Advances Technologies for Making India as a Global Leader in Horticulture Sector”. This will be focused especially on promotion of vegetable crops like onion, garlic etc. This will be achieved by enhancing the production, productivity and minimizing post-harvest losses of onion, garlic and other export-oriented horticultural crops, which will facilitate to meet the domestic needs and make India the global leader in the export.

Mission

The mission of NHRDF is to provide technological empowerment to farmers through well-trained manpower and well-organized R&D activities, and efficient extension networking for enhancing the production and productivity, and minimizing post-harvest losses through scientifically developed technologies. The NHRDF would make the programmes to meet 25% of demand of onion and garlic by tapping the potential of unused land and 75% by technological interventions.

03 Chapter

The Infrastructure

To fulfill the mission and vision, NHRDF has created necessary infrastructural facilities to carry out the field and laboratory studies. It has established research stations and extension centres in different states of the country. Presently, NHRDF has 5 Regional Research Stations (RRSs) and 17 Extension Centres (ECs) all over the country. The RRSs are located in Maharashtra, Haryana, Tamil Nadu and Odisha. Whereas, ECs are located in main onion- and garlic- growing pockets of the country.

The Plant Pathology, Entomology, Plant Physiology, Soil Testing and Biochemistry laboratories are established at Nashik and Karnal. Pesticides Residue Analysis Laboratory and Wine Testing laboratory have also been established at Nashik (Maharashtra). The Pesticide Residue Analysis Laboratory has been accredited by the National Accreditation Board for Testing and Calibration of Laboratories (NABL) and approved by APEDA, AGMARK and monitored by NRL and ICAR- NRC for Grapes, Pune. The wine testing laboratory has also been recognized by European Union.

One Model Post-Harvest Research Complex at Lasalgaon, Nashik, having 10 handling sheds of 100 tonnes capacity each and 20 modern storage godowns of 50 tonnes capacity each have been established by NHRDF for training and providing infrastructural support to onion growers, traders and exporters on post-harvest management of onion. The garlic storages have been constructed at Karnal, Boudh and Indore for storage of garlic seed bulbs. The onion storage structures are constructed

at RRS, Sinnar and Chitegaon in Maharashtra and Ujwa, South-West district in Delhi and Karnal in Haryana for storage of onion bulbs. The NHRDF has established seed processing units and dehumidified seed storage facilities at Lasalgaon and Chitegaon Phata, Nashik (Maharashtra), Karnal (Haryana), Indore (Madhya Pradesh), Rajkot (Gujarat), Boudh (Odisha), Kurnool (Andhra Pradesh), Deoria (Uttar Pradesh) and Delhi.



Head office, New Delhi



RRS, Chitegaon, Nashik (MS)



Krishi Vigyan Kendra, New Delhi



RRS, Karnal (Haryana)

The Biocontrol Laboratory has been established at Chitegaon Phata, Nashik under NHM where large-scale production of *Trichoderma viride* and SNPV is taken up for distribution to farmers under plant-protection services. The Mushroom Spawn Production unit at Janakpuri and Pasteurized

Compost Unit at Ujwa, South-West Delhi district, New Delhi, have been established by NHRDF to extend services to farmers and entrepreneurs.



Indore (MP)



Lasalgaon, Nashik (MH)



Rajkot (Gujarat)



RRS, Sinnar, Nashik (MH)



Deoria (UP)



RRS, Boudh (Odisha)



Kurnool (AP)

Recently, Bio-control Laboratory has been also established under MIDH at Regional Research Station, Karnal for mass production of *Beauveria bassiana* and other biopesticides.

The NHRDF has established one Krishi Vigyan Kendra at Ujwa, South-West district, New Delhi

to cater to the needs of farmers of NCT, Delhi and it is fully sponsored by the ICAR, Department of Agriculture Research Education (DARE), Ministry of Agriculture and Farmers' Welfare, Government of India. This KVK comes under the ICAR-ATARI zone-II, Jodhpur, Rajasthan. The NHRDF has established Information Center, one each at Nashik and Delhi to gather and disseminate the information on area, production, crop condition, marketing, availability and export of horticultural crops, particularly on onion, garlic, tomato and potato. The information on area, production, export and market data of onion, garlic and potato are being uploaded on daily basis on website www.nhrdf.org for the benefit of farmers, exporters and other stakeholders. The NHRDF has established Meteorological Observatory with automatic weather station at Karnal, Sinnar, Chitegaon and recently at Paljhar to study the crop performance in relation to weather conditions. Six polyhouses of 2,000 m² each have also been constructed at Karnal, Boudh, Chitegaon and Sinnar.

Executive Summary

The national scenario of onion and garlic production has shown a considerable increase during the past 41 years after the inception of NHRDF in 1977. The research and developmental programmes were initially started on onion and later on garlic was included in its mandate. In view of the vast export potential, NHRDF has extended its research and developmental programmes on other export-oriented horticultural crops. During 2018-19, research and developmental works have been carried out on onion, garlic, potato, okra, frenchbean, tomato, chilli, drumstick, cowpea and cucurbits.

The studies were undertaken for evaluation of onion germplasm, varietal trials, promising lines of red and white onion, bolting behaviour, late *kharif* onions and exotic onion hybrids under the Plant Genetic Resources and Crop Improvement Programme. The research trials were conducted on spacing, time and method of planting / transplanting, nutrition, weed control and effect of drip irrigation on onion seed production at different levels of soil moisture under Crop Production System Management. The trials on management of soil-borne diseases, foliar diseases and effect of various fungicides, bio-control agents and plant products against onion pathogens, chemical control of onion thrips, use of organic products and entomopathogenic fungi for thrips management, integrated pest management, effect of intercropping of different crops, plant extracts, neem-based biopesticides, insect, growth regulators and environmental factors were conducted under Plant Health Management. Storage studies on onion in different experiments were undertaken under Post-Harvest Management.

Similarly in garlic, studies were undertaken on evaluation of germplasm, varietal trials, advanced

lines of garlic under Plant Genetic Resources and Crop Improvement. Nutritional aspects were studied in Crop Production System Management and different promising lines of garlic were screened against diseases and pests under Plant Health Management. Storage of garlic was studied under Post-Harvest Management.

The studies on pest control in okra under Plant Health Management, varietal trails in French bean under Plant Genetic Resources and Crop Improvement were undertaken during the period. Nutrient management and seed production of cowpea were taken under Crop Production System Management. Onion seed coated with growth promoters and nutrient and fungicide trials were conducted under Seed Technology.

The NHRDF is engaged in quality seed production of improved and notified varieties of onion, garlic, potato, tomato, chilli, drumstick, and distribute their seed as a part of developmental activities, since its inception, with a view to serve the farming community. A total of 12,398.30 quintals seed of improved varieties of different vegetable and spice crops, besides paddy, wheat and soybean were distributed. The programmes of different projects, namely Mission for Integrated Development of Horticulture, Monitoring of Pesticide Residue at National Level, Department of Agriculture Cooperation and Farmers Welfare (DAC&FW), ICAR-Krishi Vigyan Kendra, AINRPOG & AICRP-VC, Department of Agriculture Research and Education (DARE), Ministry of Agriculture and Farmer's Welfare, Government of India; RRS, NHRDF Boudh under RKVY, Government of Odisha; Water Storage Pond at RRS, Sinnar under RKVY, Government of Maharashtra have successfully been implemented during 2018-19.

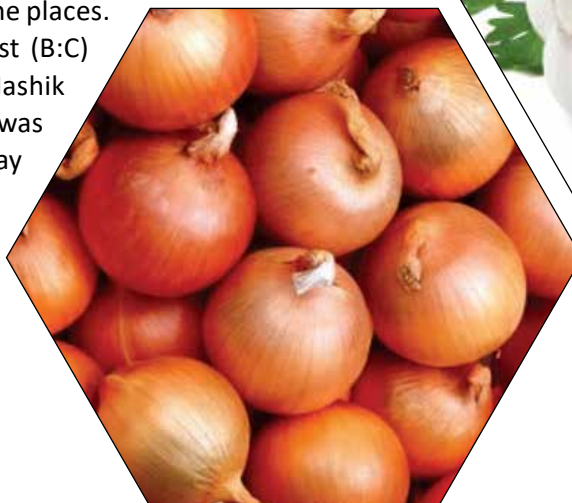
05 Chapter

The Recommendations

The NHRDF conducted need-based and location-specific research on onion, garlic and other vegetables crops. The trials were conducted for 2-3 consecutive years and on exhibiting consistent results and similar trends were finally discussed in the Scientific Advisory Committee Meeting before making the recommendations to farmers and other stakeholders. The findings of trials concluded at different Regional Research Stations of NHRDF during *rabi* 2017-18 at Nashik and Karnal are presented here brief:

Onion

- The data collected during three consecutive years (2015-18) on onion variety NHRDF Red for management of thrips at Nashik and Karnal revealed that, foliar spray of Spinosad @ 0.3 ml/L at thrips appearance and subsequently at 10 days' interval performed superior for their management and increased the yield of onion at both the places. The highest benefit cost (B:C) ratio of 7.40:1 at Nashik and 7.78:1 at Karnal was recorded with the spray of Fenprothrin @ 0.6 ml/L of water.



Garlic

- The three consecutive year data (*rabi* 2015-18) on garlic variety Yamuna Safed-3 for management of foliar diseases at Karnal revealed that combined fungicide Cymoxanil 8% + Mancozeb 64% @ 0.20% spray at 30 days after planting and subsequently at fortnightly interval performed superior, followed by spray of Mancozeb @ 0.25% as standard check for the management of stemphylium blight and purple blotch and as increased the yield. The highest B:C ratio of 2.57:1 was recorded with the spray of Mancozeb @ 0.25% as standard check, followed by Cymoxanil 8% + Mancozeb 64% spray @ 0.20% with B:C ratio of 2.56:1.



Colour Plate No. 1

Onion Genotypes under ICAR - AINRPOG Testing



L - 863



L - 883



L - 857



L - 849

Colour Plate No. 2

Garlic Genotypes under ICAR - AINRPOG Testing



G-417



G-389



G-304



G-363

Apex Committees

Management

The management of NHRDF vests in the Managing Committee consisting of 4 representatives from NAFED, including Managing Director, 5 representatives from Associate Shippers, 6 representatives engaged in cultivation of onion or any other vegetables, 4 eminent horticultural scientists and Director, NHRDF as Member Secretary. The 159th Managing Committee Meeting was held on 23 August

2018 at Bagwani Bhawan, New Delhi, under the Chairmanship of Dr Bijender Singh, Hon'ble President, NHRDF. The list of the Managing Committee Members is given in Annexure I. The 158th, 159th, 160th, and 161th MCM was organized on 20th March, 23rd August, 27th October 2018 and 14th March 2019 at Delhi respectively. The 41st Annual General Meeting and Extra-ordinary Meeting was organized on 23rd August and 27th October 2018 respectively.



Annual General Meeting of NHRDF held on 23 August 2018 at NCUI, New Delhi

Scientific Advisory

The NHRDF has a Scientific Advisory Committee Chaired by Deputy Director-General (Horticultural Science), ICAR, DARE, Ministry of Agriculture and Farmers' Welfare, New Delhi. It consists of eminent horticultural scientists from different institutes of ICAR and State Agricultural Universities (SAUs) in the respective disciplines as members and Director,

NHRDF as Member secretary. This committee meets twice a year to review the research and developmental programmes and also to discuss and decide the future technical programmes for *kharif* and *rabi* seasons. The list of honorable members of the Scientific Advisory Committee is given in Annexure II. The 76th, and 77th SAC meeting was organized on 21st July 2018 and 14th February 2019 at Delhi respectively.



SAC Meeting held at NHRDF Head Office, New Delhi on 21 July 2018

Awards / Prize

4th NHRDF Award

The 4th NHRDF Award for Outstanding Research in onion and garlic was presented to Dr Veera Gowda R., Principal Scientist, ICAR-IIHR, Bengaluru. The award was given by Dr A K Singh, DDG (Horticultural Science), ICAR and other dignitaries on dais on 30th May 2019 during inaugural ceremony of X-Annual Group Meeting

of ICAR–All India Network Research Project on Onion and Garlic held at ICAR – IARI, New Delhi. The contribution of Dr Gowda to Onion and Garlic development in India is well known. He had his Bachelor of Science (Horticulture) during 1981, Master of Science (Horticulture) in Olericulture, during 1983 and Ph.D. in Horticulture during 1989 from the University of Agricultural Science (UAS), Bengaluru, Karnataka.



5th NHRDF Award 2018 for outstanding contribution for promotion of onion and garlic conferred upon Dr Veera Gowda. R, Principal Scientist (Hort.) ICAR- IIHR, Bengaluru

Dr Veera Gowda is a vegetable breeder by profession and has been actively involved in the development of several varieties in onion and carrot. His contribution in developing white onion variety with high TSS and dry-matter content and rose onion varieties and their promotion for export has been commendable. True seed multiplier onion and short-day yellow onions also have been developed by him, besides developing molecular markers for male sterility, lines resistance to purple blotch and moisture stress. He has registered his onion varieties with Plant Protection and Varieties and Farmers' Right (PPVFR) Authority and presently involved in rose onion registration as geographical indicator crop in collaboration with Department of Horticulture, Government of Karnataka with National Biodiversity Authority, Chennai.

He has guided three Ph.D. and eight M.Sc. students and published 46 research articles in refereed journals. He is the recipient of UNDP Senior Fellowship for doing Ph.D (Horticulture). He has received the award for his significant research contribution in the filed of onion and garlic research from the Indian Society of Alliums, Rajgurunagar, during 2016 and Editorial Excellence Award from ARCC, Karnal during 2016. He has been awarded FAO International Fellowship for undergoing training at IAC, the Netherlands and fellowship of National Academy of Agricultural Sciences for training in Russia during 1997. The NHRDF Award was initiated during 2015 to recognizes onion and garlic scientists and given to following scientists:

Sr. No.	Name of awardee	Year	Venue
First	Dr K E Lawande, Ex Director, ICAR-DOGR, Pune	2015	ICAR-IARI, New Delhi
Second	Shri U B Panday, Ex- Director, NHRDF	2016	RARI, Jaipur
Third	Dr Vijay Mahajan, Principal Scientist, ICAR-DOGR, Pune	2017	PAU, Ludhiana

KVK Prize

The distribution of awards and prizes ceremony of Delhi Enviro Quest -2018 (A mega events at state level school children to create awareness among students to safe environment under Central sector scheme " *In-situ* Crop Residue Management) was organized on 8th March 2019 at Krishi Vigyan Kendra. Dr A. K. Singh, DDG (Agriculture Extension), Indian Council of Agricultural Research, DARE, Ministry of Agriculture and Farmers' Welfare, Government of

India was the Chief Guest and Shri Rahul Singh, IAS, District Mazistrate and Dy. Commisioner, South-West Delhi and Dr T. Jankiram, ADG (Horticultural Science) Indian Council of Agricultural Research, New Delhi, were Guest of Honor on the occasion. Certificates and prizes to winner students during Delhi – Enviro-Quest 2018 of different events like debate, extempore, slogan writing, poster making and GK quiz were awarded by the Chief Guest. In this programme about 100 winner students, teachers and parents were participated.



Award given by Dr A.K. Singh, DDG (Agriculture Extension), ICAR, New Delhi to Winner Students



Award given by Shri Rahul Singh, IAS, DM, Kapashera, New Delhi to winner students

Research Achievements

Field Studies

Onion

Plant Genetic Resources and Crop Improvement

Rabi 2017-18

Collection, evaluation and utilization

To select high-yielding genotypes over the control varieties, 59 onion genotypes were evaluated at RRS, Nashik. The highest gross yield (432.89 q/ha) and marketable yield (398.26 q/ha) were recorded by line-853 and line-782, respectively. They were at par with lines-748, 780, 782, 851, 862, 880 and 908 in gross yield, while lines, 743, 748, 750, 780, 821, 822, 837, 853, 862, 880, 881, 908 and 910, in marketable yield. The highest total soluble solids (13.99%) were recorded by line-871 and it was at par with lines-625, 753, 821, 822, 850, 870, 878, 903 and 910.

An evaluation trial of 25 different collections/variety of onion along with the control variety, NHRDF Red, done at RRS, Karnal, revealed that highest gross yield (441.67 q/ha) and marketable yield (411.11 q/ha) were recorded in L-1203. It was found at par with L-1668 in gross yield and with L-1640, L-1668 and Bhima Shweta in marketable yield. The highest total soluble solids (14.90%) and dry-matter content (16.38%) were recorded by W-355, which was found at par with W-172 and W-440.

Multiplier onion

A total of 25 different collections of multiplier onion along with two control varieties, viz. CO-4 and CO-5 were evaluated at RRS, Karnal. The highest

gross yield (195.83 q/ha) and marketable yield (163.82 q/ha) with total soluble solids (16.80%) were recorded in the control variety, CO-5. It was found at par with line-1535 in marketable yield and lines-1512, 1515, 1531, 1534, 1535, 1540, 1545 and the control variety, CO-4, in total soluble solids.

Varietal Trial (IET)

At RRS, Nashik, the highest gross yield (383.26 q/ha) and marketable yield (299.35 q/ha) were recorded in the control variety NHRDF Red-4, and it was at par with lines, ON-17-58, ON-17-62, ON-17-67, ON-17-73 and the control variety, NHRDF Red-3, in gross yield and lines, ON-17-58, ON-17-67, ON-17-73 and the control variety NHRDF Red-4, in marketable yield. The highest total soluble solids (12.66%) and dry-matter contents (14.15%) were recorded in line ON-17-75 and it was found at par with lines, ON-17-58, ON-17-67, ON-17-73 and the NHRDF Red-4, in total soluble solids and line ON-



17-67 and NHRDF Red-4 in dry-matter contents. At RRS, Karnal, highest gross yield (323.83 q/ha) and marketable yield (301.07 q/ha) were recorded in lines ON-17-83 and it was at par with line ON-17-85 in gross yield and lines ON-17-71 and ON-17-85 in marketable yield. The highest total soluble solids (14.38%) and dry-matter contents (15.68%) were recorded in line ON-17-69 and it was found at par with line ON-17-73.

Varietal Trial (AVT-I)

At RRS, Nashik, highest gross yield (400.33 q/ha) and marketable yield (334.39 q/ha) were recorded in line, ON-16-15 and it was found at par with lines ON-16-13 and ON-16-18 in gross yield. The highest total soluble solids (14.33%) and dry-matter content (15.69%) were noted in line ON-16-25. At Karnal the highest gross yield (398.41 q/ha) and marketable yield (378.99 q/ha) were recorded in line ON-16-54 and it was at par with lines ON-16-37, ON-16-39 and ON-16-41 in gross yield and line, ON-16-39 in marketable yield. The highest total soluble solids (14.58%) and dry-matter content (15.95%) were recorded in line ON-16-27 but it was at par with line ON-16-22.

Varietal Trial (AVT-II)

The highest gross yield (379.30 q/ha) and marketable yield (314.70 q/ha) were noted in line ON-15-20 and it was found at par with lines ON-15-37, ON-15-42, ON-15-45 and the control variety, NHRDF Red-4. The highest total soluble solids (14.27%) and dry-matter content (15.64%) were noted in line ON-15-06 and it was at par with line ON-15-20 at RRS, Nashik. At RRS, Karnal, the highest gross yield (314.51 q/ha) and marketable yield (259.88 q/ha) were recorded in line ON-15-18 and it was found at par with line ON-15-42 in gross yield and lines ON-15-16, ON-15-20 and ON-15-27 in marketable yield. The highest total soluble solids (14.62%) and dry-matter content (15.93%) were noted in line ON-15-42 and it was found at par with line ON-15-27 in total soluble solids and line ON-15-27 and ON-15-06 in dry-matter content.

Varietal Trial (AVT-II-II)

The highest gross yield (396.12 q/ha) and marketable yield (368.46 q/ha) were recorded in line ON-17-223 and ON-17-230, respectively, and it was at par with lines On-17-214, ON-17-218, ON-17-228, ON-17-230, ON-17-234 and the

control variety NHRDF Red-2, gross yield and lines ON-17-223, ON-17-234 and the control varieties, NHRDF Red-4, in marketable yield. The highest total soluble solids (14.47%) and dry-matter content (15.84%) were recorded in line ON-17-218 and it was found at par with line ON-17-214 and ON-17-230 at RRS, Nasik.

Red onion advance lines

The highest gross yield (453.79 q/ha) and marketable yield (297.95 q/ha) were recorded in advance line-824 and 807, respectively at RRS, Nashik and it was found at par with advanced lines-811, 824, 852 and the control varieties NHRDF Red and NHRDF Red-4, in marketable yield. The highest total soluble solids (14.11%) and dry-matter content (15.43%) were recorded in advance line-703 and 825, respectively, and it was found at par with advance line-852 and the NHRDF Red-4 in total soluble solids. At RRS, Karnal, highest gross yield (365.51 q/ha) and marketable yield (333.47 q/ha) were recorded in advance line-844 and it was found at par with advance line-807 in marketable yield. The highest total soluble solids (12.93%) were recorded in advance line-703 and it was found at par with advance lines-704, 811, 825, 845, 873 and the NHRDF Red and NHRDF Red-4.

White onion advance lines

The highest gross yield (382.13 q/ha) and marketable yield (250.47 q/ha) were recorded at RRS, Nashik by advance line-874 and it was found at par with advance line-827 in marketable yield. The highest total soluble solids (13.05%) and dry-matter content (14.44%) were noted in advance line-830 and it was found at par with advance lines-562, 799, 823, 832, 865, 886 and the control variety Agrifound White. At RRS, Karnal, the highest gross yield (290.28 q/ha) and marketable yield (258.82 q/ha) were recorded in line-810 and 562, respectively, and it was found at par with advance line-562 in gross yield. The highest total soluble solids (14.40%) were recorded in line-810 at RRS, Nashik.

Kharif 2018

Collection, evaluation and utilization

To select the high-yielding genotypes over the control varieties, 40 genotypes were evaluated at

RRS, Nashik. Among all genotypes, highest gross yield (414.28 q/ha) and marketable yield (284.57 q/ha) were recorded in line-555 and 883, respectively, followed by line-629 in gross yield and line-883 in marketable yield. The highest total soluble solids (15.50%) and dry-matter content (16.70%) were recorded in line-753 and 562, respectively, followed by line-845 and 854 in total soluble solids and line-753 in dry-matter content.

Varietal Trial (IET)

At RRS, Nashik, the highest gross yield (323.60 q/ha) was recorded in line OA-18-02, while highest marketable yield (252.32 q/ha) was recorded in line OA-18-12. The highest total soluble solids (13.40%) were recorded in line OA-18-18 and it was found at par with line OA-18-04 and OA-18-10. The highest dry-matter content (14.67%) were recorded in line OA-18-10 and OA-18-18 and it was found at par with line OA-18-02 and OA-18-04. At RRS, Karnal, highest gross yield (422.08 q/ha) and marketable yield (410.60 q/ha) were recorded in line OA-18-02 and it was found at par with the check variety, Agrifound Dark Red, in gross yield. The highest total soluble solids (14.04%) and dry-matter content (15.43%) were recorded in line OA-18-10.

