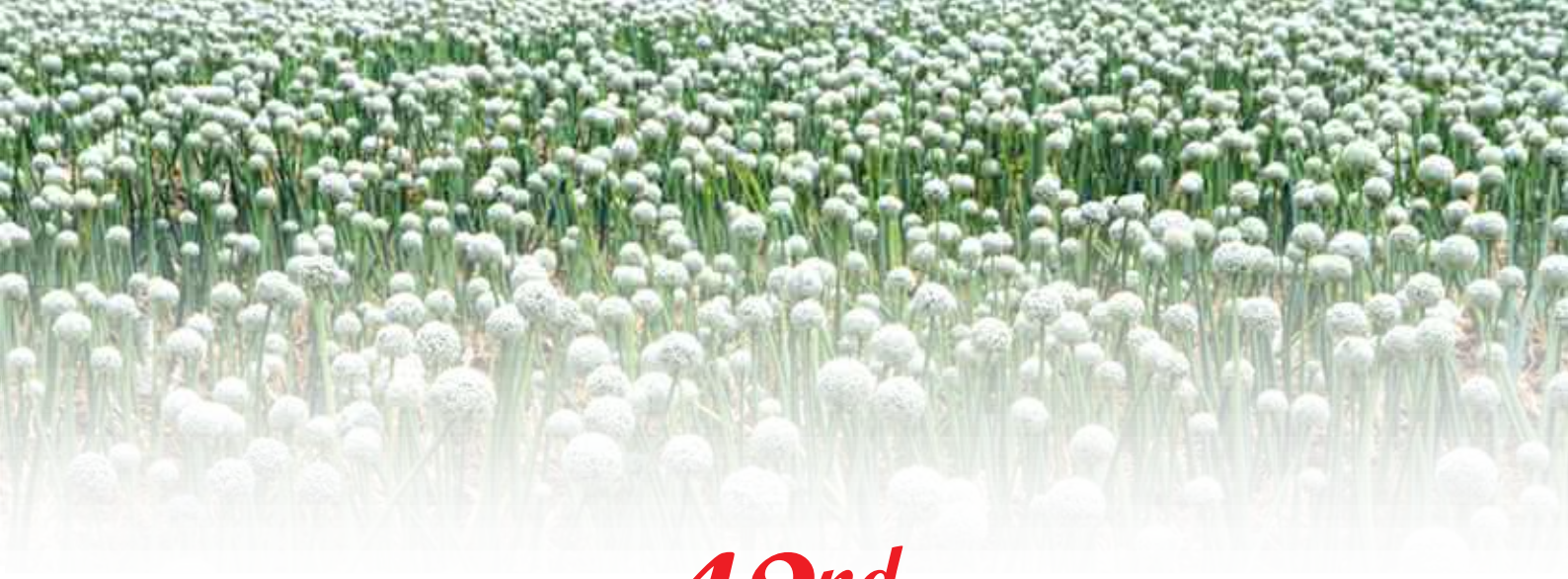
42nd ANNUAL REPORT 2019-20

National Horticultural Research and Development Foundation

New Delhi



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Preface

It is a matter of great privilege to present the 42nd Annual Report of the National Horticultural Research and Development Foundation (NHRDF) for the year 2019-20. The report includes research and developmental, extension, laboratories, activities, carried out at NHRDF Regional Research Stations/laboratories having state of the art facilities, Krishi Vigyan Kendra, Seed Production & Distribution 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 and Tomato *etc*. The quality seed of improved and notified varieties of vegetable crops, especially Onion, Garlic, Potato, Drumstick, Chilli, Tomato, Okra, Cowpea and other 25 crops were produced and distributed to farming community across the country.

NHRDF also imparted the training on improved production technology of onion, garlic & Mushroom production 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. Besides these the cost of cultivation for major onion, garlic and potato growing states, based on the surveys for inputs and rate of produce in local markets done by NHRDF centres, 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 reference and to impact technical know-how to researchers, extension workers, policy- planners, farmers and other stake holders 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 the NHRDF for their valuable inputs to bring out this publication with high quality.

(Dr. P. K. Gupta)
Director

Place: New Delhi
Date: 13th December, 2021

1

Introduction

The National Horticultural Research and Development Foundation (NHRDF) is a research wing of NAFED (National Agricultural Cooperative Marketing Federation of India Ltd.) and was established on 03rd November, 1977 under the 'Societies Registration Act, I860' 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 (longitude: 77.1020585o and latitude: 28.6088852o). The NHRDF is a centre of ICAR- All India Coordinated Research Project on Vegetable Crops (AICRP-VC) and 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 Monitoring of Pesticide Residue at National Level (MPRNL) and SMAP scheme 2018, Department of Agriculture and Farmers' Welfare (DA&FW), Ministry of Agriculture and Farmers' Welfare, Government of India.