Varietal Trial (AVT-I)

Highest gross yield (286.73 q/ha) and marketable yield (267.50 q/ha) were recorded in line OB-18-11 at RRS, Nashik and it was found at par with line OB-18-13. The highest total soluble solids (13.24%) and dry-matter content (14.65%) were recorded in line OB-18-07 and it was found at par with line OB-18-09 in total soluble solids. At RRS, Karnal, highest average bulb weight (74.18 g) and 20 bulbs weight (1.48 kg) were recorded in line OB-18-01 and it was found at par with line OB-18-03. The highest total soluble solids (13%) were recorded in line OB-18-13 and OB-18-16 and it was found at par with all lines except line OB-18-03. The highest dry-matter content (14.39%) were recorded in line OB-18-13 and it was found at par with all lines except the line OB-18-03.

Varietal Trial (AVT-II)

Highest gross yield (284.76 q/ha) and marketable yield (212.53 q/ha) were recorded in line OC-18-24 and OC-18-21, respectively at RRS, Nashik, and it was found at par with line OC-18-21 and OC-18-26 in gross yield and line OC-18-24 and OC-18-26 in respect of marketable yield. The highest total soluble solids (13.64%) and dry-matter content (14.91%) were recorded in line OC-18-19 and it



**EVALUATION OF ONION LINES FOR KHARIF SEASON
AVT-I (AINRPOG)**

DETAILS OF EXPERIMENT:		
Crop	Onion	
Season/Year	Kharif, 2018	
Design	R.B.D.	
Plot Size	0.75 m X 1.20 m	
Spacing	15 cm X 10 cm	
Replication	3	
Date of transplanting	20.08.2018	
DETAILS OF ENTRIES:		
OB-18-01	OB-18-03	OB-18-06
OB-18-07	OB-18-13	OB-18-16
ADR (Ch)		

was found at par with line OC-18-37 and OC-18-41 in total soluble solids and lines OC-18-23, OC-18-26 and OC-18-41 in dry-matter content. At RRS, Karnal, highest gross yield (432.04 q/ha) and marketable yield (412.41 q/ha) were recorded in line OC-18-30 and it was found at par with line OC-18-19 and OC-18-23 in gross yield and line OC-18-19 in marketable yield. The highest total soluble solids (13.78%) were recorded in line OC-18-19 and it was found at par with line OC-18-17. Highest dry-matter content (14.39%) was recorded in line OC-18-26 and the control variety Agrifound Dark Red and it was found at par with all lines except the line OC-18-19.

Multiplier onion (AVT-II)

At RRS, Nashik, the yield showed non-significant differences, however highest dry-matter content (17.00%) was recorded in line MP-18-30 and it was found at par with line MP-18-04 and MP-18-32.

Crop Production System Management

Rabi 2017-18

Weed management

The trial conducted for weed management in onion variety Agrifound Light Red at RRS, Nashik, revealed that cent percent weed control efficiency with highest gross yield (295.31 q/ha) as well as marketable yield (265.53 q/ha) were recorded in the treatment plastic mulch where marketable yield was found at par with the treatment Pendimethalin 30% EC application before planting + one hand weeding 30 days after transplanting + Quizalofop Ethyl 5% EC application 60 days after transplanting.

Integrated nutrient management for multiplier onion

The experiment conducted on multiplier onion variety, CO no-5, at RRS, Boudh, Odisha, revealed that application of 50% of nitrogen and full dose of phosphorus and potassium + 10 kg micronutrient (TN grade) / ha + 10 kg basal application of Bentonite Sulphur by basal application of recommended dose of NPK + half dose N at 30 DAT + soil drenching of AMC and ACT @ 20 g/L of water) at transplanting and foliar spray at 30 and 60 DAT performed superior over other treatments in gross yield (140.50 q/ha), while highest marketable yield (68.42 q/ha) was recorded in the treatment

50% of nitrogen and full dose of phosphorus and potassium + 10 kg micronutrient/ha (TN grade) + 10 kg basal application bentonite sulphur by basal application of recommended dose of NPK + half dose N at 30 DAT.

Weed management in nursery

At RRS, Nashik, treatment hand weeding (two times) performed better over other treatments in highest seedling fresh weight and dry weight and lowest total dry weight of weeds, where total weed dry weight was found at par with the combined spray of Pendimethalin @ 1.5 ml + Quizalofop ethyl @ 0.75 ml/L before seed sowing and second at 15 DAS. At RRS, Karnal, treatment hand weeding (two times) performed better over other treatments in terms of highest seedling fresh weight and dry weight, where fresh weight of seedlings was found at par with the treatment of Pendimethalin 30% EC @ 2.0 ml/L at transplanting and quizalofop ethyl @ 1.5 ml/L at 15 DAS.

Weed management in direct seeded crop

The trial conducted to find out the suitable method of weed management to control the weeds in direct seeded onion at RRS, Karnal, on onion variety Agrifound Light Red revealed that hand weeding three times, performed better over other treatments in highest gross yield (326.99 q/ha), marketable yield (275.60 q/ha) and weed control efficiency (92.94%), while in herbicide treatments poor bulb formation was observed.

Weed management in onion seed crop

The treatment, three times hand weeding (weed free control) recorded highest number of umbels (6.15/plant) and seed yield (6.63 q/ha) with highest test weight of 1,000 seed (3.99 g), whereas number of umbels and seed yield were found at par with Pendimethalin 30% EC @ 5.0 ml/L application before planting + one hand weeding at 30-40 DAP and combined application of Oxyfluorfen 23.5% EC @ 0.75 ml/L + Quizalofop ethyl 5% EC @ 1.0 ml/L at 60 DAP at RRS, Nashik. The highest Benefit:Cost (B:C) ratio (1.58:1) was noted in the same treatment in onion variety Agrifound Light Red. At RRS, Karnal three times hand weeding recorded highest number of umbels (8.40/plant) and seed yield (10.90 q/ha) with highest 1,000 seed weight (3.55 g) and B:C ratio (2.02:1) in onion variety NHRDF Red.

Application of boron, sulphur and CaCl₂ on shelf-life of onion bulbs

To assess the effect of foliar application of boron, sulphur and CaCl₂ on onion yield, quality and storage performance, the trial conducted at RRS, Nashik on onion variety Agrifound Light Red revealed that foliar application of boric acid (0.25%), ZnSO₄ (0.5%) and CaCl₂ (0.5%) at 60, 75 and 90 DAT gave highest gross yield (30.33 t/ha), marketable yield (28.18 t/ha), dry-matter content of bulb (4.89 t/ha), dry-matter yield of leaves (1.01 t/ha) and total dry matter yield (5.90 t/ha).

Fertilizer scheduling through drip irrigation in onion

To standardize the fertilizer application through drip irrigation system in onion, the field experiment was conducted at RRS, Nashik, on onion variety NHRDF Red 4. The study revealed that drip irrigation at 100% PE through drip system-Irrigation at alternate day 100% RDF (110:40:60:30 kg NPKS/ha) + 5 tonnes organic manures/ha at 6 days interval; full dose of organic manures applied as a basal before transplanting recorded highest total yield (30.96 t/ha) and marketable yield (28.79 t/ha).

Weed management in onion seed crop

To manage the weed flora in onion seed crop, the field trial conducted at RRS, Karnal, on onion variety NHRDF Red revealed that lowest population count of monocot weed at 45 DAT (5.80/m²), 65 DAT (4.40/ m²), 75 DAT (7.80/ m²), 95 DAT (7.00/ m²) and 105 DAT (6.80 m²) as well as dicot weed at 45 DAT (7.60/m²), 65 DAT (0.0/ m²), 75 DAT (7.80/ m²), 95 DAT (17.40/ m²) and 105 DAT (18.80 m²) with highest weed control efficiency (95.41%), B:C ratio (1.61:1.0) and seed yield (1.09 ton/ha) were recorded in oxyfluorfen 23.5% EC application before planting, followed by 2 hand weedings at 30 and 60 DAP.

Kharif 2018

Weed management in onion

The three years consecutive trial (2016-18) was conducted to find out the suitable method of weed control in onion variety Agrifound Dark Red in *kharif* season at RRS, Nashik. The highest gross yield (208.37 q/ha) was recorded with plastic mulch but it was at par with oxyfluorfen 23.5% EC @ 1.5 ml/L + one hand weeding at 30 DAT + Quizalofop ethyl 5% EC at 60 DAT. However, highest

marketable yield (171.65 q/ha) was recorded in Oxyfluorfen 23.5% EC application before planting + one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC at 60 days after transplanting and it was found at par with treatment plastic mulch.

Weed management

The trial was conducted to find out the best method to control weeds in onion crop with application of different herbicides on onion variety Agrifound Dark Red at RRS, Karnal. The three times hand weeding resulted in highest plant growth (59.60 cm), gross yield (201.4 q/ha), marketable yield (188.04 q/ha) and weed control efficiency (91.16%). However, highest B:C ratio (2.50:1) was recorded in the treatment, combined spray of oxyfluorfen @ 1.0 ml + quizalofop ethyl @ 2.0 ml/L at transplanting and second at 30 DAT.

Weed management in nursery

At RRS, Nashik, the treatment hand weeding (two times) performed better over other treatments in terms of highest seed germination (77.33%), number of transplantable seedlings (1018.33/m²), seedling fresh weight (241.67 g/100 seedling) and weed control efficiency (93.68%). Among herbicide treatments, the application of Oxyfluorfen 23.5% EC @ 0.5 ml/L before seed sowing and Quizalofop ethyl (5% EC) @ 1.5 ml/L at 15 days after seed sowing performed better in highest transplantable seedlings (97% seedlings) with good weed control efficiency (85.28%). At Karnal also, hand weeding (two times) performed better over other treatments in terms of highest fresh weight (189.21 g) of seedlings and dry-matter content (10.64%).

Effect of herbicide application through drip irrigation

The trial conducted on onion variety Agrifound Dark Red at RRS, Nashik, revealed that there was highest weed control efficiency (93.35%), gross yield (217.88 q/ha) and marketable yield (142.43 q/ha) with three times hand weeding. Among the herbicide treatments, lowest weed index (17.33) was recorded with Pendimethalin 30% EC @ 1.5 L/ha application through drip irrigation before transplanting; one hand weeding 30 days after transplanting; 0.500 L/ha ready mix formulation of propaquizafop 5% + oxyfluorfen 12% w/w EC application through drip 35-40 days after

transplanting, and highest weed control efficiency (79.89%) was recorded in combined application of oxyfluorfen @ 0.300 L/ha and Quizalofop ethyl @ 0.600 L/ha application through drip before planting; one hand weeding 30 days after transplanting; combined application of oxyfluorfen @ 0.300 L/ha and quizalofop ethyl @ 0.600 L/ha application through drip at 35 – 40 days after transplanting.

Screening of onion cultivars for water stress tolerance under field

The experiment conducted at RRS, Nashik, revealed that the Collection-883 had highest drought tolerance efficiency (78.93%), least drought susceptibility index (0.29) and maximum drought tolerance index (0.93) due to water stress as compared to rest of the collections. The control variety, Agrifound Dark Red, recorded 74.30% drought tolerance efficiency and 0.36 drought susceptible index. Under water stress conditions, maximum leaf relative water content (70.14%) was recorded in Collection – 883, followed by Agrifound Dark Red (69.63%).

Plant Health Management

Rabi 2017-18

Survey and monitoring of diseases of onion and garlic

At RRS, Nashik, the occurrence of major diseases of onion and garlic as recorded at the research farm, Chitegaon revealed that among foliar diseases,

stemphylium blight (*Stemphylium vesicarium*) incidence ranged from 45.0% - 85.0% with intensity from 2.20-18.0% in onion bulb as well as seed crop during the cropping period. The higher incidence of stemphylium blight (85.0%) and intensity (15.20%) in onion bulb crop and highest incidence (80.0%) and intensity (18.0%) in onion seed crop were recorded during March, 2018. In garlic crop, stemphylium blight was recorded with highest incidence (80.0%) and intensity (14.80%) and highest incidence (20.0%) and intensity (2.0%) of purple blotch during February, 2018.

At RRS, Karnal, occurrence of major diseases of onion and garlic recorded at the research farm, Karnal revealed 100% incidence of stemphylium blight disease with 3.92- 36.28% intensity in onion bulb crop during cropping period. The cent percent incidence of stemphylium blight and intensity (36.28%) were recorded during May 2018 on onion bulb crop. On garlic crop, 100% incidence of stemphylium blight and highest intensity (22.56%) were recorded during February–March 2018, while highest incidence (100%) and intensity (28.64%) of purple blotch were recorded during March 2018.

Survey and monitoring of insect of onion and garlic

At RRS, Karnal, four districts, viz. Panipat, Yamuna Nagar, Kurushetra and Karnal were surveyed with 45 onion and 55 garlic fields in 11 villages. There was stemphylium blight, purple blotch and thrips as the



major threats in onion crop at different locations in Nashik district of Maharashtra, however, stemphylium blight was major constraint in onion production in different areas of Haryana. At RRS, Nashik, occurrence of major diseases and insects of onion were recorded at three Talukas-Kalwan, Sinnar and Niphad of district Nashik. Accordingly, five villages were selected in each taluka and five onion fields in each village for observation. In total, 75 fields of 15 villages in Nashik were surveyed.

Evaluation of onion lines for disease resistance (IET)

The trial conducted at RRS, Nashik, revealed that line, ON17-67, proved to be superior with lower intensity (5.40%) of stemphylium blight but it was found at par with all other lines except line ON17-69 and ON17-85. The control variety, NHRDF Red 2, recorded an intensity of 14.0%. At RRS, Karnal, line ON17-75 proved to be superior with lower intensity of stemphylium blight (9.05%). However, it was at par with all other lines evaluated except lines ON17-60, ON17-67 and ON17-83. The control variety, NHRDF Red, recorded an intensity of 11.0%.

Evaluation of onion lines for disease resistance (AVT-I)

The trials conducted to evaluate different lines of onion against foliar diseases, viz. stemphylium blight (*Stemphylium vesicarium*), purple blotch (*Alternaria porri*) and colletotrichum blight (*Colletotrichum gloeosporioides*) at RRS, Nashik, revealed that line ON16-25 performed superior with lower intensity (5.20%) of stemphylium blight. However, it was found at par with all other lines except lines ON16-11, ON16-22, ON16-27, ON16-29, ON16-30, ON16-32 and the control variety, NHRDF Red-2 (14.0%). At Karnal, line ON16-39 performed superior with lower intensity of stemphylium blight (7.85%) but it was found at par with lines, ON16-32 and ON16-35. The control variety, NHRDF Red, recorded an intensity of 10.70%.

Evaluation of onion lines for disease resistance (AVT-II)

The trial conducted at RRS, Nashik, revealed that line ON15-45 proved to be superior with lower intensity (6.80%) of stemphylium blight but it was found at par with all other lines except lines, ON15-11, ON15-13, and the control variety, NHRDF Red 2 (13.20%). At RRS, Karnal, line ON15-20 proved to be superior with lower intensity of stemphylium

blight (8.30%), however, it was at par with lines, ON15-11, ON15-16, ON15-27, ON15-48, including the control variety NHRDF Red (9.75%).

Evaluation of hybrid onion lines for disease resistance

The trial revealed that the hybrid line ONHY17-04 proved to be superior with lower intensity (10.20%) of stemphylium blight. However, it was at par with all other lines, except lines ONHY17-24, ONHY17-27, ONHY17-29, ONHY17-40, ONHY17-44, ONHY17-46, ONHY17-51, ONHY17-53, ONHY17-55 and the control variety, NHRDF Red-2 (16.40%). At RRS, Karnal, hybrid line ONHY17-04 proved to be superior with lower intensity of stemphylium blight (9.27%) but it was at par with lines ONHY17-18, ONHY17-24 and ONHY17-55. The control variety NHRDF Red, recorded an intensity of 14.10% at RRS, Nashik.

Evaluation of onion advanced lines for disease resistance (AVT-II-II)

The trial conducted at RRS, Nashik, revealed that the line ON17-214 proved to be superior with lower intensity (5.0%) of stemphylium blight but it was found at par with all other lines except the control variety NHRDF Red-2 (13.60%).

Evaluation of onion lines for disease resistance in late kharif (IET)

The trial conducted at RRS, Nashik, revealed that the line ONLK17-08 proved to be superior with lower intensity (4.0%) of stemphylium blight but it was at par with line ONLK17-11. The control variety, NHRDF Red-2, recorded an intensity of 8.40%. At RRS, Karnal, Agrifound Dark Red, proved to be superior with lower intensity of stemphylium blight (3.35%) but it was found at par with lines, ONLK17-02, ONLK17-05, ONLK17-14, ONLK17-16, ONLK17-31 and ONLK17-34, including the NHRDF Red and Agrifound Light Red.

Screening of onion lines for thrips resistance (IET)

The evaluation of eleven lines along with check variety NHRDF Red-2 at RRS, Nashik and NHRDF Red at Karnal revealed that none of the lines were free from thrips.

Screening of onion lines for thrips resistance (AVT-I)

The evaluation of 20 lines along with the control variety, NHRDF Red-2 at RRS, Nashik and NHRDF Red at RRS, Karnal, revealed that none of the lines including checks were free from thrips.

Screening of onion lines for thrips resistance (AVT-II)

An evaluation of 30 lines along with the control variety, NHRDF Red-2 at RRS, Nashik and NHRDF Red at RRS, Karnal, revealed that none of the lines were free from thrips.

Screening of onion lines for thrips resistance (AVT-II-II)

The evaluation of nine lines along with the control variety, NHRDF Red-2, at RRS, Nashik revealed that none of the lines were free from thrips.

Hybrid lines

An evaluation of 33 hybrid lines along with the control variety, NHRDF Red-2, at RRS, Nashik and NHRDF Red at RRS, Karnal revealed that none of the lines were free from thrips. An evaluation of 13 lines along with the control variety, NHRDF Red-2 at RRS, Nashik and NHRDF Red, ALR, and ADR at RRS, Karnal, revealed that none of the lines were free from thrips.

Integrated management of Erwinia rot and foliar diseases in onion bulb production and storage

The trial conducted on onion varieties, NHRDF Red-2 at RRS, Nashik and on NHRDF Red, at Karnal revealed that transplanting on raised bed with drip irrigation system followed by soil application of *Bacillus subtilis* @ 5 kg/ha and sequential sprays of Propineb 0.20% at 40, 60, 80 DAT, and combined spray of Carbendazim @ 0.10% + Streptocycline @ 0.02% at 100 DAT proved to be superior for integrated management of foliar diseases in onion, however, incidence of Erwinia rot in onion bulbs was not found after harvesting at both the location.

Integrated crop health management in onion seed crop

The trial conducted at RRS, Nashik, on seed crop of onion variety, Agrifound Light Red, revealed that planting of marigold as a trap crop and soil application of *Tricoderma viride* + *Pseudomonas fluorescens* @ 5 kg/ha and sequential spray of Fipronil @ 1 ml/L + Chlorothalonil @ 2 g/L at 45 DAP, Carbosulphan @ 2 ml/L + Antracol @ 2g/L at 60 DAP, Profenofos @ 1 ml/L + Mancozeb @ 2.5 g/L at 75 DAP, Cypermethrin @ 1 ml/L + Carbendazim @ 1 g/L at 90 DAP proved to be superior for integrated crop health management of thrips as well as foliar diseases in onion seed crop.

Evaluation of new generation insecticides for management of onion thrips

The trials conducted on varieties NHRDF Red-2 and NHRDF Red respectively, during of three years of *rabi* (2015-18,) seasons revealed that least thrips populations were recorded by spraying of Spinosad @0.3 ml/L at RRS, Nashik and Karnal. At RRS, Nashik, highest gross yield and marketable yield were recorded as 330.0 q/ha and 312.7 q/ha, respectively. At RRS, Karnal, highest gross yield (292.71 q/ha) was also recorded with the Spinosad @0.3 ml/L only. The highest B:C ratio was noted in the case of Fenpropathrin 30 EC @ 0.6 ml/L at Nashik (4.5:1) as well as Karnal (7.4:1).

Effect of silica-based surfactant

The experiment conducted at RRS, Nashik and Karnal, revealed that overall lowest thrips populations at Nashik (5.37 nymphs/plant) as well as at Karnal (9.57 nymphs/plant) were recorded with spraying of Fipronil 5% SC @ 1.0 ml/L + surfactant (silica-based) @ 0.5 ml/L of water.

Evaluation of new molecules

The trials were conducted on onion variety, Agrifound Light Red, at RRS, Nashik and Karnal on variety, NHRDF Red. The combined spray of Metiram + Pyraclostrobin @ 2 g/L + Cyantraniliprole @ 0.9 ml/L - Tank mix at 30, 60 and 70 DAT was better for foliar disease management, however, spraying of Fipronil @ 1 ml/L at 30, 60 and 70 DAT was better superior for management of thrips and increasing the yield of onion at both the locations.

Effect of *Thrips tabaci* on epidemiology of Iris Yellow Spot Virus

The trial conducted at RRS, Karnal, on onion variety, NHRDF Red, revealed that Iris Yellow Spot Virus appeared at later stage on seed crop and incidence and severity of disease also increased with increase in thrips population in seed crop.

Kharif 2018

Survey and monitoring of major diseases of onion and garlic

The incidence of damping off (7%) in onion nursery during July and stemphylium blight (11.20%) and purple blotch (8.80%) diseases with 11.20% and 8.80% intensity respectively, were recorded in onion bulb crop during November 2018 at RRS, Nasik. The maximum incidence of black mold

(18%) and bacterial soft rot (5.0%) were recorded in stored onion bulbs during November 2018. The higher intensity of stemphylium blight (6.0%) and purple blotch (4.80%) in garlic were also recorded in November 2018 in *kharif* crop. At RRS, Karnal, higher intensity of stemphylium blight (19.30%) in onion and garlic crops (5.10%) were recorded in December 2018. The maximum incidence of black mold in onion (16%) and garlic (12%) bulbs in storage were recorded during October-November 2018.

Survey and monitoring of major insect of onion

The occurrence of major diseases and insects of onion were studied at Talukas-Yeola, Kalwan, Satana and Sinnar of district Nashik in Maharashtra and districts Yamuna Nagar, Kurukshetra, Karnal, Ambala, and Panipat in Haryana. Accordingly, five villages were selected for survey in each taluka and five onion fields (62 nos.) and five onion storages (100 bulbs / store) in each village were surveyed for observations of major diseases and insects from August to November 2018 at Nashik. At Karnal, 18 onion fields were surveyed in 13 villages of 5 different districts from October to December 2018. The survey revealed that stemphylium blight, purple blotch and thrips were major threats in onion production at different locations in Nashik district of Maharashtra, whereas stemphylium blight was major constraint for onion in different areas of Haryana in *kharif* season.

Onion lines for disease resistance (IET)

The trials were conducted at RRSs, Nashik and Karnal with seven different onion lines along with the control variety, Agrifound Dark Red, to find out the source of resistance against foliar diseases, *viz.* stemphylium blight, purple blotch and anthracnose. At Nashik none of the lines was free from stemphylium blight disease including Agrifound Dark Red. However, line OA18-14 was better with lowest intensity of stemphylium blight (5.0%), while Agrifound Dark Red recorded 9.80% intensity. At RRS, Karnal, none of the lines was free from stemphylium blight disease including Agrifound Dark Red, however, line OA18-10 was better with lowest intensity of stemphylium blight (3.50%), while Agrifound Dark Red recorded 5.37% intensity.