The NHRDF provides services to farmers through research and developmental activities such as seed production of different crops, especially vegetable, vermicompost, biopesticide and honey and their distribution as well as other laboratory facilities. The NHRDF generate some revenue through these technical service to build-up revolving fund for further expansion of research and developmental activities of the NHRDF in the country.

The research and developmental programmes were initially started on onion and later on garlic was included in the mandate crops. In view of the vast export potential, the NHRDF has also extended its R & D programmes on other export-oriented 30 vegetable crops.

2

The Mandate

The mandate of the NHRDF is:

- To undertake, carry on or help in the research and other scientific investigation on the growth and development of different varieties of various export - oriented horticultural produce.
- To establish institutes, laboratories, research centers, 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 carryon 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 objective of further developing the horticultural exports 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 of the society not 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, it 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 agriculture in all its aspects.
- To conduct all aspects of scientific research and developmental 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 developmental 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 advance technologies for making India a global leader in Horticulture sector". This will be focused especially on the 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 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 developments.

3

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 18 Extension Centres (ECs) all over the country and one Krishi Vigyan Kendra, at Delhi. The RRSs are located in Maharashtra, Haryana, Tamil Nadu and Odisha, whereas, the 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 Laboratories 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, ICAR- NRC for Grapes, Pune. The Wine Testing Laboratory has also been recognized by European Union.

Head Office, New Delhi

One Model Post-Harvest Research Complex at Lasalgaon, Nashik, having 10 handling sheds of 150 tones capacity each and 20 modern storage godowns of 50 tones capacity each has been established by NHRDF for training and providing infrastructural support to onion growers, traders and exporters on post-harvest management of onion. The onion storage structures were constructed at RRS, Sinnar and Chitegaon in Maharashtra and Ujwa, Najafgarh in Delhi and Karnal in Haryana for storage of onion bulbs. The garlic storages have been constructed at Karnal, Boudh and Indore for storage of garlic seed bulbs. NHRDF has established seed processing units and temperature and relative humidity-controlled seed storage facilities at Lasalgaon and Chitegaon Phata, Nashik (Maharashtra), Karnal (Haryana), Indore (Madhya Pradesh), Deoria (Uttar Pradesh), Rajkot (Gujarat), Boudh (Odisha), Kurnool (Andhra Pradesh), KVK Ujwa, Delhi and Janakpuri, Delhi with capacity of 1500 MT.

ICAR-Krishi Vigyan Kendra, Ujwa, New Delhi

The Bio-control Laboratory has been established at Nashik and Karnal under NHM (MIDH) where large scale production of *Trichoderma viride, Pseudomonas, Beauveria* and SNPV is taken up for distribution to the farmers under plant protection services. The Mushroom Spawn Production Unit at Janakpuri and Pasteurized Compost Unit at Ujwa, Najafgarh, New Delhi have been established by NHRDF to extend services to the farmers and entrepreneurs.

NHRDF has established one Krishi Vigyan Kendra at Ujwa, South-West Delhi to cater the needs of the farmers of NCT, Delhi and it is fully sponsored by 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. 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 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 concerned, stock holders. NHRDF has established Metrological Observatory with automatic weather station at KVK, Ujwa, Chitegaon and recently at Boudh to study the crop performance in relation to weather conditions. Six polyhouses of 2000 sqm each have also been constructed at Karnal, Chitegaon, Nashik, Boudh, and Sinnar Farm.

4

Executive Summary

The national scenario of onion and garlic production has shown a considerable increase during the past 42 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, the NHRDF has extended its research and development programmes on other export-oriented horticultural crops. During 2019-20, research and developmental work was carried out on onion, garlic, okra, tomato and drumstick, etc.

The studies were undertaken for evaluation of onion germplasm, varietal trials, promising lines of red and white onion, bolting behavior, late *kharif* onion evaluation and 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 management of soil-borne diseases, foliar diseases and effect of various fungicides, bio-control agents and plant products against onion pathogens and the trial on 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 bio-pesticides, insect, growth regulators and environmental factors were conducted under Plant Health Management. Storage studies on onion in different experiments were undertaken under Post Harvest Managements.

Similarly, in garlic the studies were undertaken on evaluation of germplasm, varietal trials, advance 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 seasonal incidence of pests in okra and tomato under Plant Health Management, varietal trials in Okra, Cowpea under Plant Genetic Resources and Crop Improvement were undertaken during the period. Nutrient management and seed production of tomato were taken up under Crop Production System Management.

The NHRDF is arranging quality seed production and distribution of improved varieties as a part of developmental activities since its inception, with a view to serve the farming community closely. A total of 12227.79 q seeds of improved notifies varieties of different vegetable & spice crops, besides soybean and paddy were distributed during the year 2019-20. The programmes of different projects, namely Monitoring of Pesticide Residue at National Level (MPRNL), Soil Health Card scheme (SHC) and Krishi Vigyan Kendra have been successfully implemented in this year.

5

The Recommendations

The NHRDF conducted need-based and location-specific research for 2-3 consecutive years and thereafter the trials exhibiting consistent results and similar trends were discussed finally in the Scientific Advisory Committee Meeting thoroughly twice in a year, before making the recommendations to the farmers and other stakeholders. The findings of the trials concluded at different Regional Research Stations of NHRDF during *Kharif,* 2018 and *Rabi* 2018-19 at Nashik and Karnal are given here under in brief:

Onion

- The combined data of trials conducted at RRS, Nashik during *kharif*, 2016, 2017 and 2018 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 performed better for management of stemphylium blight with 63.57% disease control. The higher benefit: cost ratio (7.83:1) was also recorded in same treatment.
- At Karnal, the combined data revealed that soil application of Arka Microbial Consortia @ 12.50 kg/ha followed by sequential sprays of Mancozeb + Carbendazim @ 0.2% at 25 DAT, Trifloxystrobin+Tebuconazole @ 0.20% at 50 DAT and Pyraclostrobin + Metiram @ 0.3% at 75 DAT performed better for management of stemphylium blight with 62.04% disease control and increasing the marketable yield by 66.24% over untreated control with benefit: cost ratio of 4.14:1.
- The combined data of trials conducted at RRS, Nashik during *kharif*, 2016, 2017 and 2018 on onion variety Agrifound Dark Red revealed that sprays of Epoxyconazole @ 0.1% at 30 DAT and subsequently at fortnightly intervals proved better for management of stemphylium blight with 57.20% disease control and increasing the marketable yield by 48.44% over untreated control with benefit: cost ratio of 4.68:1.
- At Karnal, the combined data revealed that treatment of mancozeb @ 0.25% spray at 30 DAT and subsequently at fortnightly intervals proved better for management of stemphylium blight with 54.39% disease control and increasing the marketable yield by 71.37% over untreated control with benefit: cost ratio of 8.85:1.
- The combined data of trials conducted during *rabi* 2017-18 and 2018-19 at RRS, Nashik and Karnal revealed that foliar spray of Fipronil 5% SC @ 1.0 ml/L+ surfactant (silica based) @ 0.5 ml/L at 30 DAT and subsequently at 15 days intervals proved superior for thrips management and increased the yield of onion at both the places.

Colour Plate No. 1

Onion advance lines under AINRPOG testing

L - 863

L - 883

L - 857

L - 849

L - 913

L - 920

Colour Plate No. 2

Garlic advance lines under AINRPOG testing

G-417

G-389

G-304

G-363

Colour Plate No. 3

Notified Onion variety - NHRDF Fursungi

Advance onion Line 719 has been identified in Xth group meeting of All India Network Research Project on Onion and Garlic (AINRPOG) held at ICAR-IARI, New Delhi during 31 May to 02 June, 2019 and released vide notification No**.** SO.4272 (E) dated 26.11.2019 by Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi on recommendation by the sub-central variety release committee. The variety named as NHRDF FURSUNGI, suitable for growing in Gujarat, Maharashtra, Delhi, Rajasthan, Haryana, Punjab and Jammu & Kashmir.

NHRDF Fursungi

Colour Plate No. 4

Notified Garlic variety - Yamuna Purple -10 (G-404)

Advance garlic line "G-404" has been identified in Xth group meeting of All India Network Research Project on Onion and Garlic (AINRPOG) held at ICAR-IARI, New Delhi during 31st May to 02 June, 2019 and released vide notification No. SO.4272 (E) dtd. 26.11.2019 by the Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi on recommendation by the sub-central variety release committee. The variety is named as Yamuna Purple-10 and recommended for the states Delhi, Rajasthan, Haryana, Jammu & Kashmir, Punjab, Tarai region of Uttra Pradesh, Uttarakhand, Bihar and Jharkhand.

Yamuna Purple-10

6

Apex Committees

Management

The management of NHRDF vests in the Managing Committee consisting of 4 representatives from NAFED, 5 representatives from Associate Shippers, 6 representatives engaged in cultivation of onion or any other vegetable crops, 4 eminent horticultural scientists and Director, NHRDF as Member Secretary. The 164th Management Committee Meeting was held on 24 December, 2019 at Bagwani Bhavan, 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.