Onion lines for disease resistance (AVT-I)

The trial revealed that none of the lines was free from stemphylium blight disease including the

control variety, Agrifound Dark Red at RRS, Nashik, However, line OB18-03 proved to be superior with lowest intensity of stemphylium blight (5.60%), while Agrifound Dark Red recorded 9.60% intensity. At RRS, Karnal. None of the lines was free from stemphylium blight disease including the control variety Agrifound Dark Red. However, line OB18-03 was with lowest intensity of stemphylium blight (5.23%) and it was at par with line OB18-01 while Agrifound Dark Red recorded 7.43% intensity.

Onion lines for disease resistance (AVT-II)

At RRS, Nashik, trial result revealed that none of the lines was free from stemphylium blight disease including the control variety, Agrifound Dark Red. However, line OC18-50 was with lowest intensity of stemphylium blight (6.80%), while Agrifound Dark Red recorded 11.0% intensity. At RRS, Karnal, none of the lines was free from stemphylium blight disease including the control variety Agrifound Dark Red. However, line OC18-24 showed lowest intensity of stemphylium blight (3.93%), while Agrifound Dark Red recorded 7.50% intensity.

Multiplier onion lines for disease resistance (AVT-II)

None of the lines was free from stemphylium blight disease, however, line MP18-30 proved to be superior with lowest intensity of stemphylium blight (7.80%) at RRS, Nashik

Efficacy of bio-pesticides and fungicides on foliar diseases of onion

The combined trials conducted at RRS, Nashik, during three *kharif*, season (2016-18) on onion variety Agrifound Dark Red revealed that soil application of Arka Microbial Consortia @ 12.50 kg/ha, followed by sequential sprays of Propiconazole @ 0.1% at 25 DAT, Hexaconazole @ 0.1% at 50 DAT and Tricyclazole @ 0.1% at 75 DAT was better for management of stemphylium blight with 63.57% disease control, increasing marketable yield by 58.54% over the untreated control. The higher B:C ratio (7.83:1) was also recorded in the same treatment. At Karnal, combined treatment, soil application of Arka Microbial Consortia @ 12.50 kg/ha, followed by sequential spray of Mancozeb + Carbendazim @ 0.2% at 25 DAT, Trifloxystrobin + Tebuconazole @ 0.20% at 50 DAT and Pyraclostrobin + Metiram @ 0.3% at 75 DAT was better for management of stemphylium blight with 62.04% disease control, thus increasing the marketable yield by 66.24% over the untreated control.

Effect of triazole fungicides against *Stemphylium* blight

The combined trial conducted at RRS, Nashik during three consecutive *kharif* seasons (2016-18) on onion variety Agrifound Dark Red revealed that spraying of epoxiconazole @ 0.1% at 30 DAT and subsequently at fortnightly intervals proved to be better for management of stemphylium blight with 57.20% disease control, increasing marketable yield by 48.44% over the untreated control. At RRS, Karnal, combined mancozeb @ 0.25% spray at 30 DAT and subsequently at fortnightly intervals proved to be better for management of stemphylium blight with 54.39% disease control (PDC) thus, increasing the marketable yield by 71.37% over the untreated control.

Effect of fungicides with insecticides on onion bulb and their residue

The trial conducted at RRS, Nashik, during *kharif* season of 2018 on onion variety Agrifound Dark Red revealed that spraying of Pyraclostrobin + Metiram @ 0.25% + Deltamethrin @ 0.1% at 30 DAT, Trifloxistrobin + Tebuconazole @ 0.1% + Cypermethrin @ 0.1% at 45 DAT, Zineb + Hexaconazole @ 0.25% + Fipronil @ 0.1% at 60 DAT, Carbendazim + Mancozeb @ 0.25% + Curacron @ 0.1% at 75 DAT was better for management of foliar diseases, viz. stemphylium blight (68.55%) and purple blotch (61.27% control), and insect pest, viz. thrips control (93.69%), increased the marketable yield by 39.03% over the untreated control. At Karnal, spraying of Propineb @ 0.25% + Deltamethrin @ 0.1% at 30 DAT, Propiconazole @ 0.1% + Cypermethrin @ 0.1% at 45 DAT, Pyraclostrobin + Metiram @ 0.25% + Fipronil @ 0.1% at 60 DAT, Carbendazim + Mancozeb @ 0.25% + Curacron @ 0.1% at 75 DAT better for management of stemphylium blight (68.85%), purple blotch (54.10% PDC), increasing the marketable yield by 67.52%, over the untreated control.

Screening of onion lines for thrips resistance (IET)

An evaluation of seven onion lines along with the control variety Agrifound Dark Red at RRSs, Nashik and Karnal revealed that none of the lines was found free from thrips.

Screening of onion lines for thrips resistance (AVT-I)

An evaluation of eight onion lines along with the control variety Agrifound Dark Red at RRSs, Nashik and Karnal, revealed that none of the lines were free from thrips including the control.

Screening of onion lines for thrips resistance (AVT-II)

An evaluation of 17 onion lines along with the control variety Agrifound Dark Red at RRSs, Nashik and Karnal, revealed that none of the lines were free from thrips.

Screening of multiplier onion lines for thrips resistance (AVT-II)

An evaluation of seven multiplier onion lines at RRS, Nashik, revealed that none of the lines were free from thrips.

Organic crop health management in onion bulb crop

The experiment conducted at RRS, Nashik revealed that the least thrips population (8.93 nymphs/plant) was recorded with basal application of Vermicompost @ 5 tones/ha + *Trichoderma viride* @ 5.0 kg/ha + foliar spray of Vermiwash @ 30% + foliar spray of cow urine @ 30% + foliar spray of *Beaveria bassiana* @ 5 g/L.

Seed Technology

Evaluation of Onion Seed Coating

The trial conducted at RRS, Karnal, for production of onion bulb by direct sowing of coated onion seeds with fertilizers and pesticides in onion variety Agrifound Light Red revealed that under normal package of practices, i.e. onion nursery raising and transplanting gave highest gross yield (275.17 q/ha), marketable yield (249.91 q/ha) with a C:B ratio of 1.8:1 during *rabi* season of 2017-18

Post-Harvest Management

Plant Genetic Resources and Crop Improvement

Rabi, 2017-18

Storage performance of onion germplasm

The trial conducted at RRS, Nashik revealed that there was least PLW (3.66%) and total loss (4.16%) in line-837 but it was at par with lines-432, 618, 628, 682, 750, 868 and 881 five months after storage. The least PLW (20.60%) and total loss (26.10%) were recorded in line L-1667 at RRS, Karnal but it was at par with lines L-1210, L-1668, W-340, W-440, Bhima Kiran, Bhima Shakti and the control variety NHRDF Red in respect of PLW and lines W-340, W-355, W-440, Bhima Kiran and Bhima Shakti in total loss.

Onion Lines (IET)

The least total loss (30.72%) was recorded in the control variety NHRDF Red-4 at RRS, Nashik and it was at par with lines ON-17-65, ON-17-71, ON-17-73, ON-17-75, ON-17-85 and the control variety NHRDF Red-3 at five months after of storage. At RRS, Karnal, the least PLW (24.81%) and total loss (34.38%) were recorded in line ON-17-83 but it was at par with line ON-17-73 and ON-17-75 in PLW and line ON-17-73 in total loss, five months after storage.

Onion Lines (AVT-I)

At RRS, Nashik, there was least PLW (15.18%) and total loss (16.41%) in line ON-16-25 and ON-16-20, respectively, but were at par with lines ON-16-11, ON-16-18, ON-16-20, ON-16-22, ON-16-35, ON-16-37, ON-16-39, ON-16-54, and the control varieties, NHRDF Red-3 and NHRDF Red-4, in PLW and lines ON-16-11, ON-16-18, ON-16-22, ON-16-25, ON-16-35, ON-16-37, ON-16-39, ON-16-54, and the control varieties, NHRDF Red-3 and NHRDF Red-4, in total loss four month after storage. The least PLW (18.72%) and total loss (21.99%) were recorded in line ON-16-57 at RRS, Karnal, but were found at par with lines ON-16-39 and ON-16-54 in respect of PLW and line ON-16-54 in total loss five months after storage.

Onion Lines (AVT-II)

At RRS, Nashik, the lowest PLW (20.73%) and total loss (32.27%) were recorded in line ON-15-23, however, these were found at par with lines ON-15-01, ON-15-06, ON-15-20, ON-15-37, ON-15-42, and the control varieties, NHRDF Red-2 and NHRDF Red-4. At RRS, Karnal, the least PLW (27.93%) and total loss (40.45%) were recorded in the control variety, NHRDF Red and line ON-15-37, respectively, but were at par with lines ON-15-01, ON-15-18, ON-15-20, ON-15-23, ON-15-37 and ON-15-42 in PLW and lines ON-15-01, ON-15-18, ON-15-20, ON-15-23 and the control variety, NHRDF Red in total loss five months after storage.

Onion Lines (AVT-II-II)

The least PLW (18.28%) and total loss (27.50%) were recorded in check variety NHRDF Red-4 and line ON-17-225, respectively at RRS, Nashik, but were at par with all lines except the lines ON-17-218, ON-17-230 and ON-17-234 in respect of PLW and lines ON-17-218, ON-17-234 and the control varieties, NHRDF Red-2 and NHRDF-3, in total loss five month after storage.

Red onion advance lines

The least PLW (19.04%) and total loss (24.73%) were recorded in advance line-845 at RRS, Nashik but were at par with advance lines-704, 807, 849, 852 and 873 in PLW and advance lines-704, 807, 826, 849 and 852 in total loss. At RRS, Karnal, lowest PLW (24.92%) and total loss (29.76%) were recorded in advance line-807 but were found at par with advance lines-703, 704, 824, 826, 844, 849, 852, 854 and the control varieties, NHRDF Red-3 and NHRDF Red-4, in PLW and advance lines-703, 704, 824 and the control variety NHRDF Red-4 in total loss five months after storage.

White onion advance lines

At RRS, Nashik, the lowest PLW (19.17%) and total loss (29.69%) were recorded in advance line-865 and 799, respectively. However, these were found at par with advance lines-784, 810, 827, 885 and 857 in PLW and advance lines-827, 865 and 857 in total loss. At RRS, Karnal, lowest PLW (32.24%) and total loss (48.40%) were recorded in advance line-793 but were at par with advance lines-784, 810, 827, 830, 832, 836 and 869 in PLW and advance lines-562, 784, 810, 827, 830, 832 and 836 in total loss five month after storage.

Onion hybrids

The lowest PLW (9.69%) and total loss (10.92%) were recorded in lines ONHY-1757 and ONHY-1778, respectively at RRS, Nashik, but were at par with lines ONHY-1713, ONHY-1744, ONHY-1751, ONHY-1776 and ONHY-1778 in PLW and lines ONHY-1708, ONHY-1713, ONHY-1716, ONHY-1722, ONHY-1724, ONHY-1727, ONHY-1731, ONHY-1735, ONHY-1738, ONHY-1744, ONHY-1746, ONHY-1751, ONHY-1757, ONHY-1776 and the control variety, Agrifound Light Red, in total loss three month after storage. At RRS, Karnal, lowest PLW (26.19%) and total loss (34.72%) were recorded in line ONHY-1704 but were at par with lines ONHY-1757 and ONHY-1766 in PLW and line ONHY-1731 in total loss five months after storage.

Onin lines (IET)

The trial conducted at RRS, Nashik, revealed that there was lowest PLW and total loss (13.91%) in line ONLK-17-34 and it were par with all lines except lines, ONLK-17-26 and ONLK-17-31, four months after storage.

Crop Production System Management

Effect of Zn, B application on yield and storage of onion

The trial conducted at RRS, Nashik on onion variety Agrifound Light Red revealed that foliar application of boric acid (0.25%) at 30, 45 and 60 DAT was better as compared with all other treatments in terms of lowest total loss. The foliar application of boric acid (0.25%), ZnSO₄ (0.5%) and CaCl₂ (0.5%) at 60, 75 and 90 DAT proved to be better in good bulb recovery after 5 months.

Post-Harvest Management

Kharif 2017

Storage performance of onion lines (IET)

At RRS, Nashik, the lowest PLW (15.23%) and total loss (16.98%) were recorded in line ON-17-67, three months after storage but were at par with lines ON-17-58, ON-17-69 and the control variety, Agrifound Dark Red. At RRS, Karnal, the lowest PLW (1.80%) and total loss (5.29%) were recorded in line ON-17-692 months after storage.

Storage performance of onion lines(AVT-I)

At RRS, Nashik, the lowest PLW (11.22%) and total loss (13.15%) were recorded in line ON-16-27 and the control variety, Agrifound Dark Red respectively, but were at par with lines, ON-16-01 and ON-16-17. At RRS, Karnal, the lowest PLW (10.90%) and total loss (22.00%) were recorded in line ON-16-20 but it was found at par with line ON-16-24 in PLW and line ON-16-18 in total loss.

Storage performance of onion lines(AVT-II)

At RRS, Nashik, the lowest PLW (8.22%) and total loss (10.41%) were recorded in the control variety, Agrifound Dark Red, three months after storage. At RRS, Karnal, the lowest total loss (22.09%) was recorded in line ON-15-16 but it was found at par with lines, ON-15-21, ON-15-32 and ON-15-45, 2 months after storage.

Storage performance of onion lines (AVT-II-II)

At RRS, Nashik at 3 months after storage. The lowest PLW (13.42%) and total loss (21.60%) were recorded in the control variety, Agrifound Dark Red, but were at par with line ONR-17-12, ONR-17-17 and ONR-17-35 three months after storage at RRS, Nashik. The lowest PLW (12.27%) and total loss (24.43%) were recorded in lines ONR-17-15 and ONR-17-35, respectively at RRS, Karnal, but

were at par with line ONR-17-31 in respect of PLW and lines ONR-17-15, ONR-17-31 and ONR-17-33 in total loss two months after storage.

Storage performance of multiplier onion lines (AVT-I)

The lowest PLW (6.15%) and total loss (14.44%) in line, MP16-29 and MP16-27, respectively at RRS, Nashik, but were found at par with line MP16-18 in PLW and lines recorded MP16-15 and MP16-29 in total loss, three months after storage.

Advanced lines against bolting behavior

The lowest total loss (28.00%) was recorded in advanced line L-653 but was at par with advance line L-881, at RRS, Karnal in late *kharif* season. There was lowest total loss (13.91%) in line ONLK-17-34 but was at par with all the lines except line ONLK-17-26 and ONLK-17-31, four months after storage at RRS, Nashik in late *kharif* season.

Garlic

Plant Genetic Resources and Crop Improvement

Rabi 2017-18

Collection, evaluation and utilization

The highest gross yield (179.57 q/ha) and marketable yield (179.43 q/ha) were recorded in line G-392 but were found at par with line G-428 at Karnal. The highest total soluble solids (43.67%) were recorded in line G-268 but were found at par with lines G-417, G-290, G-1, G-278, G-405, G-203, G-66, G-392, G-377, G-27, G-289, G-347, G-404 and G-414.

Garlic lines (IET)

At RRS, Karnal, highest gross yield (126.67 q/ha) and marketable yield (126.30 q/ha) were recorded in line GN17-12 but were at par with the control varieties, Yamuna Safed-3 and Yamuna Safed-8. The highest total soluble solids (38.74%) and dry-matter contents (40.06%) were recorded in the control variety, Yamuna Safed-3. However, these were at par with line GN17-08 and the control variety, Yamuna Safed-8. The highest gross yield (75.50 q/ha), marketable yield (61.57 q/ha), total soluble solids (36.27%) and dry-matter content (37.66%) were recorded in the control variety, Yamuna Safed-9 at Nashik.

AVT-I

At RRS, Karnal, the highest gross yield (126.90 q/ha), marketable yield (126.57 q/ha), total soluble



solids (38.58%) and dry-matter content (40.00%) were recorded in line GN15-68 but were at par with the control variety, Yamuna Safed-3 and Yamuna Safed-9, in total soluble solids and the control variety Yamuna Safed-3 in dry-matter content. At RRS, Nashik, highest gross yield (166.88 q/ha), marketable yield (128.64 q/ha), total soluble solids (36.87%) and dry-matter content (38.40%) were recorded in line GN15-68 but marketable yield was found at par with line GN15-65.

Garlic advances lines

There was highest gross yield (138.74 q/ha) and marketable yield (138.68 q/ha) in advanced line G-404 at Karnal. The highest total soluble solids (39.78%) were recorded in advanced line G-366 but were at par with that of G-6, G-417 and the control variety, Yamuna Safed -3.

Kharif 2018

Garlic Advance Line (AVT-II)

The bulb development and clove separation did not taken place in any garlic line at Nashik and Karnal during *kharif* 2018 season.

Crop Production System Management

Effect of Zn and B on storage quality of garlic

The soil application of zinc sulphate @ 10.0 kg / ha as a basal dose gave more total bulb yield and

marketable yield but was at par with foliar application of micronutrient mixture @ 0.5% - (Fe- 2.5%, B- 0.50%, Zn-3.0%, Cu-1.0%, Mn- 1.0%) at 45 and 60 DAT of garlic variety Yamuna Safed-3 at RRS, Nashik.

Fertigation schedule with plant growth regulators on storage of garlic

The experiment conducted at Karnal, on garlic variety Yamuna Safed-3 revealed that 100% RDF, i.e. 100N:50P: 50K:30S in 8 splits + foliar application of gibberelic acid (GA₃) @ 50 ppm at 45 and 60 DAP gave highest gross yield (137.36 q/ha) and marketable yield (131.08 q/ha).

Fertilizer scheduling through drip irrigation on garlic storage

The drip irrigation at 100% PE at alternate day 100% RDF (100:50:50:50 kg NPKS/ha, respectively) + 5 t organic manure/ha applied as a basal dose in garlic variety, Yamuna Safed-4 before planting gave total bulb total yield (12.61 t/ha) and marketable yield (11.96 t/ha) at RRS Karnal.

Plant Health Management

Advance lines for disease resistance (IET)

The advanced line GN17-08 recorded lowest intensity (2.47%) of stemphylium blight, but was found at par with advanced lines GN17-03, GN17-05, GN17-12, GN17-14 and GN17-19, including the control

variety Yamuna Safed-8 (3.63%), at RRS, Karnal. The 7 advanced lines of garlic evaluated along with the control variety, Yamuna Safed-8, at RRS, Nashik, line GN17-12 gave better yield with lowest intensity (5.20%) of stemphylium blight. The control variety Yamuna Safed-8 recorded intensity of 8.80%.

Advance lines for disease resistance (AVT-I)

The advanced line GN15-68 recorded lowest intensity (1.97%) of stemphylium blight, but it was at par with advanced lines, GN15-52, GN15-65, GN15-71, including the control variety Yamuna Safed-8 (2.80%), at RRS, Karnal. The 8 advanced lines of garlic evaluated along with the control variety, Yamuna Safed-8, at RRS, Nashik, line GN15-83 was superior with lowest intensity (4.80%) of stemphylium blight but it was at par with that of GN15-68. The control variety, Yamuna Safed-8, recorded intensity of 7.80%.

Advanced garlic lines for thrips resistance IET)

The seven lines along with the control variety Yamuna Safed-8, none were free from thrips infection at RRS, Nashik at Karnal.

Advanced garlic lines for thrips resistance (AVT-I)

At RRS, Nashik and Karnal, eight lines along with the control variety Yamuna Safed-8 were screened. None of the lines was free from thrips infection.

Evaluation of fungicides for the management of foliar diseases in garlic

The combined trials conducted during three consecutive three years of *rabi* seasons (2015-18) at RRS, Karnal, on garlic variety Agrifound White revealed that Cymoxanil 8% + Mancozeb 64% @ 0.20% spray 30 days after planting and thereafter at fortnightly interval proved to be superior, followed by spraying of Mancozeb @ 0.25% as standard check for the management of stemphylium blight and purple blotch as well as increasing the yield of garlic. The highest B:C ratio (2.57:1) was recorded with spray of Mancozeb @ 0.25% as standard check followed by Cymoxanil 8% + Mancozeb 64% @ 0.20% (2.56:1).

Khariif 2018

Garlic lines for disease resistance (AVT-II)

At RRS, Karnal none of the lines was found free from stemphylium blight disease including the control variety Yamuna Safed-8. However, line GN18-57, proved to be superior with lowest intensity

of stemphylium blight (2.43%), while the control variety, Yamuna Safed-8, recorded 3.90% intensity.

An evaluation of seven lines of garlic along with the control variety Agrifound White at RRS, Nashik, revealed that none of the lines was free from stemphylium blight disease, however, the control variety Agrifound White was superior with lowest intensity of stemphylium blight (11.80%). No bulb formation was found in any line of garlic including the control variety Agrifound White and Yamuna Safed-8 at RRSs, Nashik and Karnal, respectively.

Garlic lines for thrips resistance (AVT-II)

Of the seven garlic lines along with the control variety Agrifound White screened at RRS, Nashik and Yamuna Safed-8 at RRS, Karnal, none of the lines was free from thrips and no bulb formation was found in any line at both the places including the control varieties.

Post Harvest Management

Rabi 2017-18

Plant Genetic Resources and Crop Improvement

Garlic germplasm

There was lowest total losses (3.02%) in line G-428, but was at par with losses in lines G-273, G-39, G-343, G-298, G-268, G-414, G-399, G-387, G-428, G-60, G-437 and G-329 at 135 days after storage, at RRS, Karnal.

Garlic lines (IET)

At RRS, Karnal, the lowest PLW and total loss (9.33%) were recorded in line GN-17-19 at 180 days after storage. The lowest PLW and total loss (11.13%) were recorded in the control variety Yamuna Safed-9 at RRS, Nashik. However, it was at par with line GN-17-12 in respect of PLW at 135 days of storage.

Garlic lines (AVT-I)

At RRS, Karnal, the lowest PLW and total loss (10.53%) were recorded in line GN-15-65 but, it was found at par with lines GN-15-55, GN-15-71, GN-15-72, the control varieties, Yamuna Safed-3 and Yamuna Safed-8, 180 days after storage. At Nashik the lowest PLW and total loss (10.28%) were recorded in the control variety Yamuna Safed-9 but the line GN-15-66 was at par in PLW 135 days after storage.

Storage performance of garlic lines

The trial conducted at RRS, Karnal, revealed that lowest PLW and total loss (5.10%) were recorded in advanced line G-366, but advanced line G-398 was at par 135 days after storage.

Crop Production System Management

Fertigation schedule of plant growth regulators on storage life of garlic

The experiment conducted at RRS, Karnal, on garlic variety Yamuna Safed-3 revealed that there was significant variation's up to two months of storage and there after, during the entire storage period of five months all the treatments performed statistically at par.

Effect of zinc and boron on yield and storage quality

The experiment conducted at RRS Nashik, on garlic variety Yamuna Safed-3, indicated that after five months of storage there was lowest physiological loss of weight as well as total loss were recorded in soil application of borax @ 10.0 kg / ha, however, soil application of zinc sulphate @ 10.0 kg /ha and foliar application of micronutrient mixture @ 0.5% @ 45 and 60 DAT was found at par.

Kharif 2018

Tomato

Crop Production System Management

Response of foliar application of micronutrients on tomato

The trial conducted on tomato variety, 1057, at RRS, Nashik, revealed that highest fruit yield / plant, / plot, total yield and highest benefit:cost ratio (4.86: 1.0) were recorded in foliar application of mixture of all micro-nutrients at 40, 50 and 60 days after transplanting.