164th Managing Committee Meeting of NHRDF

Scientific Advisory

The NHRDF has a Scientific Advisory Committee headed by Deputy Director-General (Horticultural Science), ICAR, Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi. It consists of eminent horticultural scientists from different institutes of ICAR and State Agricultural Universities (SAUs) in the respective disciplines as a members and Director, NHRDF as a Member Secretory. This committee meets twice a year to review the research and development programmes and also to discuss and decide the future technical programmes for *kharif and rabi* seasons. The 79th Scientific Advisory Committee meeting was held on 23 November, 2019 at Bagwani Bhavan, New Delhi. The list of members of the Scientific Advisory Committee is given in Annexure-II.

79th Scientific Advisory Committee meeting of NHRDF

7

Award / Prize

(A) 5th NHRDF Award 2019

Dr. Ajmer Singh Dhatt was born on 03rd December, 1967 at Rupowal village, District Hoshiarpur, Punjab. He achieved doctorate in Vegetable Breeding from Punjab Agricultural University, Ludhiana in 2001. He also worked as 'Visiting Research Scientist' at university of Wisconsin, Madison, USA. Presently, Dr. Singh is working as Additional Director of Research (Horticulture & Food Science) at PAU, Ludhiana.

While working at Punjab Agricultural University, Ludhiana, Dr. Singh, to his credit for developing 23 varieties including hybrids of onion and vegetables crops besides developing 21 innovative production technologies for enhancing productivity of onion. Dr. Sing is pioneer in the field of development of male sterile lines using molecular markers in onion and alloplasmic male sterile in onion.

He is also developed 7 machines/tools for use in research and commercial cultivation of onion and garlic. He also contributed 97 research papers in reputed journals; 6 book chapters: 6 review paper; 3 manuals and 68 extension articles.

Dr. Singh also a Vice President of Crop Improvement Society of India; Member of Editorial Board Indian Journal of Horticulture and nine professional/scientific societies. As many as 7 Ph.D scholars and 17 M.Sc. (Agri.) students have worked under his supervision, secured ICAR-Jwahar Lal Nehru Award, DST & CII-Prime Minister Fellowship, ICAR-International Fellowship, DST-INSPIRE Fellowship and ISVS-Dwarika Das Memorial Awards.

He is Principal Investigator in five research projects funded by the State Govt., ICAR, DBT, DST, SRTT and PAEC. Dr. Singh is the Fellow of Horticultural Society of India and Indian Society of Vegetable Science. A number of well-known awards has been bestowed upon him namely; Dr. Kirti Singh Gold Medal Award by Indian Academy of Horticultural Science, Dr Harbhajan Singh Memorial Award by Indian Society of Vegetable Science, Plaque by Indian Society of Alliums, Hans Raj Pahwa Award, Harpal Kaur Memorial Award, Life Time Achievement Award and Appreciation Certificates by Punjab Agricultural University, Ludhiana. Under his leadership PAU was conferred best AICRP (Vegetable Crops) and ICAR-AINRPOG (Onion & Garlic) centre awards.

(B) Prize

Delhi-Enviro-Quest-2019-20

KVK organized a State Level Programme in the form of "Delhi-Enviro-Quest-2019-20" held at Shiskha Bharati Global School, Dwarka, New Delhi on 27 and 28 November, 2019 under Central Sector Scheme "*In-Situ* Crop Residue Management" Sponsored by Indian Council of Agricultural Research, New Delhi. The main motive of the programme was to stimulate the thoughtful minds of Delhi youth about this burning issue through different events like Debate, Extempore, Slogan Writing, Poster Making and General Knowledge Quiz competition at school level. More than 1025 students from different 121 Schools of NCT Delhi Region participated in the programme and received the awards and certificate by auspicious hand of Dr. A.K. Singh, Dy. Director General (Extension), ICAR, DARE, MoAFW, Govt. of India and Sri Rahul Singh, IAS, District Magistrates cum Dy. Commissioner, South-West Delhi, Govt. of NCT Delhi on 8 March 2020.

8A

Research Achievement

Field Studies

Onion

Plant Genetic Resources and Crop Improvement

Rabi, 2018-19

Collection, evaluation and utilization

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that the highest gross yield (403.97 q/ha) and marketable yield (392.41 q/ha) recorded in line-743, was at par with lines-628, 705, 750, 780, 798, 880, 918, check varieties Agrifound Light Red, NHRDF Red-2, NHRDF Red-3 and NHRDF Red-4. The highest total soluble solids (15.70%) and dry matter contents (17.11%) were recorded in line-798.

Varietal Trial (IET, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that the high gross yield (344.13 q/ha) and marketable yield (334.78 q/ha) recorded in line OA-18-03 were found at par with

those lines OA-18-05, check varieties Agrifound Light Red, NHRDF Red-2 and NHRDF Red-4. The highest total soluble solids (13.82%) and dry matter contents (15.20%) were recorded in line OA-18-09. At Karnal, the high gross yield (362.40 q/ha) and marketable yield (355.93 q/ha) were recorded in line OA-18-03, though it was found at par with line OA-18-22 and check variety NHRDF Red in respect of gross yield and with line OA-18-22 regarding marketable yield. The highest total soluble solids (13.71%) recorded in line OA-18-13 was found at par with lines OA-18-03, OA-18-22 and OA-18-27.

Varietal Trial (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that, the high gross yield (358.44 q/ha) and marketable yield (347.89 q/ha) recorded in line OB-18-56 it was found at par with lines OB-18-64, OB-18-67, OB-18-69, check varieties Agrifound Light Red, NHRDF Red-2 and NHRDF Red-4. The highest total soluble solids (14.11%) and dry matter contents (15.22%) were recorded in line OB-18-70. At Karnal, the high gross yield (311.02 q/ha), marketable yield (293.49 q/ha), total soluble solids (14.11%) and dry matter contents (15.22%) were recorded in line OB-18-70 and it was found at par with line OB-18-72 and check variety NHRDF Red in respect of gross yield and marketable yield.

Varietal Trial (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that the high gross yield (338.11 q/ha) and marketable yield (327.44 q/ha) were recorded in line OC-18-75 which was found at par with check variety NHRDF Red-2. The highest total soluble solids (13.88%) and dry matter contents (15.20%) were recorded in line OC-18-73. At Karnal, the highest gross yield (344.27 q/ha) and marketable yield (313.85 q/ha) were recorded in check variety NHRDF Red and OC-18-59, respectively, being statistically at par with line OC-18-59 in respect of gross yield and check variety NHRDF Red regarding marketable yield. The highest total soluble solids (13.47%) and dry matter contents (14.78%) were recorded in line OC-18-87 and it was found at par with lines OC-18-68, OC-18-71, OC-18-79 and OC-18-94 in respect of dry matter contents.

Evaluation of multiplier onion (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 showed the highest weight of bulblet per plant (23.80 g) and average bulblet weight (8.47 g) in the lines MP-18-25 and MP-18-30, respectively, where the weight of bulblet per plant was found at par with lines MP-18-30 and MP-18-32.

Performance of red onion advance lines

The trial conducted at RRS, Nashik during *rabi* 2018-19 showed high gross yield (360.32 q/ha) and marketable yield (350.22 q/ha) in check variety NHRDF Red-4 and it was found at par with advance lines-849, 852, 870, 913 and check variety NHRDF Red-2. At Karnal, high gross yield (353.90 q/ha) and marketable yield (298.42 q/ha) recorded in check variety Pusa Riddhi, were found at par with NHRDF Red and NHRDF Red-4 in respect of marketable yield. The highest contents of total soluble solids (14.07%) was recorded in Agrifound Light Red and it was found at par with advance line-920.

Performance of white onion advance lines

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed, high gross yield (329.86 q/ha) and marketable yield (318.47 q/ha) in check variety Agrifound White and it was found at par with advance lines-857 and 869. The highest total soluble solids (14.67%) and dry matter contents (16.16%) were recorded in advance line-562. At Karnal, the high gross yield (284.37 q/ha) and

marketable yield (234.02 q/ha) recorded in advance lines-886 and 799, respectively, were at par with advance lines-784, 827, 832, 837, 869, 885, 857 and Agrifound White in respect of gross yield and advance lines-784, 832, 869, 885, 857 and Agrifound White regarding marketable yield. The highest total soluble solids (13.53%) recorded in advance line-865 was at par with advance lines-885 and 886.

Late *Kharif,* 2018-19

Performance of red onion advance lines against bolting behaviour

The trial conducted at RRS, Nashik during late *kharif* 2018-19 revealed that the high gross yield (416.50 q/ha) in advance line-581, which was at par with advance line-683 and check variety NHRDF Red-3. Similarly, the high marketable yield 402.52 q/ha recorded in advance line-581 was found at par with advance lines-683, 822 and check variety NHRDF Red-3.

Varietal trial (IET, AINRPOG)

The trial conducted at RRS, Nashik during late *kharif* 2018-19 showed high gross yield (357.42 q/ha) and marketable yield (346.71 q/ha) in check variety NHRDF Red-4, but it was at par with lines OLK-18-38, OLK-18-46, OLK-18-59, OLK-18-64, OLK-18-67 and OLK-18-69. The highest total soluble solids (16.80%) and dry matter contents (18.14%) were recorded in line OLK-18-53. However, at Karnal, bulb formation could not place in any line at 125 days after transplanting.