Okra & Tomato

Plant Health Management

Seasonal incidence of major insect pest of Okra and Tomato

At RRS, Nashik, the highest population of jassid (4.70 nymphs/ 3 leaves/ plant), white fly (38.50 nymphs/ 3 leaves / plant) and fruit borer infestation

(37.33%) were recorded during 32nd, 35th and 39th standard week, respectively in okra variety Arka Anamika. In tomato variety, CI-944, the highest population of white fly (22.50 nymphs / 3 leaves / plant) was recorded during the 35th standard week, while highest jassid population (1.90 nymphs/3 leaves/plant) was recorded during 36th standard week.

At Karnal, highest population of jassid (21.86 nymph/ 3 leaves/ plant), fruit borer infestation (35.0%), whitefly (12.54 nymphs/ 3 leaves/ plant) and aphid (22.06 nymphs/ 3 leaves/ plant) were recorded during 39th, 40th, 44th and 49th standard week, respectively in okra. In tomato variety Arka Rakshak, the highest whitefly population (6.46 nymphs/ 3 leaves/ plant) was recorded during the 38th standard week.



Dolichos Bean

Plant Genetic Resources and Crop Improvement

Evaluation of bush type Dolichos Bean (AVT-I)

The trial conducted at RRS, Nashik, revealed that highest gross yield (403.66 q/ha) was recorded in line 2017/DBBVAR-5, however, line 2017/DBBVAR-6 was found at par.

Evaluation of pole type Dolichos Bean (AVT-I)

The trial conducted at RRS, Nashik, revealed that line 2017/DBPVAR-1 was superior to other two lines in gross yield (178.89 q/ha) and other parameters.

08B

Chapter

Laboratories Studies/ Services

Studies

In-vitro experiments were conducted for quality test of talcum base *Trichoderma viride* produced in Bio-control Laboratory at RRS Chitegaon, Nashik. The colony count of *T. viride* was recorded in talcum base formulation, followed by serial dilution method using potato dextrose agar (PDA) medium. The colony count, after mixing of *T. viride* culture, talcum powder and carboxy methyl cellulose, ranged from 2.0×10^6 to 3.0×10^6 per gram in talcum base, while in liquid formulation of *T. viride*, the colony ranged from 2.66×10^6 to 3.66×10^6 /ml in the product. The colony count after mixing of *Ps. fluorescens* culture and talcum powder were recorded 1.0×10^8 per gram.

Biocontrol

RRS, Nashik

(a) NHRDF Tricho-Vir (*Trichoderma viride*)



Talcum base

Mass production of NHRDF Tricho-Vir was carried out and total of 25,147 kg of Tricho-Vir produced and distributed to farmers under the Mission for Integrated Development of Horticulture for the management of soil-borne fungal diseases in different vegetables all over the countries under different components.

Liquid base

Mass production of liquid base NHRDF Tricho-Vir, was 782.50 liters produced and distributed to farmers under plant-protection services for the management of soil-borne fungal diseases, viz. wilt, white rot, basal rot, root rot and collar rot in different vegetables as well as fruits crops



b) NHRDF Pseudo-Guard (*Pseudomonas fluorescens*)

Mass production of talcum based of NHRDF Pseudo-Guard was carried out and total of 2,413 kg produced and distributed to farmers under the Mission for Integrated Development of Horticulture for the management of soil-borne diseases in different vegetables.

(c) NHRDF S Guard (*Spodoptera Nuclear Polyhedrosis Virus*)

Mass production of NHRDF S-guard was

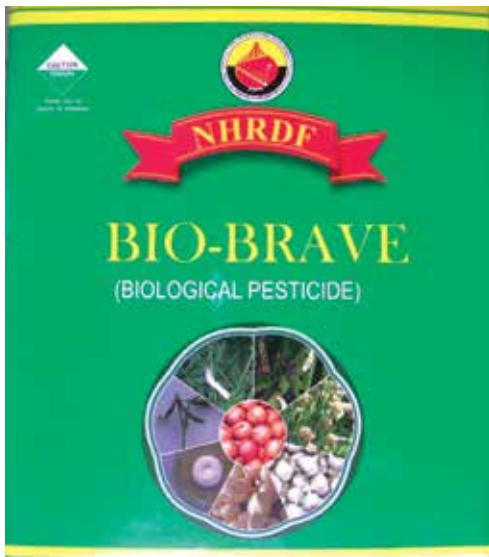


made and 3,00,400 LE, produced and distributed to farmers under the Mission for Integrated Development of Horticulture in vegetable seed production programme.

RRS, Karnal

d) NHRDF Bio-Brave (*Beauveria bassiana*)

Mass production of NHRDF BIO BRAVE was carried out and produced 106.95 q and distributed to farmers under the Mission for Integrated Development of Horticulture.



Entomology

NHRDF Honey

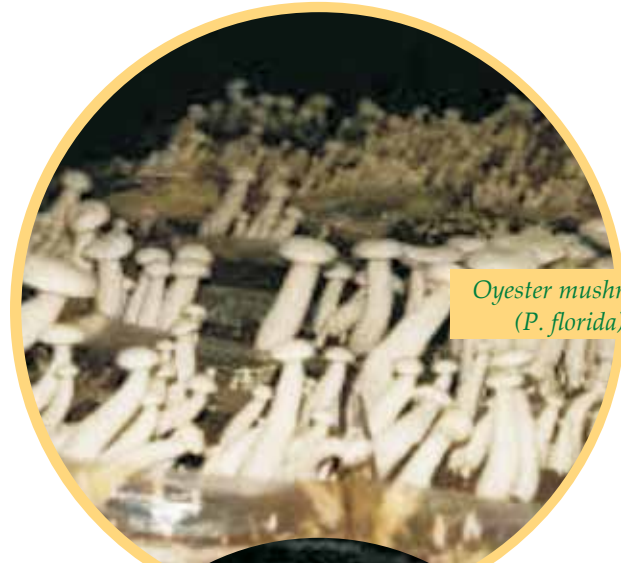
A total of 555.0 kg honey was produced by honey bee unit at RRS, Karnal. The entire quantity was distributed on nominal cost basis for the maintenance of bee unit.



Mushroom

New Delhi

The good quality spawn of different edible species of mushroom, namely Button (*Agaricus bisporus*) -2463 kg, Oyster (*Pleurotu spp*) 2457 kg, Milky (*Calocybe indica*) -880 kg, was produce distributed to the mushroom growers in Delhi, Uttar Pradesh, Haryana, Punjab and Uttarakhand. A total 7,660.0 kg good quality pasteurized compost was also produced and distributed to mushroom growers.



Oyester mushroom (*P. florida*)



Button mushroom (*A. bisporus*)



Milky mushroom (*C. indica*)

Pesticide Residue Analysis

Nashik

A total of 1,692 samples of different horticultural crops (grapes-315, wine-85, chemical-283, onion-359 and other fruits and vegetables-650) was received from growers and exporters, analyzed as per national/ international standards protocols as well as NABL Scope. The 600 samples of vegetables received & analysed under central sector scheme "Monitoring of Pesticides Residue at National Level" (MPRNL), Division of Plant Protection, Deptt. of Agriculture, Cooperation and Farmers 'Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

Plant Pathology

A total of 928 samples (soil-119, grape-14, onion bulbs-757, potato-23, rose-2, bio-products-11 and other 2) were tested. Sample of onion bulbs, potato, cabbage and frenchbean were received from growers and exporter for export to different countries. The soil samples were analyzed for estimation of nematode population, fungal count, identified diseases and made recommended to farmers' accordingly. The bioproducts was tested to know the strength of ingredients by the growers to used in the crop.

A total of 68 samples of grape canes received from farmers in Nashik area of Maharashtra were observed under stereoscopic binocular microscope for fruit bud differentiation and the reports were issued, accordingly.

Plant Physiology

RRS Nashik

A total of 6,177 samples of onion and garlic received from different field trials were analyzed

for total soluble solid, dry-matter content, moisture, leaf area, leaf dry matter, pyruvic acid, reducing sugar, non-reducing sugar as well as total sugar, at RRS Nashik.

RRS Karnal

A total of 687 samples of onion and garlic received from different field trials were analyzed for total soluble solid, dry-matter and pyruvic acid content.

Seed Testing

New Delhi

A total of 1,211 seed samples of around 28 crops like vegetables, cereals, pulses, oilseeds, flowers, , mustard, , groundnut, wheat, paddy, spinach, bottle guard, chilli, coriander, capsicum, cucumber, french bean, bean, radish, sponge gourd, muskmelon, drumstick, cluster bean, soybean, pumpkin and dolichos beans were received and tested for the germination, moisture and physical purity (GMP). These sample received from NHRDF Centers and other reputed seed producing company through out the year.

Soil Testing and Biochemistry

RRS Nashik

A total of 8,516 samples of soil, irrigation water, plant petiole, grape wine, table grapes, organic manure, FYM, and vermicompost were tested. A total of 6,665 soil samples received from different talukas of Nashik under RKVY, Government of Maharashtra under soil health card mission were tested in the laboratory and 18,979 Soil Health Cards were generated for distribution to concerned farmers with recommendations at Nashik.

Agriculture Economics

Cost of Production of Onion, Garlic and Potatoes

Onion, garlic and potato are important vegetable crops and grown in India on large scale. These crops are cultivated in almost all this state's of the country, however, Maharashtra is the leading state for onion; Rajasthan and Madhya Pradesh are major garlic growing states, while Uttar Pradesh and Bihar are top states for potato cultivation in view of area and production. All these crops, i.e., onion, garlic and potato are highly input intensive crops and requires large number of labours, frequent irrigations and high quantity of manures and chemical fertilizers and all these factors collectively increases the cost of production of these crops.

Onion crop is grown in *kharif*, late *kharif* and *rabi* season the seed is sown in field and seedlings are raised which are transplanted in main filed manually. Depending upon the aims, the *khraif*, require 5-7 irrigations, 10-15 in late *kharif* and 15-18 during *rabi* session. Due to frequent irrigations and use of high fertilizer, there is sever problem was observed. Besides, the crop is affected by disease and insect-pest and thus, the application of herbicides and pesticides is must to address the problem which enhances the cost of production. When the crop attains maturity, harvesting is done manually which further increases the cost of production.

The garlic crop is grown in *rabi* session only by planting of cloves in the main filed. Like the onion crop, garlic crop is also an input- intensive crop

and need frequent irrigations, high manure and chemical fertilizers, herbicides and pesticides for higher yield. It is also harvested manually and thus, all these factors increases the cost of production.

The potato crop is cultivated mainly in *rabi* season, however, in the states of Madhya Pradesh, Maharashtra and Karnataka, *kharif* crop is also grown. Like the onion and garlic crop, the potato is also planted and harvested manually and require frequent irrigations, high manure and chemical fertilizer alongwith weedicide and pesticides for higher yield and all these factors increases the cost of production of potato.

Thus, there is an urgent need of mechanization for cultivation of these crops i.e. onion, garlic and potato. The development of onion, garlic and potato planter and harvester will help to a large extent in lowering the cost of production of these crops. Further, cultivation of these crops on drip irrigation (micro-irrigation system) will not only increase the yield but also help in saving 40% water, which can be area for other crops and thus help a lot in reducing the cost of production.

The NHRDF made all necessary arrangements to survey the cost of production of onion bulb and seed crops, garlic and potato in major growing pockets of the country. The summarized description was given based in the table of each crop with area as below:

- The cost of production of onion seed varied from Rs. 274 to 442/kg in different varieties depending upon the onion bulbs inputs, labour and seed yield (Table 2).

- The cost of production of *kharif* onion varied from Rs. 572 to 1590 per quintal, upon the labour wages, cost of seed, other inputs and yield of onion (Tables 3).
- The cost of production of *kharif* onion produced through locally grown bulblets in Coimbatore district at Tamil Nadu was Rs. 1590/q, while it was Rs. 1482/q for crop raised by transplanting seedlings (Table 3).
- The cost of production of *rabi* onion bulb varied from Rs 489 to Rs 1193/q raised by seedlings (Table 4).
- The cost of production of garlic ranged from Rs. 1684 to 3058 /q depending upon the varieties, labour wages, input cost, and yield at different places (Table 5).
- The cost of production of potato tuber in major producing states like Uttar Pradesh, West Bengal, Bihar, Haryana, Punjab, Odisha and Uttar Pradesh is given in Table 6 and varied from Rs 510 to Rs 828.

Area and Production of Onion, Garlic and Potato

The production of onion, garlic and potato crop increased during the period under report. Onion production was accounted more by around 0.95%,

3.34% potato and 15.58% garlic as compared to 2017-18. The state-wise area, production and productivity of onion, garlic and potato during 2018-19 are given in Table 7, 8, 9.

Export of Onion, Garlic and Potato

During 2018-19, the export was done free and no NOC was required. However, MEP is to be followed. Garlic and potato were exported to different countries under open general license (OGL). The data, obtained from the APEDA, New Delhi, and DGCI&S, Kolkata, indicates that export of onion was 21.84 lakh tones, 27% more than the previous year (2017-18). The onion was exported mainly to Malaysia, Singapore, Bangladesh, Nepal, Sri Lanka, Mauritius and Gulf countries (Tables 10-11).

The export of garlic was 11,050 MT, 46% lesser than previous year. The garlic was exported mainly to Canada, Mexico, Australia, Thailand, Sri Lanka, Nepal, Taiwan, Bangladesh and Poland (Table 12).

The potato was exported mainly to Nepal, Brazil, Germany, Maldives, Arab Emirates, the USA, Oman and the UK. A total export of potato was 3,67,391 MT, about 81% more than previous year. The export of potato are given in Table 13.

Projects Implemented

The NHRDF continued to implement various projects related to research, development of vegetable and their seed production under different central sector schemes of government of the India and state governments. The projects implemented during the year are given as under:

Ministry of Agriculture and Farmer's Welfare, Government of India

Department of Agriculture, Cooperation and Farmer's Welfare

- Mission for Integrated Development of Horticulture (MIDH)
- Central Sector Scheme for Mushroom Development
- Monitoring of Pesticide Residue at National Level (MPRNL)

Department of Agriculture Research and Education -Indian Council of Agricultural Research

- Krishi Vigyan Kendra, Ujwa, Delhi

- All India Network Research Project on Onion and Garlic (AINRPOG)
- All India Coordinated Research Project on Vegetable Crops (AICRP-VC)
- *In-situ* Crop Residue Management through Mechanization

Ministry of Skill Development and Entrepreneurship, Government of India

- Agricultural Skill Council of India (ASCI)

Government of Maharashtra

- Soil Health Card
- Water Harvesting Pond
- Onion Storage Structure through NAFED

Government of Odisha

- Regional Research Station, NHRDF, Boudh

Government of Madhya Pradesh

- Onion Storage Structure through NAFED

11 Chapter

Transfer of Technology

Extension

The NHRDF has been involved in extension activities of farmers and trainers since its inception. Its main object is to quicken the process of transfer of technology so that farmers are able to adopt the same and thereby improve the yield and quality of their crops at a faster rate. The farmers were guided on improved package of practices for growing onion, garlic, potato and other export-oriented vegetable crops. The NHRDF implemented extension education through demonstrations, trainings, meetings, providing literatures and arranging exhibitions and, seminars through different centres located almost all over the country. The extension centres implemented the transfer of technology programmes are given below:

S. No.	Name of the centre	State covered
1	Bathinda	Punjab
2	Chitegaon	Maharashtra
3	Coimbatore	Tamil Nadu
4	Delhi	Delhi, Uttar Pradesh (Western)

S. No.	Name of the centre	State covered
5	Deoria	Uttar Pradesh
6	Hubli	Karnataka
7	Indore	Madhya Pradesh & Chhattisgarh
8	Karnal	Haryana, H.P., J&K, Uttarakhand
9	Kurnool	Andhra Pradesh & Telangana
10	Kota	Rajasthan
11	Boudh	Odisha
12	Patna	Bihar, Jharkhand, West Bengal & NE states
13	Rajkot	Gujarat
14	Mahua	Gujarat
15	Dindigul	Tamil Nadu
16	Lasalgaon	Maharashtra
17	Sinnar	Maharashtra
18	Krishi Vigyan Kendra	NCT Delhi

Electronic Media Coverage

Sr. No.	Topics	Programme	Date of Telecast/Broadcast
Dr. P. K. Gupta, Head KVK and Director, NHRDF			
1.	<i>Pyaz Ki Kheti Va Nursery Prabandhan</i>	Hello Phone Live DD Kisan, Channel, Delhi	18.12. 2018 at 06:00 to 07:00 PM

Sr. No.	Topics	Programme	Date of Telecast/Broadcast
2.	Importance of Seasonal Vegetables and their Production Technologies	Indraprastha Channel, All India Radio (819 Khz), Delhi	21 .12.2018 at 07:05 PM
3.	<i>Pyaaaz Va Lehsun Ki Kheti</i>	Indraprastha Channel, All India Radio (819 Khz), Delhi	01.01.2019 at 07.05 PM
Mrs. Ritu Singh, SMS (Home Science), KVK, New Delhi			
4.	<i>Poshan Prebandhan Ke Liye Jowar Bajra Yojana</i>	Hello Phone Live DD Kisan, Channel, Delhi	2.4.2018 from 6.00 – 7.00 PM
5.	<i>Madhumakhi Palan Se Mahila Sashikatikaran</i>	Hello Phone Live DD Kisan, Channel, Delhi	14.06.2018 from 6.00 – 7.00 PM
6.	<i>Khaad Prasanskaran</i>	Hello Phone Live DD Kisan, Channel, Delhi	26.11.2018 at 06:00 to 07:00 PM
7.	<i>Krishak Mahilaon Ke Utthan Ke Liye Labhkari Yojananayn</i>	Hello Phone Live DD Kisan, Channel, Delhi	07.02.2019 at 6.00 – 7.00 PM
Sri Rakesh Kumar, SMS (Horticulture), KVK, New Delhi			
8.	Orchard Management	National Institute of Open Schooling	18.04.18 from 2.00 – 3.00 PM
9.	<i>Rabi Season Vegetable Cultivation</i>	FM Gold Channel, Delhi	28-9-2018 from 2:30 to 3:00 PM
10.	<i>Rabi Mausam Me Sabjiyon Kee Khetee</i>	Hello Phone Live DD Kisan, Channel, Delhi	6.11.2018 at 06:00 to 07:00 PM
Dr. D.K. Rana, SMS (Plant Protection), KVK, Ujwa, New Delhi			
11.	<i>Madhumakhi Palan Se Badhaye Aamdani</i>	Hello Phone Live DD Kisan, Channel, Delhi	12.09.18 from 6.00 – 7.00 PM
12.	<i>Kisan Ki Baat</i>	FM Gold Channel, Delhi	27-9-2018 from 4:30 to 4:15 PM
13.	<i>Madhumakkhee Paalan Va Madhu Prasanskaran</i>	Hello Phone Live DD Kisan, Channel, Delhi	06.12.2018 at 06:00 to 07:00 PM
14.	<i>Madhumakhi Palan</i>	Hello Phone Live DD Kisan, Channel, Delhi	07.02.2019 at 6.00 – 7.00 PM
Shri Kailash, SMS (Ext), KVK, New Delhi			
15.	Discussion on Crop Residue Management	DD Kisaan Channel	2.9.2018 from 10:00 to 12:00 noon

Topic		Programme	Date of Telecast/Broadcast
Coverage of Program			
Organic Farming	KVK Scientists	Hello Phone Live DD Kisan, Channel, Delhi	14.01.2019 at 9.00 AM & 3.30 PM
Coverage of National Seminar of KVK held on 8-9 March 2019	Chief Guest and Dignitaries	Krishi Darshan, DD Kisaan, Channel, Delhi	11.03.2019 at 5.30 PM

Visitors

A total of 5,000 farmers, 2,255 students and 135 officers visited various centers of NHRDF

from different states of the country to know the research and developmental activities of horticultural crops, especially onion and garlic.