Varietal trial (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during late *kharif* 2018-19 revealed high gross yield (395.04 q/ha) and marketable yield (380.75 q/ha) in line OLK-18-05, which was at par with lines OLK-18-03, OLK-18-15, OLK-18-28, OLK-18-31 and check variety NHRDF Red-4. The highest total soluble solids (14.37%) and dry matter contents (15.74%) were recorded in line OLK-18-22 and it was found at par with lines OLK-18-03, OLK-18-08, OLK-18-28 and OLK-18-31. However, at Karnal, no bulb formation took place in any line at 125 days after transplanting.

Kharif, 2019

Collection, evaluation and utilization of onion germplasm

The trial conducted at RRS, Nashik during *kharif,* 2019 showed high gross yield (156.77 q/ha) and marketable yield (144.04 q/ha) in line 883, which was statiscally at par with lines 581, 750, 782, 800, 810, 850, 853, 866, 868, 888, Bhima Dark Red and Agrifound Dark Red in respect of gross yield and with lines 581, 705, 743, 750, 782, 784, 800, 804, 807, 810, 845, 850, 853, 854, 866, 868, 888, Bhima Dark Red and Agrifound Dark Red regarding marketable yield. The highest total soluble solids (12.73%) was recorded in lines 784, 854 and Agrifound Dark Red, but it was at par with all the lines except 555, 581, 683, 705, 711, 748, 807, 810, 820, 821 and Baswant-780.

Varietal Trial (IET, AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2019 revealed that the high gross yield (160.00 q/ha) marketable yield (134.32 q/ha) recorded in line OAV-19-16 were at par with lines OAV-19-05, OAV-19-14, check varieties Baswant-780, Bhima Dark Red and Agrifound Dark Red. At Karnal, the high gross yield (287.70 q/ha) and marketable yield (206.22 q/ha) were recorded in check variety Agrifound Dark Red, and it was at par with check variety Baswant-780 in respect of gross yield.

Varietal Trial (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2019 showed high gross yield (165.75 q/ha) and marketable yield (149.65 q/ha) were recorded in line OBV-19-44, it being at par with line OBV-19-47

and check variety Agrifound Dark Red in respect of gross yield and with line OBV-19-47, Bhima Dark Red and Agrifound Dark Red regarding marketable yield. The highest total soluble solids (12.83%) and dry matter (14.07%) were recorded in line OBV-19-51.

Varietal Trial (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *kharif,* 2019 revealed that high gross yield (166.24 q/ha) and marketable yield (151.90 q/ha) in check variety Agrifound Dark Red and it was found at par with line OCV-19-62 and check variety Bhima Dark Red.

White onion varietal Trial (IET, AINRPOG)

The trial conducted at RRS, Nashik during *kharif,* 2019 exhibited high gross yield (155.27 q/ha) and marketable yield (141.84 q/ha) were recorded in line OAV-19-21 and it was found at par with line OAV-19-23 and check variety Agrifound White. The highest total soluble solids (12.75%) and dry matter (13.97%) were recorded in line OAV-19-23 and was found at par with line OAV-19-31 at Nashik. At Karnal, the highest gross yield (214.07 q/ha) as well as marketable yield (97.41 q/ha) was recorded in line OAV-19-31.

Red onion hybrid varietal Trial (IET, AINRPOG)

The trial conducted at RRS, Nashik during *kharif,* 2019 revealed that high gross yield (168.32 q/ha) and marketable yield (158.51 q/ha) in line OAH-19-38, which was found at par with lines OAH-19-35 and OAH-19-42 in respect of gross yield and with line OAH-19-35 regarding marketable yield. The highest total soluble solids (12.37%) and dry matter (13.67%) were recorded in line OAH-19-35. At Karnal, the highest gross yield (164.89%) and marketable yield (120.81 q/ha) were recorded in line OAH-19-38 and it was found at par with line OAH-19-40.

Crop Production System Management

Rabi, 2018-19

Weed management studies in onion (AINRPOG)

The combined data of *rabi* 2016-17, 2017-18 and 2018-2019 on onion variety Agrifound Light Red revealed that highest gross yield (312.28 q/ha) and marketable yield (261.80 q/ha) with highest weed control efficiency were recorded in the treatment Plastic mulch. However, the highest Benefit: Cost ratio (3.41:1) was recorded in the treatment Pendimethalin (30% EC) application before planting + one hand weeding at 30 DAT + Quizalofop Ethyl (5% EC) application at 60 DAT.

Weed management in onion nursery

The trials conducted on onion variety Agrifound Light Red during *rabi,* 2018-19 at RRS, Nashik and Karnal proved that hand weeding (two times) was superior to other treatments in terms of highest seedling fresh weight, dry weight, weed control efficiency and transplantable seedlings at both the places.

Weed management in direct seeded onion

In the trials conducted on onion variety Agrifound Light Red during *rabi* 2018-19 at RRS, Nashik and Karnal, three-times hand weeding proved to be superior to other treatments in terms of plant growth, yield and better weed control at both places.

Weed management in onion seed crop

The experiments conducted at RRS, Nashik and Karnal showed that three-times hand weeding (weed free check) was superior in terms of highest number of umbels and seed yield at both the

places. At Nashik, the highest weed control efficiency (82.21%) was recorded in Plastic mulch and highest Benefit : Cost ratio (1.65 : 1) was recorded in the treatment Pendimethalin (30% EC) @ 5.0 ml/L application before planting + one hand weeding at 30 - 40 DAP and combined application of Oxyflurofen (23.5% EC) @ 0.75 ml/L + Quizalofop Ethyl (5% EC) @ 1.0ml/L at 60. At Karnal, the highest weed control efficiency (100%) as well as highest Benefit : Cost ratio (1.49 : 1) were recorded in Plastic mulch treatment.

Effect of foliar application of Boron, Sulphur and $CaCl_2$ on shelf-life of onion bulbs (AINRPOG)

The experiment conducted during *rabi* season for three consecutive years from 2016-17, 2017-18 and 2018-2019 on onion variety Agrifound Light Red at Nashik revealed that foliar application of Boric acid (0.25%), $ZnSO_4$ (0.5%) and $CaCl_2$ (0.5%) at 60, 75 and 90 DAT was superior in terms of highest bulb yield, dry matter and benefit : cost ratio (2.68 : 1).

Fertilizer scheduling through drip irrigation system in onion (AINRPOG)

The experiment conducted at RRS, Nashik on onion variety Agrifound Light Red to standardize the fertilizer scheduling through drip irrigation during *rabi* 2018-19 revealed that drip irrigation at 100% PE through drip system-irrigation at alternate days 100% RDF (110:40:60:30 kg NPKS/ha) + organic manures 5 t/ha at 6 days interval; total quantity (100%) of organic manure applied as a basal before transplanting recorded highest macronutrient as well as micronutrients uptake and it proved to be superior to other treatments in terms of bulb yield. However, the highest benefit: cost ratio (3.10: 1) was recorded under drip irrigation at 100% PE through drip system - irrigation at alternate days 80% RDF (88:32:48:24 kg NPKS/ha) + organic manures 5 t/ha at 6 days interval; total quantity of organic manure applied as basal before transplanting.

Weed management studies in onion seed crop (AINRPOG)

The trial conducted at RRS, Karnal during *rabi* 2018-19 on onion variety NHRDF Red showed the lowest monocot as well as dicot weed population counts, highest weed control efficiency, seed yield and Benefit: Cost (1. 36 :1) ratio in the treatment oxyflurofen (23.5% EC) applied before planting, followed by two hand weedings at 30 and 60 DAP.

Effect of direct sowing using onion seed drill on onion production (AINRPOG)

The field experiment conducted at RRS, Nashik on onion variety Bhima Shakti to standardize the direct sowing technique of onion seed through onion seed drill during *rabi* 2018-19 revealed that the transplanting of 50-days old seedlings (Sowing in nursery and main field for direct sowing done on same day) was superior over other treatments in terms of total bulb yield and marketable yield.

Kharif, 2019

Weed management studies in onion

The field experiments conducted on onion variety Agrifound Dark Red during *kharif*, 2017, 2018 and 2019 at RRS Karnal revealed the highest weed control efficiency and marketable yield with three hand weedings. However, the highest Benefit : Cost ratio (2.68 : 1) was recorded in the treatment combined spray of oxyflurofen @ 1.0 ml + quizalofop ethyl @ 2.0 ml/L at transplanting and second at 30 DAT.

Effect of pre- and post-emergence herbicides application through drip irrigation system in onion

The field experiment conducted on onion variety Agrifound Dark Red during *kharif*, 2019 at RRS Nashik showed that highest weed control efficiency, gross yield and marketable yield

under three-times hand weeding. Among the herbicide treatments, the lowest weed index was recorded in the treatment Oxyflurofen (23.5% EC) @ 0.600 L/ha application through drip before transplanting; one hand weeding at 30 DAT; quizalofop ethyl (5% EC) @ 0.800 L/ha through drip at 35–40 DAT,while the highest weed control efficiency was recorded with treatment combined application of oxyflurofen @ 0.300 L/ha and quizalofop ethyl @ 0.600 L/ha through drip before transplanting; one hand weeding at 30 DAT; combined application of oxyflurofen @ 0.300 L/ha and quizalofop ethyl @ 0.600 L/ha through drip at 35–40 DAT. The highest benefit : cost ratio (4.22 : 1) was recorded in Pendimethalin 30% EC @ 1.5 L/ha application through drip before transplanting; one hand weeding at 30 DAT; 0.500 L /ha ready mix formulation of propaquizafop (5%) + oxyflurofen (12% EC) application through drip at 35-40 DAT.