Sr. No.	Name	Designation & Organization	Date
Boudh, Odisha			
1	Dr. Panda Amitabh	Addl. Director, (Animal Husbandry), Govt. of Odisha	18.04.2018
2	Shri. Manoranjan Panigrahi, IRS	District Nodal Secretary, Boudh, Odisha	23.04.2018
3	Shri. Raghaba Mallick	Project Director Watershed, Boudh, Odisha	20.06.2018
4	Shri. Madhusudan Mishra, IAS	District Collector and Magistrate, Boudh, Odisha	20.06.2018
5	Sh. Hemanta Ku. Bhir	Asst. Agriculture Engineer, Boudh, Odisha	03.07.2018
6	Smt. Sairendri Mahakul	Sarpanch, Baghipada, Boudh, Odisha	15.08.2018
7	Dr. Salitabala Sahoo	Ayush, Baghipada, Boudh, Odisha	15.08.2018
Chitegaon, Nashik, Maharashtra			
1	Sh. H. K. Indoliya	Rajasthan State Seeds Corporation Ltd, Jaipur, Rajasthan	02.08.2018
2	Sh. Gopal Singh	Director, Rajasthan State Seed Co-operation Ltd., Jaipur, Rajasthan	02.08.2018
3	Sh. Mahendra Singh Thakur	Hon'ble Minister of Horticulture, Govt. of Himanchal Pradesh	06.08.2018
4	Sh. Omprakash Desmukh, IAS	Managing Director, MSSC Ltd, Akola, Maharashtra	14.09.2018
5	Sh. M. K. V. Shreenivasulu	Joint Director, (Horticulture) and Project Director, AMMIP, Kurnool, Andhra Pradesh	03.10.2018
6	Dr. Sandip Hingmire	NABL Assessor	22.12.2018
7	Mr. Raviraj Shinde	NABL Assessor	22.12.2018
Janakpuri, Delhi			
1	Smt. Saloni Rai, IAS	Sub-Divisional Magistrate, Govt. of NCT, Delhi	18.04.2018
2	Dr. M. Muthukumar, IAS	Director Agriculture, Govt. of Odisha, Bhubaneswar, Odisha	26.04.2018
3	Sh. M. K. V. Sreenivasulu	Dy. Director of Horticulture, Govt. of Andhra Pradesh, Kurnool, Andhra Pradesh	20.07.2018
4	Sh. Ashwani Kumar	Joint Secretary (Seeds & Machines & Tools) Dept. of Agriculture, Co-op, & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India	16.08.2018
5	Sh. Omprakash Deshmukh, IAS	Managing Director, MSSC Akola, Maharashtra	05.09.2018
6	Dr H.M.S.P. Herath	Additional Director (Seed Paddy OFC), Seed and Planting Material Development Centre, Department of Agriculture, Peradeniya, Sri-Lanka	16.01.2019

Sr. No.	Name	Designation & Organization	Date
7	Dr. S. B. Singh	Head, Krishi Vigyan Kendra, Gaya, Bihar	02.01.2019
Deoria, Uttar Pradesh			
1	Dr. Yashwant Singh	Secretary, Utthan, Aktaha Dari, Deoria, Uttar Pradesh	20.02.2019
Indore, Madhya Pradesh			
1	Sh. A. K. Jain	Seed Certification officer, MPSSCA, Ujjain, Madhya Pradesh	26.07.2018
2	Dr. H. S. Thakur	Nodal Officer, Collage of Agriculture, Indore	29.08.2018
3	Dr. D. K. Mishra,	SMS, Krishi Vigyan Kendra, Indore	29.08.2018
4	Dr. Shreila Thomas	Project Director. ATMA, Indore	30.08.2018
5	Sh. Y. K. Singh	Area Manager, NSC, Indore	31.08.2018
Karnal, Haryana			
1	Dr. Major Singh,	Director, ICAR- DOGR, Pune, Maharashtra	24.04.2018
2	Dr. V. Mahajan	Nodal Officer, ICAR- AINRPOG, DOGR, Pune, Maharashtra	24.04.2018
3	Dr. Satyendra Yadav,	Deputy Director, Potato Technology Centre, Deptt. of Haryana, Shamgarh, Karnal, Haryana	07.05.2018 17.01.2019
4	Dr. R. C. Upadhyaya	Ex. ADG (Horticultural Science), ICAR, New Delhi	07.08.2018
5	Sh. Vikash Kumar	Agriculture Finance Corporation Ltd, Delhi	20.08.2018
6	Dr. C. B. Singh	Ex. Head, KVK, Kurukshetra, Haryana	23.08.2018
7	Dr. Parveen Kumar	Principal Scientist, ICAR-CSSRI, Karnal, Haryana	01.10.2018
8	Dr. S. K. Pattanayak, IAS	Secretary (Retd.), Dept. of Agriculture, Co-Op. & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi	20.10.2018
9	Sh. M. B. Vaghamshi,	Deputy Director (Horticulture), Govt. of Gujrat, Bhawnagar	28.02.2019
Kota, Rajasthan			
1	Sh. C.K. Sharma,	Dy. Director, Agriculture, Irrigation Management & Training Institute (IMTI), Kota, Rajasthan	16.05.2018
2	Sh. Rajeev Daima	Dy Development Manager, NABARD, Kota	25.05.2018
3	Dr. M. K. Poonia	Dean, College of Agriculture, Nagour	18.08.2018
4	Dr. D.K. Singh	Sr. Scientist and Head, KVK Anta, District Baran	29.12.2018
Mahua, Bhawnagar, Gujrat			
1	Sh. Sanjay Koshambi	District Agriculture Officer, Bhawnagar	30.05.2018
2	Sh. Ghanshyambhai R. Patel	Chairman, APMC, Mahua, Bhawnagar	06.06.2018
3	Sh. Sanjaybhai Doshi	Vice President, APMC, Mahua, Bhawnagar	06.06.2018
4	Dr. K. D. Desai	Asst. Prof., Dept. of Vegetable Science, College of Horti. & Forestry, Navasari Krishi Vidyapeeth, Navasari	17.07.2018
5	Dr. Pankaj Bhalerao	Asst. Prof. Dept. of Vegetable Science, College of Horti. & Forestry, Navasari Krishi Vidyapeeth, Navsari	17.07.2018

Sr. No.	Name	Designation & Organization	Date
6	Mrs. Chandra Murthy	District Development Manager, NABARD, Bhawnagar	26.07.2018
7	Sh. Varun Kumar Baranwal, IAS	DDO, Bhawnagar	04.10.2018
8	Sh. Ghanshyam Bhai Patel	Chairman, APMC, Mahuva, Bhawnagar	04.10.2018
9	Dr. P. K. Kapadiya	Ex Research Scientist, ARS, JAU- Mahuva, Bhawnagar	28.02.2019
Patna, Bihar			
1	Dr. B. Mandal	Head , KVK, Supaul	05.07.2018
2	Dr. Brijesh Patel	SMS, KVK, Bardh	20.08.2018
3	Dr. A. K. Shinha	Head , KVK, Arariya	20.08.2018
4	Dr. B. K. Mandal	Programme Coordinator, KVK- Shekपुरa	04.10.2018
5	Dr. Ram Raj Meena	Assistant Prof. Horticulture, KVK, Borkheda, Agriculture University Kota, Rajasthan	27.10.2018
6	Smt. Vibha Rani	SMS (Horticulture), Krishi Vigyan Kendra, Nalanda	13.02.2019
Rajkot, Gujrat			
1	Dr. C. M. Patel	Joint Director, Dept. of Horticulture, Rajkot	24.08.2018
Lasalgaon, Nashik, Maharashtra			
1	Sh. Gokul D. Wagh	SDAO, Dept. of Agri. Nashik	25.08.2018
2	Sh. Anna Shab Gagare	TAO, Dept. of Agri. Nashik	25.08.2018

Krishi Vigyan Kendra, Delhi

Trainings

The NHRDF imparted training to Agriculture Officers/ Extension Functionaries/ elite farmers sponsored by different state governments under various schemes all over the country. The NHRDF

also conducted trainings to official from SAARC countries time-to-time on onion, mushroom and allied crops. Trainings imparted by NHRDF to Agricultural/Horticultural officers/farmers at National and International participants during 2018-19 are as under.

New Delhi

Date	Duration (days)	No. of farmers/ students*	District and state/country	Sponsored by
4-6 September, 2018	3	40	UP	MIDH-VSP
11-15 September, 2018	5	30	Rajasthan	ATMA, Rajasthan
17-19 January, 2019	5	62	Rajasthan	ATMA, Rajasthan
4-6 March, 2019	3	18	Delhi	Individual

Nashik

Date	Duration (days)	No. of farmers/ students*	District and state/ Country	Sponsored by
05-10 July 2019	6	25*	Nashik (Maharashtra)	Under MIDH
05-10 July 2018	6	30	Rajasthan	ATMA, Rajasthan
05-07 September 2018	3	80	Solapur (Maharashtra)	Under MIDH
11-15 September 2019	6	33	Kota, Rajasthan	ATMA, Rajasthan
22-24 October 2018	3	36	Kota (Rajasthan)	ATMA, Rajasthan
29-31 January 2019	3	23	Jalgaon (Maharashtra)	ATMA, Jalgaon
02-06 February 2019	5	30	Jhalore (Rajasthan)	ATMA, Rajasthan
04-06 March 2019	3	10	Dubai	Individual

*Students

Colour Plate No. 3 National and State Level Seminars



Shri Santosh Kumar Sarangi, IAS, Joint Secretary, Ministry of Commerce and Industry, Government of India inaugurate the National Seminar as a Chief Guest on 11 March 2019 at ICAR - IARI, New Delhi.



Farmers from northern states attending National Seminar, held on 11-12 March 2019 at ICAR - IARI, New Delhi



National Seminar organised by NHRDF, Deoria at ICAR-IISR, Lucknow during 12 – 13 October 2018



National Seminar organised by NHRDF, Kota at Baran (Rajasthan) during 27 – 28 January 2019



Inaugural of National Seminar cum exhibition by Dr. A.K. Singh, Dy. Director General (Extension), ICAR, New Delhi



Chief Guest Dr. A.K. Singh, DDG (Extension), ICAR, inaugurating National Seminar, held on 8 March 2019 at KVK, Ujwa, New Delhi



State Seminar organised by RRS NHRDF, Sinnar Nashik, Maharashtra during 8 - 9 October 2018



State Seminar organised by NHRDF, Indore during 10 - 11 September 2018 at Dhar (Madhya Pradesh)



State Level Seminar organised by NHRDF, Karnal during 29 - 30 August 2018 at Ambala (Haryana)



State Level Seminar inaugurated by Hon'ble Vice Chancellor Dr B S Dhillon, PAU, Ludhiana at Barnala (Punjab) organised by NHRDF, Bhatinda during 30-31 August 2018



State Level Seminar organised by NHRDF, Kota during 22-23 October 2019 at Fatehpur (Rajasthan)

Colour Plate No. 4

Trainings Imparted to Agriculture/Horticulture Officials and Farmers



Karnal



New Delhi



Hubli



Patna



Rajkot



Nashik

Colour Plate No. 05

Farmer's Group Visited to NHRDF Centers



Farmers of Sabarkantha district of Gujarat visiting RRS Chitegaon, Nashik



Farmers of Bathinda district, Punjab visiting RRS Karnal



Farmers of Maharashtra visiting RRS, Chitegaon, Nashik



Farmers of Gujarat visiting Chitegaon, Nashik



Farmers of Bolangir district of Odisha visiting RRS, Chitegaon, Nashik



Students of Vivekanand Education Society, Chambur, visiting RRS, Chitegaon, Nashik

Colour Plate No. 06

Field Days



Field day organized by Bathinda Centre on kharif onion under TDTD on 29 November 2018



Field day organized by Hubli Centre on rabi onion under TDTD on dated 28 March 2019



Field day organized by Chitegaon, Nashik on rabi onion variety NHRDF Red-4 under TDTD

Colour Plate No. 7

Participated in Exhibitions /Farmer's Fair



KVK, Ujwa, New Delhi



Indore, Madhya Pradesh



Karnal, Haryana



Kota, Rajasthan



Mahuva, Gujrat



Coimbatore, Tamil Nadu

Colour Plate No. 8

Laiddown of Foundation Stone of Biocontrol Lab and Water Pound



A Biocontrol Laboratory has been established at Regional Research Station, Karnal, under Mission of Integrated of Development of Horticulture scheme, Ministry of Agriculture and Farmers' Welfare, Government of India as per approved Annual Action Plan 2018-19. The lab facility will be utilized for production of bio products, viz. *Trichoderma spp*, *Beauveria bassiana*, SNPV, *Pseudomonas spp* etc. These bio products will help to control pest and diseases on horticultural crops. The Foundation Stone of Biocontrol Laboratory was laid by Hon'ble Dr S.K. Pattanayak, IAS, Secretary (Retd.), Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture and Farmers Welfare, Government of India and Hon'ble President of NHRDF, Dr Bijendra Singh on 20 October 2018 at RRS, NHRDF, Karnal.

Water Pond at RRS, Sinnar, Nashik

Water pond with a capacity of 5, 00 Killo litres has been constructed at RRS, Sinnar under MIDH through Deptt of Agriculture & Horticulture, Govt of Maharashtra. It will help in storing the rain water for conducting research trials/ demonstrations and production of mother bulbs of different varieties of onion for further seed production.



Colour Plate No. 9

Higher Official Visit to NHRDF Offices



Dr. S.K. Pattanayak, IAS, Secretary (Retd.), Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture and Farmer's Welfare, Government of India, visited RRS, Karnal on 20 October 2018 as a Chief Guest on closing ceremony of Training on Vegetable Seed Production, Under MIDH as per course curriculum of ASCI



Shri Ashwani Kumar, Joint Secretary (Seed), Ministry of Agricultural and Farmer's Welfare, Government of India, as a Chief Guest during during closing ceremony of training programme on Mushroom Production on 5th August 2018 at NHRDF, New Delhi



Shri Sanjeev Kumar Chadha, IFS, MD, NAFED, Ministry of Agriculture & Farmer's Welfare, Govt. of India is a chief guest during closing ceremony of training program on Mushroom Production on 14th April 2018 at NHRDF, New Delhi



Miss Saloni Rai, IAS, SDM, Najafgarh Taluka, South West District, Government of NCT, Delhi is a chief guest during closing ceremony of skill development training programme on Mushroom Production on 18 April 2018.



Shri Choudhary Sukhvair Singh, Vice-Chairman and Smt. Anita Rawat, Managing Director, Delhi State Cooperative Bank Limited, Delhi, visited at NHRDF, New Delhi on 24 April 2019

Major Activities - Krishi Vigyan Kendra, Delhi

Farmer-Scientist Interface (FSI) – I

Farmers-Scientists Interface was held at Krishi Vigyan Kendra, Ujwa, Delhi, on 28 August 2018. Dr Harsh Vardhan, Hon'ble Minister of Science and Technology, Environment, Forest and Climate Change and Earth Sciences, Government of India, was the Chief Guest, while Dr Bijendra Singh (Ex-MLA) and President, NHRDF,

presided over the function and addressed farmers about achievements of KVK of the last 23 years for the benefit of farming community of NCT Delhi. Dr P.K. Gupta, Head, KVK and Director (Acting), NHRDF, gave a brief introduction for celebrating the FSI under Crop Residue Management. Dr Randhir Singh, ADG (Extension), ICAR, New Delhi, addressed the farmers about the rice residue management in field under central sector scheme program by Ministry of Agriculture & Farmers Welfare, Govt. of India.



Dr Bijendra Singh President NHRDF welcome to Dr Harsh Vardhan jee Cabinet Minister, Government of India



Dr P.K. Gupta, Head, KVK Delhi and Director (Acting), NHRDF briefed about the exhibition and FSI to Chief Guest.

Chief Guest inaugurated the Exhibition and Farmers-Scientists Interface. During addressing the farmers on this occasion he emphasised that “science has solution for every problem faced by the country and people”. During his deliberation he highlighted the harmful effects of crop residue burning on environment and urged farmers to stop crop residues burning in their fields, he also emphasized Ministry of Earth Science, providing agro-met services to 24 million farmers and after four years the ministry has provided agro-met services to 42 million farmers through mobile phones.

Farmer-Scientist Interface (FSI) – II

Second Farmer-Scientist Interface was held at Tigipur village in Alipur Block of North-South Delhi district on 11 October 2018. Shri Ashwani Kumar, Joint Secretary (Machine and Tool), Ministry of Agriculture and Farmers’ Welfare, Government of India, was the Chief Guest. Dr P.K. Gupta, Head, KVK, Delhi, welcomed the Chief Guest and the august gathering and briefed about this

programme. The chief guest addressed the farmers and highlighted the Central Government initiative in respect of *In-situ* Crop Residue Management by using Farm Machineries and also focused on various government schemes useful for Farmers’. Dr Randhir Singh, ADG (AE), ICAR appreciated the efforts of Krishi Vigyan Kendra, Delhi while addressing the farmers on harmful effect of crop residue burning on soil health and its properties. Dr Indra Manni, Head, Division of Agricultural Engineering, ICAR-IARI, New Delhi and Shri Aproveed Prakash, Engineer, PAU, Ludhiana, delivered lectures on Operational Guidelines of Farm Machinery for wheat sowing after rice cultivation by Combine Harvester.

Delhi Enviro Quest - 2018

State Level Environment awareness event was organized as a “Delhi Enviro-Quest” 2018, by Krishi Vigyan Kendra, Delhi, at Shiksha Bharti Global School, Dwarka, Sector -8, New Delhi, on 19 to 20 November 2018 under Central Sector Scheme, *In-situ* Crop Residue Management through Mechanization. In this program around 785 school

students of NCT Delhi region from 85 schools was participated. In this event Debate, Extempore, Quiz, Poster and Slogan writing competition

was organized and students exhibits their talents. The winner students honour with certificates, Mementoes and Cash prize.



Chief Guest Shri Ashwani Kumar, Joint Secretary (Machine and Tool), Government of India addressing the August gathering of farmers during Farmers Scientists Interface on 11 October 2018



August gathering of Farmers during Farmers Scientists Interface on 11 October 2018

Dr P. K. Gupta,
Head, KVK
addressing rules
of Extempore
Competition



Student expressing
her views during
the Debate



Invigilators during
poster making and slogan
writing competition



Message: "A World
without crop means
world without Air
and Water"



Students busy in written General
Knowledge Quiz on 20 November
2018



Students made a
diagram to Save
Earth

Seed and Planting Materials

The Seed is the primary Agri inputs for production of agricultural crop. The expected results of most advanced technology will not be achieved without using quality seed/planting material. Timely availability of recommended varieties is of utmost importance in maximizing per unit return and productivity. During the past decade, NHRDF has significantly contributed in multiplication and distribution of quality seed/planting material of improved varieties of onion, garlic, potato and other vegetables. Nucleus, breeder, foundation as well as truthful labeled seeds of onion and garlic are regularly produced and distributed. During 2018-19, NHRDF produced and distributed 8.76 q nucleus/breeder seed, 67.70 q. foundation, 186.50 q certified and 1374.50 q truthful seed of different onion varieties. In garlic, 105.72 q of nucleus/breeder seed, 186.53 q foundations, 294.38 q certified seed and 3108.21 q of truthful labeled garlic seeds/cloves were produced and distributed to growers.



Table 1: Seed Produced of different crops and distributed during 2018-19

Crop	Varieties	Quantity procured (q)	Quantity distributed (q)
Onion	Agrifound Dark Red, L-883, Agrifound Light Red, NHRDF Red, NHRDF Red-3, NHRDF Red-4, Agrifound Rose, Coon-5	1628.70	1295.18
Garlic	G-50/G-282/G- 323/G-384	3589.09	5371.15
Potato	Kufri Bahar / K. Jyoti / K. Surya / K. Khyati / K. Lavkar/ K. Chipsona-1 & 3	6705.46	5194.42
Cowpea	Kashi Kanchan (CP-4) / CP-6	53.53	72.18
Coriander	GDLC - 1/ CS-6	26.20	1.25
Okra	Arka Anamika/Pusa A-4	40.36	42.94
Bottle Gourd	Pusa Naveen	0.96	0.06
Brinjal	Kashi Taru/ Kashi Uttam	0.30	0.01
Fenugreek	Pusa Early Bunching/RMT-305	17.51	1
Cauliflower	Kashi Gobhi-25	1.52	0.03
Drumstick	PKM-1	10.00	4.49
Tomato	Arka Rakshak/PKM-1	2.57	0.36
Pea	Azad Pea-3/Pusa Pragati	117.38	68.68
Musk Melon	Pusa Madhuras	12.50	2.24
Paddy	MTU-7029/ Pusa – 44 (Farm produced)	0	72.78
Soybean	JS-335/MAUS-71	114.60	125.59
Chilli	K-1/K-2	0.80	3.34
Mustard	Pusa Vijay/Pusa Sag -1	20.00	10.00
Palak	Pusa All Green	18.00	6.75
Radish	Pusa Chetki	0.08	0.02
Carrot	Pusa Vrishthi/ Pusa Rudhira	0	1.42
Groundnut	K-9	131.82	24.41
Total		12471.38	12398.30
Kitchen Garden Kit	Rabi/Kharif season	-	23515 Nos

Publications

Lead/Invited Papers

- Gupta, P K & Bhaskar P (2018) *Crop intensification system for improving onion and garlic productivity*, in National Conference on “Intensification and diversification in agriculture for livelihood and rural development” at Dr Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar organized by ASMF, New Delhi on 29-31 May 2018 p: 28
- Gupta P K (2018). *Present scenario of Bulbus crop in the country*, in National Conference on “Multidisciplinary approaches of Plant Science” and 28th APSI scientists meet on 29-31 October 2018 at DIBNS, Dehradun
- Gupta, P.K. and Singh, S. (2019). *Present scenario of onion production and their strategies for increasing onion productivity in the country*. In: First Vegetable Science Congress on Emerging Challenges in Vegetable Research and Education, held at Agricultural University, Jodhpur, Rajasthan on 1-3 February, 2018, p:103.
- Gupta, P.K, Dubey, B.K and Tiwari, S.K. (2019). *Role of NHRDF in Research and Development of Onion and Garlic in India*. In: International Symposium on Edible Alliums: Challenges and Opportunities, on 9-12 February, 2019, pp. 103.
- Gupta, P. K. and Bhaskar, P. (2019). *Onion and garlic in health and wellness*. In: National Seminar cum Interactive Workshop on Noni and Medicinal Plants in Human Wellness, held

at University of Madras, on 23-24 March 2019 at Chennai, p: 15.

Research Papers

- Bhasker, P., Singh, R.K., Gupta, R.C., Sharma, H.P. and Gupta, P.K. (2018). Effect of drip irrigation on growth and yield of onion (*Allium cepa* L.). *Journal of Spices and Aromatic Crops*. 32-37.
- Bhasker P., Tailor A.K., Sharma H.P., Singh R.K. and Gupta, P.K. (2018). Medicinal, nutraceutical values and consumption pattern of onion (*Allium cepa*) in India: An over view. *International Journal of Current Microbiology and Applied Sciences: Special Issue*: 2629-2638.
- Bhasker, P, Gupta, P.K. and Sharma, H.P. (2018). Profit making of small holder farmers by cultivation of onion and garlic. *Indian Journal Arecanut Spices and Medicinal Plants*, 20(3): 15-23.
- Gupta, R.C., Purushothaman S., Pandey S. and Gupta, P.K. (2018). Efficacy of pre harvest spray of fungicides and bio agents on post-harvest storage diseases of onion (*Allium cepa*). *International Journal of Current Microbiology and Applied Sciences* 7(3): 2625-2629.
- Pandey, S. Pathak, M.K., Dubey, B.K. and Gupta, P.K. (2018). Effect of planting dates on infestation of thrips in garlic bulb crop. *International Journal of Current Microbiology and Applied Sciences* 7(7): 1827-1832.

- Pathak, M.K., Pandey, S., Gupta, R.C. and Gupta, P.K. (2018). Evaluation of different insecticides against onion thrips in onion seed production. *International Journal of Current Microbiology and Applied Sciences*: 7(7): 4204-4207.
- Pathak, M.K., Pandey, S., Gupta, R.C., Tailor, A.K. and Gupta, P.K. (2018). Studies on reducing thrips populations in onion by optimizing nitrogen and potash levels. *International Journal of Current Microbiology and Applied Sciences* 7(7): 4161-4166.
- Bhasker, P., Gupta, P.K. and Ganeshamurthy, A.N. (2019). Effect of micronutrients application on yield and storage of garlic variety Yamuna Safed-3 under Zone – II and Zone-V. In: *International Symposium on Edible Alliums: Challenges and opportunities* on 09 -12 February, 2019 at YASHDA, Pune. pp: 325-326.
- Bhasker, P., Gupta, P.K. and Ganeshamurthy, A.N. (2019). Influence of micronutrients application on yield and quality of onion seed under Zone II and Zone V. In: *International Symposium on Edible Alliums Challenges and Opportunities* held at YASHDA, Pune, on 09 -12 February, 2019, pp: 324-325.

Abstracts

- Bhasker, P., Gupta, P.K. and Sharma, H.P. (2019). Standardization of transplanting schedule and fertigation levels for *rabi* onion bulb production under Zone-V. In: *8th Indian Horticulture Congress-2019*, held at IGKV, Raipur, on 17-21 January, 2019, p 368.
- Gupta R.C., Purushothaman, S. and Gupta, P.K. (2019). Integrated management of foliar diseases of garlic in Zone Vth. In: *8th Indian Horticulture Congress-2019* held at IGKV, Raipur, on 17-21 January, 2019 p:215.
- Dubey, B.K., Gupta, P.K. and Tiwari, S.K. (2019). Evaluation of onion genotypes during *kharif* season under Haryana conditions. In: *First Vegetable Science Congress on Emerging Challenges in Vegetable Research and Education*, held at Agricultural University, Jodhpur, Rajasthan, on 1-3 February, 2019 pp: 78-79.
- Bhasker, P., Suresh Babu, Dube, B.K., Sharma, H.P. and Gupta, P.K. (2019). Comparative studies of onion set and seedlings performance as affected by transplanting / planting dates under Zone-II. In: *8th Indian Horticulture Congress-2019*, held at IGKV, Raipur, on 17-21 January, 2019, p: 8.
- Bhasker, P., Dubey, B.K. and Gupta, P.K. (2019). Impact of reduced nitrogen, increased potassium and chemical sprays on yield and storability of onion (*Allium cepa* L.) under Zone II and Zone V. In: *International Symposium on Edible Alliums: Challenges and Opportunities*, held at YASHDA, Pune, on 09-12 February, 2019 p:326.
- Dubey, B.K. and Gupta, P.K. (2019). Evaluation of genetic variability of garlic advance lines for *rabi* season. In: *First Vegetable Science Congress*, held at Agricultural University, Jodhpur, Rajasthan, on 9-12 February, 2019, p: 78.
- Dubey, B.K. and Gupta, P.K. (2019). Performance of garlic (*Allium sativum* L.) advances lines during *rabi* at Karnal, Haryana In: *International Symposium on Edible Alliums: Challenges and Opportunities*, held at YASHDA, Pune, on 9-12 February, 2019, p:289.
- Gupta, R.C., Pandey, M.K., Pathak, M.K. and Gupta, P.K. (2019). Evaluation of combined fungicides for management of foliar diseases of onion (*Allium cepa* L). In: *International Symposium on Edible Alliums: Challenges and Opportunities*, held at YASHDA, Pune, on 9-12 February, 2019, p: 348.
- Pathak, M.K., Pandey, M.K., Gupta, R.C. and Gupta, P.K. (2019). Bio-efficacy of different myco-insecticides against onion thrips. In: *International Symposium on Edible Alliums on Challenges and Opportunities* held on 09 -12 February, 2019 at YASHDA, Pune, p:354.
- Pathak, M.K., Pandey, M.K., Gupta, R.C. and Gupta, P.K. (2019). In-vitro evaluation of different combines and contact fungicides against *stemphylium vesicarium* causing Stemphylium blight in onion. In: *International Symposium on Edible Alliums on Challenges and Opportunities* held at YASHDA, Pune, on 09-12 February, 2019, pp: 354-355.



- Pathak, M.K., Pandey, M.K., Gupta, R.C. and Singh, S.K. (2019). Comparative study of bio-pesticides, botanicals and chemicals for thrips management in onion for Maharashtra condition. In: *International Symposium on Edible Alliums: Challenges and opportunities* on 09-12 February, 2019 at YASHDA, Pune. pp: 353.
- Pathak, M.K., Pandey, M.K., Gupta, R.C., Pandey, S. and Gupta, P.K. (2019). Evaluation of new generation insecticides for management of onion thrips in Maharashtra condition. In: *International Symposium on Edible Alliums on Challenges and Opportunities* held at YASHDA, Pune, on 09-12 February, 2019 pp: 352-353.
- Tiwari, S.K., Gupta, P.K. and Dubey, B.K. (2019). Genotype performance of *kharif* onion for zone. In: *International Symposium on Edible Alliums on Challenges and Opportunities*, held at YASHDA, Pune, on 09 -12 February, 2019 pp: 280-281.
- Gupta, R. C. and Gupta, P. K. (2019). Combined efficacy of different fungicides and microbial consortia for sustainable management of foliar diseases in onion (*Allium cepa* L.). In *National Symposium on Recent Challenges and Opportunities in Sustainable Plant Health Management* held at BHU, Varanasi, on 26-28 February, 2019 pp: 35-36.

- Onion and Garlic Varieties
- Post Harvest Management and storage of Onion and Garlic
- Nutrient deficiency and their management in onion and garlic
- Pest and disease management in onion and garlic
- Onion seed production

Hindi

- Subjion Me Ekikrit Keet Avam Rog Prabandhan
- Bharat mein Pyaj ki Kheti
- Pyaj aum Lahsun Beejotpadan
- Pyaj Phasal Calender
- Kechua aum Kechua Khad

Technical Bulletins

English

- Onion Production in India
- Garlic Cultivation in India
- Diseases of Onion and Garlic

Regular Publications

English

- NHRDF Annual Report (yearly)
- Annual Progress Report of MIDH-NHM (yearly)
- NHRDF News Letter (quarterly)



15 Chapter

Administrations

Staff Position

The total strength of staff in different categories in NHRDF (Annexure VII).

(A) Appointments

1. Shri Vikram Singh joined duty as Organic Chemist at Chitegaon (Nashik) on 27/12/2018.
2. Ms. Kriti Jain joined duty as Sr. Accounts Assistant at New Delhi on 15/02/2019.

(B) Promotions

1. Dr P. K. Gupta, Joint Director, HO, New Delhi has been promoted to the post of Additional Director now he is working as Director (Acting)
2. Dr S. K. Singh, Deputy Director (Seed) has been promoted to the post of Joint Director (Seed) at Rajkot.
3. Mr H. P. Sharma, Deputy Director (Statistics), RRS, Chitegaon has been promoted to the post of Joint Director (Statistics).
4. Mr Ramesh Babu P.K., Assistant Director (Personnel), HO, New Delhi has been promoted to the post of Deputy Director (Personnel).
5. Mr S. N. Chaudhary, Assistant Director (Plant Breeding) has been promoted to the post of Deputy Director (Plant Breeding) at Coimbatore.
6. Mr H. K. Sharma, Assistant Director (Horticulture), has been promoted to the post

of Deputy Director (Horticulture) at HO, New Delhi.

7. Mr G. P. Dwivedi, Section Officer (Personnel), HO, New Delhi has been promoted to the post of Assistant Director (Personnel).

(C) Transfer

1. Shri M.A. Joshi, AA transferred from Chitegaon (Nashik) to Lasalgaon (Nashik) and joined duty on 19/06/2018 at Lasalgaon (Nashik).
2. Shri C.D. Holkar, Attendant transferred from Chitegaon (Nashik) to Lasalgaon (Nashik) and joined duty on 11/09/2018 at Lasalgaon (Nashik).
3. Dr. Suresh B. Dagade, DD (H) transferred from Boudh (Paljhar) to Kurnool and joined duty on 17/09/2018 at Kurnool.
4. Shri. M.M. Dwivedi, AD (H) transferred from Bathinda to Hubli and joined duty on 17/09/2018 at Hubli.
5. Dr. Satyendra Singh, DD (H) transferred from Kurnool to Lasalgaon (Nashik) and joined duty on 19/09/2018 at Lasalgaon (Nashik).
6. Dr. Alok Kumar Singh, AD (H) transferred from Hubli to Bathinda and joined duty on 24/09/2018 at Bathinda.
7. Shri Fauzdar Prasad, Attendant transferred from Lasalgaon (Nashik) to Deoria and joined duty on 03/11/2018 at Deoria.
8. Shri Shinde Sharad Eknath, Attendant transferred from Deoria to Sinnar (Nashik)

and joined duty on 03/11/2018 at Sinnar (Nashik).

9. Shri Anup Kumar Singh, TA transferred from Sinnar (Nashik) to Indore and joined duty on 12/11/2018 at Indore.
10. Dr. Rajneesh Mishra, DD (H) transferred from Deoria to Boudh (Paljhar) and joined duty on 16/11/2018 at Boudh (Paljhar).
11. Dr. Hind Mahasagar Singh, STO (H) transferred from Kurnool to Patna and joined duty on 17/11/2018 at Patna.
12. Shri Tarsem Lal, GC transferred from Boudh (Paljhar) to Patna and joined duty on 19/11/2018 at Patna.
13. Shri Akash Kumar Upadhyay, TO (Seed) transferred from Indore to Kurnool and joined duty on 27/11/2018 at Kurnool.
14. Shri Prem Swaroop, STO (H) transferred from Patna to Deoria and joined duty on 28/11/2018 at Deoria.
15. Shri H.K. Sharma, DD (H) transferred from Rajkot to New Delhi and joined duty on 28/02/2019 at New Delhi.
16. Shri S.N. Choudhary, DD (Br.) transferred from New Delhi to Coimbatore and joined duty on 28/02/2019 at Coimbatore.
17. Dr. S.K. Singh, JD (Seed) transferred from New Delhi to Rajkot and joined duty on 02/03/2019 at Rajkot.
18. Shri M.K. Srivastava, DD (M) transferred from Chitegaon (Nashik) to New Delhi and joined duty on 07/03/2019 at New Delhi.

(D) Retirements

1. Shri Madan Lal, Attendant, Karnal on 31.05.2018
2. Shri Girdhari Lal, General Clerk, Bhatinda on 31.07.2018
3. Shri H. N. Tiwari, STO (Horticulture), Karnal on 31.07.2018

4. Shri S. P. Tripathi, AD (Horticulture), Karnal on 31.07.2018
5. Shri Gulab Ram, Accounts Assistant, Patna on 30.09.2018
6. Shri R. N. Singh, General Clerk, Deoria on 30.09.2018
7. Shri Pawan Kumar, Attendant, Karnal retired on 30.11.2018
8. Shri J. N. Yadav, Driver, RRS, Chitegaon on 30.11.2018
9. Shri Raj Singh, General Clerk, New Delhi on 31.12.2018
10. Shri Nand Ram, Attendant, Nashik on 31.01.2019
11. Shri A.N. Verma, STO (Horticulture), Karnal on 31.03.2019
12. Shri Ram Lochan Yadav, Attendant, Deoria on 31.03.2019

NHRDF wish a healthy and peaceful life of post retirement

(E) Condolence meetings

1. Late. Sh. Anant Govindram Joshi F/o. Shri. Mahesh Anant Joshi, Account Assistant, Lasalgaon, Nashik, Maharashtra demise on 08th January, 2018.
2. Late. Sh. Radhika Devi M/o. Shri. Ashok Kumar Srivastava, Technical Assistant, Karnal, Haryana demise on 18th January, 2018.
3. Late Shri. Khacher Mal Sharma F/o. Shri. Harish Kumar Sharma, Assistant Director, Rajkot, Rajkot demise on 23rd April, 2018
4. Late Smt. Rajrani Devi M/o Shri A. N. Verma, Senior Technical officer (Horticulture) Karnal, Haryana demise on 11th January, 2019.
5. Shri. Gaurav Guliya H/o. Pooja Phogat, Admin Assistant, New Delhi demise on 14th April, 2019.

16 Chapter

Human Resource Development

Trainings Attended by NHRDF Officials

Sr. No.	Name of official/Staff	Title of Training	Duration	Organized by
1	Dr. R. C. Gupta Asstt. Director (Plant Pathology), RRS, Nashik	Shift of ISO/IEC 17025:2005 to ISO/IEC 17025:2017	07 May 2018	NABL, Gurgaon, Haryana
2	Sh. Bishram Prajapati, Technical Assistant, RRS, Nashik	Soil Testing	22-26 October 2018	District Agriculture Office, Nashik
3	Dr. R. C. Gupta Asstt. Director (Pl. Path.), RRS, Nashik	Chemist for grading of Fruits and vegetables	28 November 2018	Regional Agmark Laboratory, Mumbai
4	Dr. Sharad Kumar Tiwari Sr. Technical Officer (Horticulture) HO, Janakpuri, New Delhi	Hybrid Seed Production of Vegetable Crops for Enhancing Productivity & Nutritional Security	12-19 February 2019	ICAR-IARI, New Delhi
5	Sh. Awadhesh Kumar Mishra, Sr. Technical Officer (Hort.), Kota	Recent Approaches in Pre- and Post-Harvest Management of Horticultural Crops for enhanced farm Income	20-27 February 2019	ICAR-CAZRI, Jodhpur

Meetings, Seminars, Workshops Attended by NHRDF Officials

Dr. P.K. Gupta, Director, HO, Janakpuri, New Delhi

Date	Particulars
03 April 2018	Agro-Export Policy & Round Table Sessions on MSP at Indian Habitat Centre, New Delhi alongwith Dr S.K. Tiwari, STO, New Delhi.
03 April 2018	On MEP of onion held at Udyog Bhawan, New Delhi under the chairmanship of Jt. Secretary (Export), Ministry of Commerce & Industry, Govt. of India, New Delhi.

Date	Particulars
19 April 2018	2 nd Congress of Indian Laboratories on AOIL and Foundation Day at New Delhi alongwith Shri. Sanjay Singh, Assistant Director (Horticulture) and Dr S.K. Tiwari, Sr. Technical Officer, New Delhi.
21 April 2018	Director Horticulture and Seed Certification, Government of Gujarat, Ahmedabad regarding onion seed certification
22 April 2018	President, Onion Processing Industry, Mahuva, Bhavnagar regarding supply of suitable onion varieties to processing industries.
26 April 2018	Joint Secretary (MIDH) to finalize Annual Action Plan-2018-19 at Krishi Bhawan, New Delhi along with Dr. S.K. Singh. Dy. Director (seed) and Shri Sudhir Kumar Singh, Sr. Programmer, H.O., New Delhi
05 May 2018	Officials of Horticulture & Agriculture Department and seed companies, Jalna about Seed Hub at Jalna by Govt. of Maharashtra.
15 May 2018	Director of Agriculture and Principal Secretary (Agriculture & Horticulture), Govt. of Himachal Pradesh, Shimla regarding NHRDF seed supply along with Sri B.K. Dubey, Dy. Director and Sri Shashi Kumar, Tech. Officer (Hort.), RRS, Karnal.
18 - 21 May 2018	XXXVI th Group Meeting of ICAR-All India Coordinated Research Project on Vegetable Crops at Rajasthan Agricultural Research Institute, Durgapura, Jaipur alongwith Sri T.P. Ambare, Senior Technical Officer (Horticulture), RRS Nashik, Sri S. Purusottam, Senior Technical Officer (Plant Pathology), RRS, Karnal and Sri A.K. Mishra, Incharge, Kota
25 May 2018	“Field Day-cum-Farmers Meeting” organised by NHRDF, Deoria at Jounpur (U.P.).
29 to 31 May 2018	National Conference on “Intensification and diversification in agriculture for livelihood and rural development” at Dr Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar alongwith Dr J.K. Tiwari, Assistant Director, and Dr H.M. Singh, Senior Technical Officer, NHRDF, Patna
31 May 2018	Principal Secretary, and Director of Horticulture, Govt. of Bihar regarding NHRDF role in Horticulture sector in Bihar
8 - 9 June 2018	IX th Group Meeting of ICAR-AINRPOG and NHRDF Award-2017 ceremony held at PAU, Ludhiana alongwith Sri B K Dubey, Incharge and Deputy Director, RRS Karnal and Dr R C Gupta, Assistant Director (Plant Pathology), Dr P Bhaskar, Technical Officer (Plant Physiology), RRS, Nashik and Sri M M Dwevedi, Incharge, NHRDF, Bhatinda
10 - 12 June 2018	Annual Zonal Workshop of ICAR-Krishi Vigyan Kendra, ATARI Zone-II, Jodhpur held at SKRAU, Bikaner.
27 June 2018	Board of Directors meeting of Mahabeej held at Nagpur regarding MoU between NHRDF and Mahabeej to supply of onion seed under chairmanship of Dr Bijay Kumar, IAS, Additional Chief Secretary, Deptt of Agriculture, Govt of Maharashtra
11 July 2018	Training on ISO/IEC: 17025:2017 held at NIPHM, Hyderabad, (Telangana) organized by ICAR-All India Network Project on Pesticide Residue, IARI, New Delhi. Alongwith Dr. R. C. Gupta, Asst. Director (Plant Pathology), RRS, Nashik
12 July 2018	12 th Annual workshop of Monitoring of Pesticide Residue at National Level (MPRNL) held at NIPHM, Hyderabad (Telangana) organized by Ministry of Agriculture and Farmers Welfare, Govt. of India alongwith Dr. R.C. Gupt, Asst. Director (Plant Pathology) RRS, Nashik

Date	Particulars
27 July 2018	Special Secretary (Hort.) and Director Horticulture, Govt. of Punjab regarding area expansion of onion in Punjab alongwith Dr. Sujay Pandey, AD (Ent.), Karnal and Shri. A.N. Verma, STO, NHRDF Bhatinda.
1 August 2018	Addl. Chief Secretary (Agriculture & Horticulture), Govt. of Punjab regarding area expansion of onion in Punjab alongwith Dr. Sujay Pandey, AD (Ent.), Karnal, Sh. M.M. Dwivedi, Assistant Director (Horticulture) and Shri A.N. Verma STO, NHRDF, Bhatinda
4 August 2018	Director of Horticulture & Mission Director, Govt. of Uttarakhand, Dehradun regarding onion and garlic area expansion in Uttarakhand alongwith Dr. Rajnish Mishra, Deputy Director (Horticulture), NHRDF, Deoria.
6 - 7 August 2018	Two day Training Programme on “ <i>In-Situ</i> Crop Residue Management through Mechanization” held at PAU, Ludhiana, alongwith Mr. Kailash, SMS (Ext.), KVK, New Delhi
21 August 2018	3 rd Advance Estimates of Area and Production of Horticultural Crops held under the Chairmanship of Principal Adviser, Dept. of Agril., Co-op. & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi.
24 August 2018	IASRI component of CHAMAN under MIDH at Krishi Bhawan, New Delhi organized by Division of Horticulture, MOA&FW, Govt. of India
5 September 2018	Zonal Seed Review Committee Meeting at NAAS Complex, Pusa, New Delhi organized by Seed Division, Ministry of Agriculture & Farmers’ Welfare, Govt. of India alongwith Dr S K Tiwari, Senior Technical Officer, New Delhi
29-30 September 2018	Principal Secretary (Agril. & Hort.), Director of Horticulture, Director of Agriculture, Govt. of Odisha, Bhubaneswar regarding developmental activities in Odisha state and seed supply to the Govt. of Odisha
11-12 September 2018	Training Programme on Capacity Building on “Agromet Advisory Preparation” at MPUAT, Udaipur for establishment of Meteorology Unit at KVK, Delhi alongwith Dr. Samar Pal Singh, SMS (Agronomy), KVK, New Delhi under DAMU Project, Ministry of Earth Science, Govt. of India
18 September 2018	State Level Executive Committee of PKVY held in the office of Secretary-cum-Commissioner, Development Department, Govt. of NCT, Delhi.
19 October 2018	National Workshop on Vertical Farming at ICAR-NASC Complex, New Delhi organized by Horticulture Division, ICAR, New Delhi
29 - 31 Oct 2018	28 th APSI Scientists Meet and National Conference on “Multidisciplinary approaches of plant science” and 28 th APSI scientists meet at DIBNS, Dehradun and received the APSI Fellowship Award -2017
25 November 2018	National Convention on “Enhanced Seed Quality” organized by Bhartiya Kissan and Research Institute at NASC Complex, Pusa, New Delhi
11 January 2019	Stakeholders Consultation Workshop on “GIZ Project-Scoping Study for Agriculture-Energy Nexus in Rural Areas of Delhi”, under the chairmanship of Mrs. Manisha Saxena, IAS, Secretary cum Development Commissioner, GNCT, Delhi alongwith Mrs. Ritu Singh, SMS (Home Science), KVK, Delhi.
17-19 January 2019	“8 th Indian Horticulture Congress - 2019 on Shaping Future of Indian Horticulture” at IGKV, Raipur, Chhattisgarh. Along with Shri A.K. Pandey, Asstt. Director, NHRDF, Indore, Dr. R.C. Gupta, Assistant Director (Plant Pathology) and Dr. P. Bhasker, Technical officer, NHRDF, Nashik.

Date	Particulars
24 January 2019	Meetings with Spl. Sec. (Hort.) and Secretary (Agril.), Govt. of Punjab, Chandigarh, regarding onion area expansion in Punjab. Alongwith Shri B.K. Dubey, Dy. Director and Dr. Sujay Pandey, Assistant Director, NHRDF, Karnal.
1-3 February 2019	1 st Vegetable Science Congress on Emerging Challenges in Vegetable Research and Education” held at Agriculture University, Jodhpur. Alongwith Dr. S. K. Tiwari, Sr. Technical Officer, NHRDF, Delhi and Shri A. K. Mishra, Sr. Technical Officer, NHRDF, Kota, Rajasthan.
9-12 February 2019	“International Symposium on Edible Alliums: Challenges and Opportunities” held at Pune organised by the Indian Society of Alliums, Pune. alongwith Dr. Satender Singh, Deputy Director, NHRDF, Lasalgaon, Dr. R. C. Gupta, Assistant Director (Plant Pathology), Dr. P. Bhasker, Technical Officer and Shri Manoj Pathak, Technical Officer, NHRDF, RRS, Nashik
1 March 2019	“All India Progressive Farmers Convention” at Constitution Club, Rafi Marg, New Delhi organised by AIFA, New Delhi as an expert.
22 March 2019	Agriculture Production Commissioner & Secretary (Agril.), Govt. of Tamil Nadu, regarding onion area expansion and seed supply by NHRDF. Alongwith Mrs. T. Devi, Sr. Technical Officer, NHRDF Coimbatore and Shri Ganasundaram, Technical Officer, NHRDF, Kombai, Dindigul
23-24 March 2019	Interactive Workshop on “Noni and Medicinal Plants in Wellness Industry” organised at University of Madras, Chennai and International Society for Noni Science.

Sh. H.P. Sharma, Dy Director (Stat), Chitegaon, Nashik

Date	Particulars
12 December 2018	Review meeting on onion production in Maharashtra alongwith Collector and DSAO, Nashik at Mantralaya, Mumbai.

Sh. B.K. Dubey, Dy. Director (Breeding), NHRDF, Karnal

Date	Particulars
30 July 2018	28 th Meeting of State Level Executive Committee of Haryana at Panchkula organized by HSHDA Govt. of Haryana alongwith Sh. R. B. Singh, AD (H), Karnal

Dr. R.C. Gupta, Assistant Director (PP), Chitegaon, Nashik

Date	Particulars
13 August 2018	APEDA Stakeholders Meeting on the residue monitoring plan on okra for export to EU countries including Indonesia organized by, APEDA, Ministry of Commerce and Industry, Govt of India.

Date	Particulars
27 August, 3 & 15 October 2018	Soil health card meeting at DSAO, Govt. of Maharashtra, Nashik alongwith Sri Deepak Kumar, TO (Soil), RRS Nashik
24 September 2018	Residue monitoring plan (RMP) on grapes export held at ICAR-National Research Centre on Grapes (NRCG) at Pune.
6 October 2018	Awareness and adopting the new IS/ISO/EC 17025:2017 of pesticide residue analysis held at Mumbai, (Maharashtra) organized by NABL & APEDA, Ministry of Commerce & Industry, Govt. of India.
28 November 2018	Training on grading of fruits and vegetables under Agmark at Mumbai, (Maharashtra) organized by DMI-Ministry of Agriculture Co-operation & Farmers Welfare, Govt. of India, New Delhi.

Sh. T.P. Ambre, Sr. Technical Officer (H), Chitegaon, Nashik

Date	Particulars
23 November 2018	Training programme on onion held at Vanjarwadi organized by Taluka Agriculture Officer, Nandgaon under ATMA as a Resource Person.
23 December 2018	Training programme on exportable vegetable and fruit production held by Taluka Agriculture Officer, Surgana, Nashik.

Dr. Sharad Kumar Tiwari, Sr. Technical Officer (Hort.), HO, Janakpuri, New Delhi

Date	Particulars
9 June 2018	World Accreditation Day Bio-Medical Waste Management for Citizen Safety organized by National Accreditation Board for Testing and Calibration Laboratories, Stein Auditorium, India Habitate Center, Lodi Road, Delhi.

Sri Avinash Mishra, Technical Officer (PRA), Chitegaon, Nashik

Date	Particulars
3-7 December 2018	Refresher training programme on Pesticide Residue Analysis held at New Delhi, organized by ICAR-All India Network Project on Pesticide Residue IARI, New Delhi alongwith Sri R.P. Shukla, Technical Officer, Nashik.

Finance and Accounts

To meet out various expenses under different heads, the funds were received by the NHRDF from the following sources:

- Receipts from distribution of seed planting material and farm produce
- Receipts from laboratory and other services.
- Income from investments

The NHRDF received Rs. 5,21,63,851.59 by interest from fixed deposits, Rs. 27,15,234 from

farm produce, Rs. 2,96,17,682 as a laboratory service charges, Rs. 9,75,84,912.32 from seed and bulb distribution and Rs. 15,900 as annual subscription. The total expenditure during 2018-19 was Rs. 18, 21, 29, 572.57 which was lesser by Rs. 27, 53, 774.74 over the income during the year 2018-19.

The details Statement of Affairs and Income & Expenditure is given in next page.



NATIONAL HORTICULTURAL RESEARCH AND DEVELOPMENT FOUNDATION
 Bagwani Bhawan, Plot No. 47, Pankha Road, Institutional Area,
 Janakpuri, New Delhi-110058 (India)
 E-mail: delhi@nhrdf.com / www.nhrdf.com

ANNEXURE - III

Statement of Affairs as on 31st March 2019

Previous Year 31.03.2018	Particulars	Sche- dule	Current Year 31.03.2019	Previous Year 31.03.2018	Particulars	Sche- dule	Current Year 31.03.2019
27,68,86,619.48	CORPUS/DEVELOPMENT FUND		28,88,60,638.90	8,09,04,484.15	FIXED ASSETS	F	7,73,79,377.15
-	Op. Balance		-6,75,178.00	8,09,04,484.15	Total (₹)		7,73,79,377.15
-5,98,123.41	Less during the period		-4,84,924.51	64,03,69,577.00	INVESTMENTS	G	72,80,00,000.00
1,25,72,142.83	Less deficit R&D		49,56,679.25	64,03,69,577.00	Fixed Deposits		
	Add Surplus Seed Division				Total (₹)		72,80,00,000.00
28,88,60,638.90	Total (₹)		29,26,57,215.64	64,03,69,577.00	CURRENT ASSETS		
19,21,87,823.69	RESERVES & SURPLUS	A	23,15,88,852.39	70,935.00	Cash in Hand		79,854.00
33,57,25,313.90	Reserve (R&D)		37,72,09,706.90	10,42,41,077.45	Cash at Bank	H	7,37,17,321.08
52,79,13,137.59	Revolving Fund (Seed)		60,87,98,559.29	1,86,49,615.05	Sundry Debtors	I	2,32,07,802.75
	CURRENT LIABILITIES	B	13,30,469.84	1,68,25,946.00	Interest Receivable		2,00,02,768.00
53,68,331.34	Sundry Creditors		13,30,469.84	6,75,178.00	Development fund Receivable		-
53,68,331.34	Total (₹)			1,25,16,469.00	Closing Stock of Seeds		1,43,27,302.00
30,43,605.00	OTHER LIABILITIES	C	26,95,872.00	2,77,412.65	Closing Stock of NHRDF Publication		1,84,559.65
26,04,980.00	Earnest Money	D	42,98,461.00	40,718.00	Prepaid Expenses		2,90,893.00
44,531.40	Security Payable		19,54,787.00	-	Grant Project Account	E	3,15,15,797.00
	Premembership Fees				Total (₹)		16,33,26,297.48
	TDS Payable		69,136.00		LOANS AND ADVANCES	J	8,43,672.30
17,08,753.00	PF Trust dues payable		90,18,256.00	8,38,347.30	Security Deposits Receivable		
74,01,869.40	Total (₹)			18,97,893.00	Staff Advance / Expenses Payable	K	59,36,417.00
4,19,60,447.50	PROVISIONS		6,03,47,696.00	36,47,408.00	TDS Receivable		
57,38,075.75	Project Expenses Payable		6,60,710.75	63,83,648.30	Total (₹)		67,80,089.30
9,29,126.00	Salary Payable		8,83,072.00		Total (₹)		97,54,85,763.93
59,000.00	Bonus Payable		59,000.00	88,09,55,060.60			
7,19,571.12	Audit Fees Payable		25,814.41				
19,95,653.00	Provision for Imprest Expenses		16,91,680.00				
	Grant Project Account		13,290.00				
	Staff Advance / Expenses Payable		6,36,81,263.16				
9,210.00	Benevolent Fund Trust						
5,14,11,083.37	Total (₹)		97,54,85,763.93	88,09,55,060.60	Total (₹)		97,54,85,763.93

(Dr. P. K. Gupta)
 Director Acting

(Rahul Dabas)
 FACAO

As per our report of even date
 For Natesh & Associates
 Chartered Accountants
 FRN: 106937 W
 (R. Natesh)
 Proprietor
 [M.No. 36481]

(Vijaya)
 Asstt. Accts. Officer



NATIONAL HORTICULTURAL RESEARCH AND DEVELOPMENT FOUNDATION

Bagwani Bhawan, Plot No. 47, Pankha Road, Institutional Area,

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Income & Expenditure Account (Seed Division) for the year ended 31st March 2019

ANNEXURE - II

Previous Year 31.03.2018	EXPENDITURE PARTICULARS	CURRENT YEAR 31.03.2019	Previous Year 31.03.2018	INCOME PARTICULARS	CURRENT YEAR 31.03.2019
68,642.49	Bank Charges	71,710.59	1,25,16,469.00	Closing Stock of seed	1,43,27,302.00
13,22,117.00	Medical Expenses	10,86,489.00	10,91,12,173.00	Seed & Bulb Distribution	9,75,84,912.32
10,82,027.64	Office Rent & Maintenance	52,25,680.00	34,08,337.00	PHRC Receipts	27,41,236.00
1,05,73,301.00	Opening Stock of Seeds	1,25,16,469.00			
6,16,24,182.31	Procurement of Seeds & Bulbs	3,07,23,431.92			
3,03,119.75	Postage and Telegram	3,56,430.00			
4,46,083.30	Printing and Stationery	6,59,166.06			
3,05,75,916.64	Salary and Allowances	4,13,25,031.00			
3,71,397.00	Staff Welfare	8,04,225.00			
20,51,304.50	Travelling and Conveyance	30,27,084.50			
13,96,086.15	Vehicle Maintenance	26,92,599.00			
22,77,055.39	Water & Electricity	56,31,734.00			
3,73,603.00	Gratuity Expenses	29,02,053.00			
-	TDS Expenses	3,997.00			
-	Compensation & Discount	26,42,666.00			
-	Interest on TDS	28,005.00			
1,25,72,142.83	Surplus for the year	49,56,679.25			
12,50,36,979.00	Total ₹	11,46,53,450.32	12,50,36,979.00	Total ₹	11,46,53,450.32

As per our report of even date
For Natesh & Associates

Chartered Accountants

FRN/ 106957 W

(R.Natesh)

Proprietor

[M.No.36481]

Date:-06.08.2019



(Vijayta)

Asstt. Accts. Officer

(Rahul Dabas)

FACAO

(Dr. P.K.Gupta)
Director Acting



NATIONAL HORTICULTURAL RESEARCH AND DEVELOPMENT FOUNDATION

Bagwani Bhawan, Plot No. 47, Pankha Road, Institutional Area,

Janakpuri, New Delhi-110058 (India)

E-mail: delhi@nhrdf.com / www.nhrdf.com

Income & Expenditure Account (Research & Development) for the year ended 31st March 2019

ANNEXURE - I

Previous Year 31.03.2018	EXPENDITURE PARTICULARS	CURRENT YEAR 31.03.2019	Previous Year 31.03.2018	INCOME PARTICULARS	CURRENT YEAR 31.03.2019
88,500.00	Audit fees & Expenses	84,289.00	45,32,085.00	Farm Produce Revenue	27,15,234.00
38,000.00	Benevolent Fund	36,320.00	4,91,52,619.82	Interest Received / Accrued	5,21,63,851.59
39,116.00	Books and Periodicals	42,637.00	1,21,91,269.00	Laboratory Charges	2,96,17,682.00
4,71,210.00	Extension Services	7,21,342.00	14,700.00	Subscription Fees	15,900.00
44,28,676.88	Farm Expenses	54,25,704.00	-	Membership Fees	44,531.40
13,08,358.00	Insurance Charges	9,21,082.00	2,77,412.65	Closing Stock of NHRDF Publication	1,84,559.65
55,72,248.50	Lab Expenses	98,93,198.50	5,98,123.41	Deficit for the Year	4,84,924.51
7,64,893.00	Legal & Professional Fees	11,09,309.00			
8,58,490.00	Medical Expenses	9,00,539.00			
9,59,795.00	Meeting Expenses	11,10,145.00			
6,31,117.35	Municipal & Non-Agril. Taxes	6,42,399.00			
11,476.00	Service Tax	-			
4,32,37,317.00	Salary and Allowances	5,42,90,407.00			
62,973.00	Staff Recruitment	-			
4,74,814.00	Staff Welfare	3,65,575.00			
2,60,166.50	Telephone Expenses	3,59,359.00			
15,142.00	Training & Seminar	60,640.00			
9,87,575.00	Conveyance Expenses	5,06,500.00			
-	Gratuity Expenses	27,23,184.00			
60,17,031.00	Depreciation	57,56,641.00			
1,78,571.00	Inauguration of Boudh Building	-			
3,60,739.65	Opening Stock of NHRDF Publication	2,77,412.65			
6,67,66,209.88	Total ₹	8,52,26,683.15	6,67,66,209.88	Total ₹	8,52,26,683.15

As per our report of even date

For Natesh & Associates

Chartered Accountants

FRN/106957 W

(R. Natesh)

Proprietor

[M.No.36481]

Date:-06.08.2019



(Vijayta)

Asstt. Accts. Officer

Rahul Dabas

(Rahul Dabas)

FACAO

(Dr. P.K. Gupta)
Director Acting

Cost of Production of Onion, Garlic and Potato in different States

Table 2: Cost of production of onion seed crop during 2018-19

(Rs.)

Operation / items	States		Gujarat				Maharashtra		
	Varities	ADR	L-883	ALR	NHRDF Red-3	NHRDF Red-4	AW	ALR	NHRDF Red-3
Land rent for six month		15000	15000	15000	15000	15000	15000	12000	12000
Bulb cost (q)		37500	37500	37500	37500	37500	37500	41250	41250
Land Preparation		11700	11700	11700	11700	11700	11700	14360	14360
Manures and fertilizers		24247	24247	24247	24247	24247	23791	15804	16027
Planting/sowing		7480	7480	7480	7480	7480	7480	13225	13225
Weeding and hoeing		18565	18565	18565	18565	18565	17315	15800	15800
Plant protection		3065	3065	3065	3065	3065	2765	18310	17410
Irrigation		30000	30000	30000	30000	30000	29500	9360	9360
Harvesting, curing, sorting, grading and packing		12550	12550	14550	14550	14550	14550	28555	28875
Transportation		2500	2500	2500	2500	2500	2700	2400	3000
Overhead charges		2000	2000	2000	2000	2000	2000	-	-
Supervisory charges		3600	3600	3600	3600	3600	3600	15060	15060
Total (Rs)		168207	168207	170207	170207	170207	167901	186124	186367
Bank interest		5887	5887	5957	5957	5957	5877	6514	6523
Grand total cost (Rs)		174094	174094	176164	176164	176164	173778	192638	192890
Average yield (kg)/ha		450	450	590	590	590	590	650	700
Final cost per kg / Rs		387	387	299	299	299	295	296	276

Contd...

Table 2 contd...

(Rs.)

Operation / items	States		Madhya Pradesh				Karnataka		Rajasthan		
	ADR	ALR	NHRDF Red-3	NHRDF Red	CO-ON-5	A. Rose	ADR	NHRDF Red	NHRDF Red-3	ALR	
Land rent for six month	18000	18000	18000	18000	15000	15000	15000	15000	15000	15000	
Bulb cost (q)	62500	62500	62500	62500	75000	37500	37500	37500	37500	41250	
Land Preparation	10000	10000	10000	10000	13900	13900	11400	11400	11400	11400	
Manures and fertilizers	18000	19000	19000	19000	17018	17018	27645	27645	27645	27645	
Planting/sowing	8000	8000	8000	8000	8300	8300	5880	5880	5880	5880	
Weeding and hoeing	15000	15000	15000	15000	13500	13500	10600	10600	10600	10600	
Plant protection	9000	11000	11000	11000	15000	15000	4790	4790	4790	4790	
Irrigation	15000	17000	17000	17000	8400	8400	22800	27300	27300	27300	
Harvesting, curing, sorting, grading and packing	23000	26000	26000	26000	9000	9000	10800	10800	10800	10800	
Transportation	5000	5000	5000	5000	6000	6000	2500	2500	2500	2500	
Overhead charges	3500	3500	3500	3500	2000	2000	2000	2000	2000	2000	
Supervisory charges	5000	5000	5000	5000	3000	3000	3600	3600	3600	3600	
Total (Rs)	192000	200000	200000	200000	186118	148618	154515	159015	159015	162765	
Bank interest	6720	7000	7000	7000	6514	5202	5408	5566	5566	5697	
Grand total cost (Rs)	198720	207000	207000	207000	192633	153820	159923	164580	164580	168461	
Average yield (kg)/ha	450	500	500	500	450	500	500	600	600	600	
Final cost per kg / Rs	442	414	414	414	428	308	320	274	274	281	

ADR: Agrifound Dark Red, ALR: Agrifound Light Red, AW: Agrifound White

Table 3: Cost of production of onion bulb during kharif 2018

(Rs.)

Operations/Item	Maharashtra		Gujarat		Madhya Pradesh	Tamil Nadu (Multiplier)		Punjab
	Seedlings	Bulblets	Seedlings	Bulblets		Bulb	Seedling	
Land rent for six month	12000	17500	20000	17500	18000	40000	40000	15000
Seed / Bulblet cost	8000	37500	11000	37500	10000	22500	6250	11000
Land Preparation	17525	11250	11750	11250	8000	16500	16500	14900
Nursery raising	7300	0	3463	0	5000	0	3000	0
Manures and fertilizers	28576	24341	29253	24341	17515	20767	20767	24057
Transplanting	23250	14750	12425	14750	17000	12600	12600	18750
Weeding and Hoeing	17150	14080	10455	14080	9750	26150	26150	16000
Plant protection	21565	7075	10150	7075	7465	9510	9510	9350
Irrigation	9990	15600	16875	15600	8000	9600	9600	0
Harvesting and Post Harvest, curing, sorting, grading and packing	34930	15750	14625	15750	31000	12980	12980	17000
Transportation	12000	12250	12925	12250	9000	7800	7800	5000
Overhead charges	-	2000	2500	2000	2000	1872	1872	2000
Supervisory charges	4600	2500	2000	2500	5000	15000	15000	2500
Total (Rs)	196886	174596	157421	174596	147730	195279	182029	135557
Bank interest	9844	6111	5510	6111	5171	3417	3186	6778
Grand total cost (Rs)	206730	180707	162931	180707	152901	198696	185215	142334
Average yield (q)/ha	225	245	235	245	260	125	125	200
Final cost (Rs/q)	919	738	693	738	588	1590	1482	712

Contd....

Operations/Item	Karnataka	Ultra Pradesh	Rajasthan		Bihar	Haryana	Andhra Pradesh
			Seedlings	Bulblets			
Land rent for six month	10000	15000	20000	20000	20000	45000	30000
Seed cost (kg)	5500	10000	10000	17500	10000	10000	8000
Land preparation	13900	11600	10000	8500	8700	9000	12800
Nursery raising cost	800	6600	6000	0	14000	2500	4000
Manures and fertilizers	16458	8650	10039	15134	27950	13152	17220
Transplanting	0	15000	13000	10000	18000	17500	14000
Weeding and hoeing	11250	19300	9300	9000	19500	13750	7750
Plant Protection	9800	9680	4700	9200	11988	4000	11125
Irrigation	0	7200	5200	6500	12000	3500	8375
Harvesting and Post Harvest , curing, sorting, grading and packing	4500	22500	15900	25750	22500	11250	26100
Transportation	5000	500	10000	10000	5625	4500	5000
Overhead charges	2000	-	3500	3500	2000	2500	1500
Supervisory charges	2500	-	4000	4000	3000	3000	4500
Total	81708	126030	121639	139084	175263	139652	150370
Bank interest	4085	4411	7298	4868	7011	4888	5263
Grand total cost	85793	130441	128937	143952	182273	144540	155633
Average yield (q)	150	200	215	225	225	200	180
Final cost (Rs / q)	572	652	600	640	810	723	865

Table 4: Cost of production of rabi onion bulb during 2018-19

(Rs.)

Operation/item	Gujarat	Maharashtra	Madhya Pradesh	Tamil Nadu	Punjab	Karnataka	
						Common	A. Rose
Land rent for six month	15000	12000	18000	40000	15000	15000	15000
Seed Cost (kg)	12000	8000	11000	11000	10000	12000	5600
Land preparation	11700	17525	8000	19000	14900	13900	13900
Nursery raising	3480	8175	5000	4000	1200	800	800
Manures and fertilizers	24330	27018	17515	24874	21751	19018	18702
Transplanting	9650	23250	18000	12150	10000	7500	7500
Weeding and hoeing	11065	11300	9750	18350	6000	13500	13500
Plant protection	3200	20000	8150	14750	13500	13000	13000
Irrigation	25000	15100	10000	9600	3600	8400	8400
Harvesting, curing, sorting, grading & packing	8750	34000	36000	27195	12000	9000	9000
Transportation	16575	1950	10000	6570	6000	6000	6000
Overhead charges	2000	-	300	2628	2000	2000	2000
Supervisory charges	2500	15060	5000	15000	3000	3000	3000
Total	145250	193378	156715	205117	118951	123118	116402
Bank interest	2542	3384	2743	3590	5948	6156	5820
Grand Total of production cost	147792	196762	159458	208707	124898	129274	122222
Average yield (q/ha)	258	250	280	175	245	250	250
Final production (Rs/q)	574	787	569	1193	510	517	489

Contd....

Table 4 contd...

(Rs.)

Operation/item	Haryana	Uttar Pradesh	Bihar	Rajasthan	Andhra Pradesh	Odisha
Land rent for six month	55000	15000	20000	25000	30000	10000
Seed Cost (kg)	11000	10000	10000	10000	9000	8000
Land preparation	10000	12900	8700	10000	10400	8400
Nursery raising	3200	4700	14000	6000	5000	5600
Manures and fertilizers	14200	8685	27950	15345	21100	17000
Transplanting	11000	15000	18000	12400	16000	14000
Weeding and hoeing	13000	17000	18000	9000	9750	19600
Plant protection	3000	14140	11288	5155	9165	4200
Irrigation	4200	12600	18000	8500	11000	8400
Harvesting, curing, sorting, grading and packing	12375	22500	26250	31100	32700	42000
Transportation	6000	7200	7500	10000	6000	5600
Overhead charges	2500	-	2000	4000	2000	3000
Supervisory charges	3000	-	3000	5000	5000	6000
Total (Rs)	148475	139725	184688	151500	167115	151800
Bank interest (%)	2598	2445	9234	7575	5849	5313
Grand total of production cost	151073	142170	193922	159075	172964	157113
Average yield (q/ha)	225	260	300	225	270	250
Final production (Rs / q)	671	547	646	707	641	628

Table 5: Cost of production of garlic during 2018-19

(Rs.)

Operation/item	Gujarat	Rajasthan	Punjab	Bihar	Haryana	Madhya Pradesh	Tamil Nadu	Uttar Pradesh	Odisha
Land Rent for six month	15000	25000	15000	20000	55000	18000	50000	15000	10000
Seed cost	12000	20000	50000	44000	25000	20000	90000	4500	70000
Land preparation	10450	5200	14900	8700	10000	11000	12000	8600	11200
Manures and fertilizers	24330	19033	21751	31416	13742	22515	32800	10192	20000
Planting	10000	12000	11500	34500	14975	13000	12000	15000	16800
Weeding and hoeing	13075	18625	6000	18000	16750	15750	22500	22500	22400
Plant protection	3065	11740	13500	10688	7500	8250	20250	12620	6000
Irrigation	22000	24000	9600	30000	5600	11000	5600	14400	8400
Harvesting, curing, sorting, grading and packing	13100	23750	8500	24000	22625	33000	19695	22000	50400
Transportation	5000	8400	7000	2500	4000	8000	18750	6400	7000
Overhead charges	2000	4500	2000	2000	2000	3000	3756	-	3000
Supervisory charges	3600	5000	3000	3000	3000	4000	15000	-	6000
Total	133620	177248	162751	228804	180192	167515	302351	131212	231200
Bank interest	4677	6204	5696	8008	6307	5863	10582	4592	8092
Total cost	138297	183452	168447	236812	186499	173378	312933	135805	239292
Average yield (q)	55	60	100	100	80	100	125	75	100
Final cost (Rs / q)	2514	3058	1684	2368	2331	1734	2503	1811	2393

Table 6: Cost of production of potato during 2018-19

Operations	West Bengal	Gujarat	Punjab	Haryana	Uttar Pradesh	Bihar	Odisha
Land Rent for six month	10000	15000	15000	55000	40000	10000	7000
Seed cost (qt)	51000	48000	48000	45000	72000	51000	34500
Land preparation	8700	22650	16150	6000	8000	8700	7000
Sowing and planting cost	20000	8000	7500	8400	0	24000	16800
Manures & fertilizers	40900	36612	24230	17893	14750	28400	25000
Weeding & hoeing	450	3750	5250	1200	20000	17950	16800
Plant protection	11413	6750	17800	3500	6000	11913	7000
Irrigation	15000	22500	7500	4700	8000	15000	7000
Haulm cutting, harvesting, curing, sorting, grading & packing	22800	50900	11000	19625	20000	24000	36400
Transportation	5000	5200	12000	6000	8000	5000	8000
Overhead charges	-	2000	2000	2000	-	-	2500
Supervisory charges	3000	3600	3000	3000	5000	3000	4000
Total (Rs)	188263	224912	169430	172318	201750	198963	172000
Bank interest	18826	11246	5930	6031	7061	7959	6020
Total Cost (Rs)	207089	236158	175360	178349	208811	206921	178020
Average Yield (q)	250	325	325	350	240	250	250
Final cost per quintal (Rs)	828	727	540	510	870	828	712

Table 7: Area, Production and Productivity of Onion in different states during 2018-19

Sl. No.	States/UTs	Onion				
		Area		Production		Productivity
		('000 ha)	Share %	('000 MT)	Share %	(Tonnes/ha)
1	Andhra Pradesh	44.58	3.66	980.66	4.30	22.00
3	Assam	8.21	0.67	84.84	0.37	10.33
4	Bihar	56.50	4.63	1311.45	5.75	23.21
5	Chhattisgarh	26.10	2.14	431.68	1.89	16.54
6	Gujarat	44.33	3.64	1111.09	4.87	25.06
7	Haryana	32.01	2.62	780.15	3.42	24.37
8	Himachal Pradesh	2.84	0.23	56.60	0.25	19.92
9	Jammu & Kashmir	4.32	0.35	77.84	0.34	18.03
10	Jharkhand	17.99	1.48	289.66	1.27	16.10
11	Karnataka	166.00	13.61	2558.00	11.21	15.41
12	Kerala	0.01	0.00	0.05	0.00	10.00
13	Madhya Pradesh	145.00	11.89	3672.00	16.09	25.32
14	Maharashtra	450.00	36.90	8047.00	35.26	17.88
15	Manipur	0.52	0.04	5.68	0.02	11.01
16	Meghalaya	0.56	0.05	5.00	0.02	8.97
17	Mizoram	0.27	0.02	25.02	0.11	92.67
18	Nagaland	0.62	0.05	5.98	0.03	9.64
19	Odisha	33.09	2.71	373.22	1.64	11.28
20	Punjab	9.61	0.79	219.79	0.96	22.87
21	Rajasthan	63.10	5.17	997.26	4.37	15.80
22	Sikkim	0.63	0.05	35.35	0.15	56.45
23	Tamil Nadu	32.00	2.62	301.00	1.32	9.41
24	Telangana	13.67	1.12	309.29	1.36	22.62
25	Tripura	0.15	0.01	0.97	0.00	6.40
26	Uttar Pradesh	26.90	2.21	440.38	1.93	16.37
27	Uttarakhand	4.37	0.36	44.60	0.20	10.21
28	West Bengal	35.20	2.89	638.38	2.80	18.14
29	Others	0.95	0.08	16.48	0.07	17.31
	Total	1219.52	100.00	22819.43	100.00	18.71

Source: Division of Horticulture Statistics, Ministry of Agriculture and Farmer Welfare, Government of India

Table 8: Area, Production and Productivity of Potato in different states during 2018-19

Sl. No.	States/UTs	Area		Production		Productivity
		('000 ha)	Share (%)	('000 tonnes)	Share (%)	(tonnes/ha)
1	Andhra Pradesh	3.59	0.17	64.58	0.13	18.00
2	Arunchal Pradesh	0.02	0.00	0.44	0.00	21.75
3	Assam	103.21	4.75	773.48	1.54	7.49
4	Bihar	321.88	14.81	8153.91	16.25	25.33
5	Chhattisgarh	49.94	2.30	797.42	1.59	15.97
6	Gujarat	124.65	5.74	3706.00	7.38	29.73
7	Haryana	34.74	1.60	897.85	1.79	25.85
8	Himachal Pradesh	14.41	0.66	186.80	0.37	12.97
9	Jammu & Kashmir	8.03	0.37	197.87	0.39	24.64
10	Jharkhand	49.03	2.26	695.46	1.39	14.19
11	Karnataka	28.00	1.29	345.00	0.69	12.32
12	Kerala	0.54	0.02	7.38	0.01	13.74
13	Madhya Pradesh	145.00	6.67	3315.00	6.60	22.86
14	Maharashtra	19.00	0.87	492.00	0.98	25.89
15	Manipur	0.05	0.00	0.91	0.00	19.32
16	Meghalaya	18.93	0.87	187.21	0.37	9.89
17	Mizoram	0.09	0.00	0.93	0.00	10.33
18	Nagaland	4.35	0.20	55.72	0.11	12.80
19	Odisha	24.69	1.14	290.14	0.58	11.75
20	Punjab	103.07	4.74	2724.44	5.43	26.43
21	Rajasthan	12.87	0.59	246.42	0.49	19.15
22	Sikkim	19.33	0.89	90.81	0.18	4.70
23	Tamil Nadu	3.93	0.18	75.08	0.15	19.10
24	Telangana	2.01	0.09	37.70	0.08	18.74
25	Tripura	8.01	0.37	144.94	0.29	18.11
26	Uttar Pradesh	610.50	28.09	15323.55	30.53	25.10
27	Uttarakhand	26.45	1.22	363.80	0.72	13.75
28	West Bengal	436.04	20.07	11000.00	21.92	25.23
29	Others	0.66	0.03	14.72	0.03	22.23
	Total	2172.99	100.00	50189.52	100.00	23.10

Table 9: Area, Production and Productivity of Garlic in different states during 2018-19

Sl. No.	States/UTs	Area	Production		Productivity
		('000 ha)	('000 MT)	Share (%)	(tonnes/ha)
1	Assam	10.45	62.33	2.142	0.168
2	Bihar	1.78	2.68	0.092	0.664
3	Chhattisgarh	1.24	3.52	0.121	0.353
4	Gujarat	10.75	82.99	2.852	0.130
5	Haryana	3.29	42.64	1.465	0.077
6	Himachal Pradesh	3.60	1.42	0.049	2.532
7	Jammu & Kashmir	0.68	0.55	0.019	1.236
8	Karnataka	4.01	26.55	0.912	0.151
9	Kerala	0.07	0.35	0.012	0.200
10	Madhya Pradesh	178.33	1821.27	62.589	0.098
11	Maharashtra	2.66	13.72	0.471	0.194
12	Nagaland	0.30	2.39	0.082	0.123
13	Odisha	12.44	45.48	1.563	0.274
14	Punjab	7.37	104.91	3.605	0.070
15	Rajasthan	74.83	415.48	14.278	0.180
16	Tamil Nadu	1.67	9.58	0.329	0.174
17	Telangana	0.09	0.22	0.008	0.391
18	Uttar Pradesh	38.51	225.69	7.756	0.171
19	Uttarakhand	2.00	11.05	0.380	0.181
20	West Bengal	3.88	37.07	1.274	0.105
Total		357.94	2909.89	100.00	7.47

Source: Division of Horticulture Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India

Table 10: Month wise onion export 2015-16 to 2018-19

Onion export (in lakh MT)				
Month	2015-16	2016-17	2017-18	2018-19
April	1.28	1.95	1.60	1.73
May	1.46	2.30	2.09	2.20
June	1.31	1.90	1.24	1.05
July	0.83	1.54	1.42	1.53
August	0.50	1.95	1.58	1.81
September	0.34	1.97	1.44	2.02
October	0.43	2.04	0.87	1.78
November	0.81	1.90	1.14	1.36
December	1.39	2.57	1.00	1.75
January	1.75	1.90	0.58	1.94
February	1.87	1.99	1.01	2.33
March	1.87	2.15	1.90	2.34
Total	13.83	24.16	15.89	21.84

Source: APEDA

Table 11: Onion importing countries during 2018-19

Country	Quantity (tonnes)	Value (Rs. Lacs)	Country	Quantity (tonnes)	Value (Rs. Lacs)
Bangladesh	578111.71	105814.01	Greece	14260	2771.28
Malaysia	332450.83	51769.83	Maldives	11217.23	2162.53
U Arab Emts	258492.15	37305.47	U K	7024.87	1611.29
Sri Lanka Dsr	229711.81	35899.72	Iraq	12572.84	1544.39
Nepal	139494.86	14634.6	Reunion	6220	1162.68
Saudi Arab	77045.21	11387.68	Italy	5609.95	1120.98
Kuwait	74715.2	10980.46	Russia	4379.9	979.74
Qatar	75293.05	10730.98	China P Rp	6587.13	867.33
Oman	74739.22	10584.35	Brunei	3618.52	862.46
Indonesia	62272.61	9430.08	Netherland	2835.56	616.47
Philippines	37376	8815.88	Seychelles	1827	363.12
Vietnam Soc Rep	57811.5	7698.46	Spain	1756.1	357.19
Singapore	34583.25	5454.31	Slovenia	646	178.24
Baharain Is	28301.47	4119.15	Gabon	662	165.47
Mauritius	14056	3084.99	Mayotte	822	151.67
Thailand	22985.2	3038.79			

Contd....

Table 11 contd...

Country	Quantity (tonnes)	Value (Rs. Lacs)
Hong Kong	815.24	142.06
Comoros	640	116.71
Canada	220.66	116.42
France	579.94	115.72
Somalia	754	105.26
Lebanon	345	67.18
Kenya	370.02	64.36
U S A	218.24	60.82
Romania	454	59.41
Germany	85.36	33.84
Cote D Ivoire	166.25	33.37
Ghana	255	26.78
Serbia Montenegro	136	24.98
Israel	87	24.7
Tanzania Rep	145	23.21
Sierra Leone	58	19.53
Turkey	145	16.99
Australia	33.56	16.35
Benin	58	16.34
Madagascar	145.12	14.78
Taiwan	112	14.42
Timor-Leste	112	13.96
Togo	29.02	12.79

Country	Quantity (tonnes)	Value (Rs. Lacs)
Belarus	56	12.32
Switzerland	21.75	9.97
Poland	61	9.89
Ireland	9.89	7.35
Belgium	28	6.3
South Africa	29	6.11
Djibouti	29	5.2
Chile	7.6	4.98
Austria	24	4.83
Norway	16.02	4.66
Sweden	14.34	3.57
Japan	5.92	3.39
Solomon Islands	16	2.41
Jordan	3	1.62
New Zealand	0.43	0.84
Egypt A Rp	0.32	0.15
Pakistan Ir	0.26	0.1
Latvia	0.06	0.03
Panama Republic	0.13	0.03
Liberia	0.09	0.02
Brazil	0.05	0.01
Morocco	0.01	0
Total	21,83,766.45	3,46,887.36

Source: APEDA and DGCIS

Table 12: Garlics importing countries during 2018-19

Countries	Quantity (tonnes)	Value (Rs. Lacs)
U S A	436.99	876.66
Thailand	2,709.02	372.13
Bangladesh Pr	3,027.86	1,464.72
Vietnam Soc Rep	603.05	193.29
Malaysia	2,700.09	317.77
U Arab Emts	285.41	137.89
Taiwan	371.00	111.35

Countries	Quantity (tonnes)	Value (Rs. Lacs)
Nepal	76.00	28.02
Oman	40.22	64.85
Sri Lanka Dsr	210.31	107.01
Qatar	12.18	8.93
Saudi Arab	4.16	4.23
Canada	0.10	0.17

Contd....

Table 12 contd...

Countries	Quantity (tonnes)	Value (Rs. Lacs)
Timor-Leste	0.00	0.00
Maldives	0.51	0.22
Comoros	0.00	0.00
Kuwait	7.48	3.63
Singapore	9.37	4.97
Baharain Is	4.83	3.17
Australia	0.55	0.32
U K	0.10	0.66
Japan	0.21	0.42
Turkey	0.04	0.06
Hong Kong	0.06	0.03
Somalia	0.20	0.11
Afghanistan Tis	14.30	6.76
Argentina	0.03	0.04
Bahamas	0.01	0.01
Cayman Is	0.01	0.00
China P Rp	0.03	0.01
Egypt A Rp	0.04	0.03

Countries	Quantity (tonnes)	Value (Rs. Lacs)
Ethiopia	0.00	0.00
Germany	0.07	0.11
Indonesia	481.09	79.61
Liberia	0.01	0.01
Madagascar	0.02	0.01
Mauritius	0.02	0.01
Nigeria	0.08	0.05
Pakistan Ir	0.04	0.06
Panama Republic	0.03	0.02
Philippines	7.25	2.63
Portugal	28.00	9.05
South Africa	16.88	6.86
St Helena	0.04	0.02
Switzerland	1.19	1.38
Ukraine	0.02	0.02
Yemen Republic	0.40	0.31
Total	11,049.30	3,807.63

Source: APEDA and DGCIS

Table 13: Potato importing country during 2018-19

Country	Quantity (MT)	Value (Rs. Lacs)
Nepal	2,90,142.59	25,264.57
Oman	22,905.50	5,593.58
Indonesia	8,293.22	1,901.27
Sri Lanka Dsr	10,151.29	2,402.30
Saudi Arab	1,178.91	220.71
Malaysia	9,453.75	2,135.77
Turkey	440.23	77.16
Mauritius	6,994.00	1,772.93
Kuwait	4,691.93	1,319.14
Maldives	5,854.97	1,542.17
U Arab Emts	3,204.82	856.02
Hong Kong	918.12	233.99

Country	Quantity (MT)	Value (Rs. Lacs)
Qatar	672.88	181.92
Seychelles	1,936.00	470.76
Baharain Is	390.53	66.7
Singapore	9.48	2.94
Brunei	27	3.79
Bhutan	2.31	0.43
Australia	9.5	2.64
Canada	2	1.95
Ireland	0.4	0.6
Germany	0.59	0.15
Brazil	0.12	0.03

Contd....

Table 13 contd...

Country	Quantity (MT)	Value (Rs. Lacs)
Cayman Is	0.08	0.02
China P Rp	0.02	0
Egypt A Rp	0.03	0
Iran	1.2	0.21
Kenya	60.12	16.82
Korea Rp	23	5.38
Latvia	0.12	0.05

Country	Quantity (MT)	Value (Rs. Lacs)
Nigeria	25	3.73
Pakistan Ir	0.35	0.08
Panama Republic	0.76	0.13
Thailand	0.08	0.02
U.S.A.	0.02	0.01
Ukraine	0.05	0.02
Total	3,67,390.99	44,078.00

Source : APEDA

I Annexure

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Mr Sudhir Kumar Singh

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Mr R.P. Gupta

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Mr Vikas Dangi

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Mr P.K.Bhagat

PS To Director

Mr Awadh Bhushan

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Mr Brijesh Kumar

General Clerk

Mr Raj Singh

General Clerk

Miss Pooja Phogat

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Mr Jai Prakash Sharma

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Mr Anil Kumar Sharma

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Mr Manjeet Singh

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Mr Subedar Pandey

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Mr Amit Kumar

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Mr Sabha Pati Dubey

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Mr Sri KishanYadav

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Mr Prahlad Singh

Attendant

Mr Ajay Kumar Singh

Attendant

Mr Ramesh Kumar Singh

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Organic Chemist

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Technical Officer

Mr Avinash Mishra

Technical Officer (Residue Analysis)

Mr Ashok Kumar Tailor

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Sh Sandeep Lawand
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Mr V.B. Mali
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Mr Aparbal Singh

Driver

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Attendant

Mr Ram Tirath Gupta

Attendant

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Mr B.P. Rayate

Technical Assistant

Mr Anup Kumar Singh

Technical Assistant

Mr Bhasker Londe

Attendant

Mr A.K. Yadav

Attendant

Mr R.R. Mali

Attendant

IV Annexure

Present Officer In-Charges of NHRDF Centers

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Meteorological Data

RRS, Nashik

Month	Temperature °C		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
July- 2018	26.92	20.85	82.64	74.32	118.0
August- 2018	26.41	20.30	81.41	75.08	85.6
September- 2018	29.15	19.09	68.0	55.33	27.6
October- 2018	31.94	17.02	48.37	30.08	3.0
November- 2018	28.24	12.52	55.65	35.52	5.6
December- 2018	22.42	7.59	57.29	40.95	-
January- 2019	23.71	6.26	50.80	30.84	-
February- 2019	27.63	9.79	44.43	28.86	-
March- 2019	31.02	12.38	35.00	21.00	-

RRS, Karnal

Month	Temperature °C		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
July- 2018	33.8	25.8	87	73	339.9
August- 2018	33.2	25.5	86	76	59.0
September- 2018	31.9	22.8	86	73	269.3
October- 2018	31.8	16.6	76.3	41.7	-
November- 2018	27.6	12.1	68.6	41.1	-
December- 2018	21.0	5.7	84.2	53.0	8.4
January- 2019	19.7	5.6	85.5	59.4	34.7
February- 2019	21.1	8.7	65.2	74.9	21.3
March- 2019					

RRS, Boudh

Month	Temperature °C		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
July- 2018	-	-	-	-	545.80
August- 2018	-	-	-	-	234.20
September- 2018	-	-	-	-	439.20
October- 2018	-	-	-	-	89.00
November- 2018	-	-	-	-	6.00
December- 2018	-	-	-	-	52.00
January- 2019	-	-	-	-	3.00
February- 2019	-	-	-	-	22.00
March- 2019	-	-	-	-	32.30

Acronyms

AICRP (VC)	All-India Coordinated Research Project on Vegetable Crops
AINRPOG	All-India Network Research Project on Onion and Garlic
AGMARK	Agriculture Marketing
APEDA	Agricultural and Processed Food Products Export Development Authority
ATMA	Agriculture Technology Management Agency
CIPC	Isopropyl N-3 chlorophenyl carbamate
CSS	Central Sector Scheme
DAC&FW	Department of Agriculture & Farmers Welfare
DAT	Days after Transpalnting
DAP	Days after Planting
DARE	Department of Agricultural Research and Education
DGCI&S	Directorate General of Commercial Intelligence and Statistics
DOS	Days after sowing
DMI	Directorate of Marketing and Inspection
EC	Extension Centre
ECs	Extension Centres
EU	European Union
FYM	Farm Yard Manure
GCMS	Gas chromatography–mass spectrometry
HPLC	High-performance liquid chromatography
IARI	Indian Agriculture Research Institute
ICAR	Indian Council of Agricultural Research
IIVR	Indian Institute of Vegetable Research

IVRS	Interactive Voice Response System
KVK	Krishi Vigyan Kendra
LCMS	Liquid chromatography Mass Spectrometry
MIDH	Mission for Integrated Development of Horticulture
MOA&FW	Ministry of Agriculture and Farmers Welfare
MOCI	Ministry of Commerce and Industry
MPRNL	Monitoring of Pesticide Residue at National Level
MT	Metric tonnes
NABL	National Accreditation for Testing and Calibration Laboratory
NAFED	National Agricultural Marketing Federation of India Ltd
NHM	National Horticulture Mission
NRL	National Referral Laboratory
NRCG	National Research Center for Grape
NHRDF	National Horticultural Research and Development Foundation
NVIUC	National Vegetable Initiative for urban cluster
NPKS	Nitrogen Phosphorus Potash Sulphur
OGI	Open General License
PHRC	Post-Harvest Research Complex
PLW	Physiological loss of weight
RKVY	Rashtriya Krishi Vikash Yojna
PRA	Pesticides Residue Analysis
R&D	Research and Development
RRS	Regional Research Station
SAU	State Agricultural University
SAUs	State Agricultural Universities
SAC	Scientific Advisory Committee
MCM	Management Committee Meeting

Onion and Garlic Varieties



Agrifound Light Red



Agrifound Dark Red



NHRDF Red-3 (L-652)



NHRDF Red-4 (L-744)



Coll-863



Coll-883



Yamuna Safed-3



Yamuna Safed-4



Yamuna Safed-5



Agrifound White

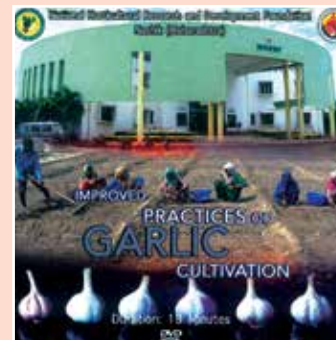
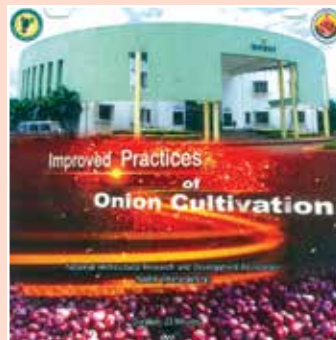
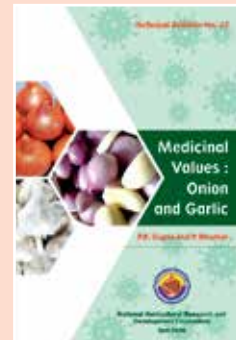
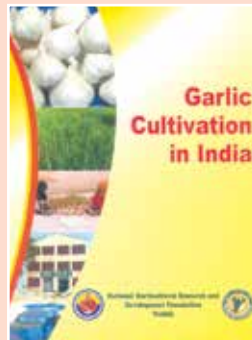
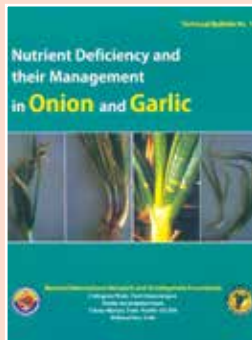
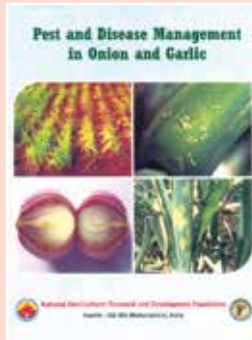
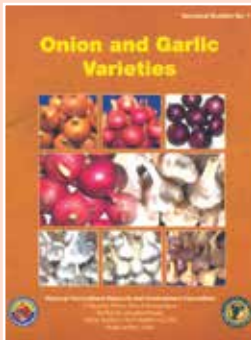
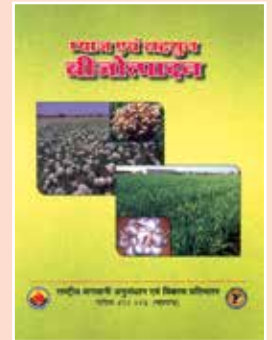
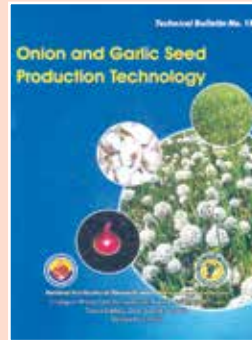
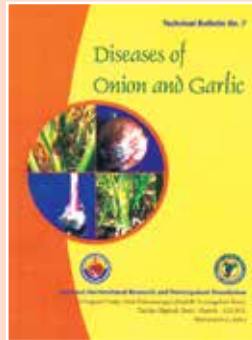
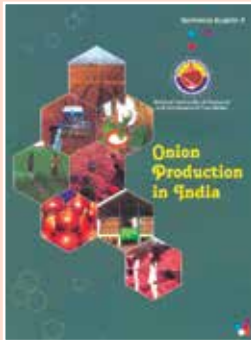
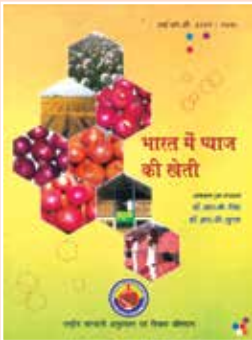
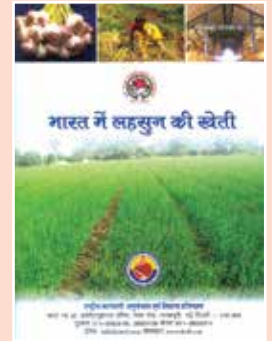
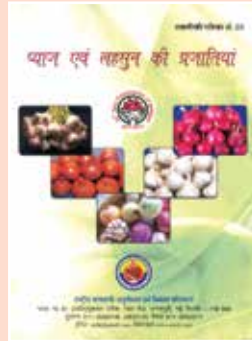
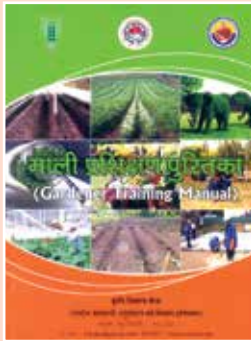
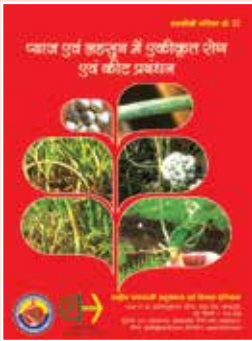


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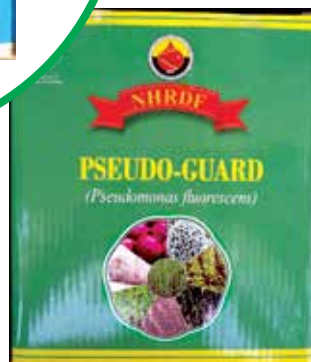
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