Response of onion to organic farming

The field experiment conducted on onion variety Agrifound Dark Red during *kharif*, 2019 at RRS, Karnal revealed that highest A grade bulbs and marketable yield were recorded in the treatment combination of three manures @ FYM 3500 kg ha^{-1} + VC 3500 kg ha^{-1}, and NC 1000 kg ha^{-1} + *Azotobacter* @ 10 kg ha^{-1} + Phosphate solubilizing bacteria @ 5 kg ha^{-1} + *Pseudomonas* @ 5 kg ha^{-1} + *Trichoderma* @ 5 kg ha^{-1}. Also, the highest N, K and S content along with soil organic carbon contents were recorded in the same treatment. However, the highest B : C ratio (2.77 : 1) was recorded in treatment conventional farming *i.e.* inorganic fertilizer: 100:50:50:30 kg NPKS ha^{-1} with chemical plant protection and weed management measures.

Plant Health Management

Rabi, 2018-19

Survey and monitoring of major diseases of onion and garlic (AINRPOG)

At RRS Nashik, the data revealed that among the foliar diseases, stemphylium blight incidence ranged from 10.0 to 95.0% and the intensity from 0.40 to 22.0% in onion bulb as well as seed crop during the cropping period. Higher incidence of stemphylium blight (95.0%) and intensity (18.60%) were recorded in onion bulb crop, while the highest incidence (95.0%) and intensity (22.0%) were recorded in onion seed crop during April, 2019. In garlic crop, stemphylium blight was recorded with highest incidence (65.0%) and intensity (6.80%) during February, 2019.

At RRS Karnal, the stemphylium blight disease incidence was 100.0% and its intensity ranged from 3.74 to 24.76% in onion bulb crop during the cropping period. Higher incidence of stemphylium blight (100.0%) and its intensity (24.76%) were recorded during May, 2019 in onion bulb crop. In garlic crop, 100% incidence of stemphylium blight was recorded during February–March, 2019 and the highest intensity (23.92%) during of March, 2019 in the variety Yamuna Safed-3, whereas 100% incidence of purple blotch was recorded in February–March, 2019 and the highest intensity (26.34%) in March, 2019 in the variety Agrifound white.

Survey and monitoring disease onion and garlic

The occurrence of major diseases and insects of onion were recorded at taluka-Sinnar, Kalwan and Niphad of district Nashik, whereas in Karnal, Ambala, Yamuna Nagar, Kurukshetra and Kaithal districts the same was recorded during the survey in r*abi* season, 2018-19. Five villages were selected for survey in each taluka and five onion fields in each village for observations on major diseases and insects in 75 fields of 15 villages at Nashik, while at Karnal 55 onion fields in 11 villages of 5 districts were surveyed. At RRS, Karnal, 71 garlic fields in 14 villages of 4 districts were covered for observations of major diseases and insects.

Evaluation of different onion lines for disease resistance (IET, AINRPOG)

During the evaluation of different lines of onion against foliar diseases the data revealed that the line OA18-15 proved to be superior with lowest intensity of stemphylium blight (4.40%) and it was found at par with lines OA18-09 and OA18-13, whereas check variety Agrifound Light Red showed the intensity of 16.20% at Nashik. However, at Karnal, line OA18-03 proved to be superior with lowest intensity of stemphylium blight (3.67%), which was at par with lines OA18-05, OA18-11 and OA18-22, whereas check variety NHRDF Red showed an intensity of 4.73%.

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

Evaluation of different lines of onion against foliar diseases at Nashik revealed that the lines OB18-53 and OB18-70 proved to be superior with lowest intensity of stemphylium blight (6.0%) and these were at par with line OB18-51, whereas the check variety Agrifound Light Red had an intensity of 15.80%. At Karnal, line OB18-56 proved to be superior with lowest intensity of stemphylium blight (2.97%) and it was at par with line OB18-64, whereas the check variety NHRDF Red showed an intensity of 4.83%.

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

Different onion lines were evaluated against foliar diseases, where in line OC18-71 at Nashik proved to be superior with lowest intensity of stemphylium blight (4.60%) and it was found at par with line OC18-63, whereas check variety Agrifound Light Red showed an intensity of 15.40%. However, at Karnal, line OC18-63 proved to be superior with lowest intensity of stemphylium blight (3.93%) but it was at par with lines OC18-64, OC18-75, OC18-83, OC18-89, OC18-96, OC18-99 as well as the check variety NHRDF Red (4.53%).

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

The studies on evaluation of multiplier onion lines at Nashik revealed that none of the lines was found free from stemphylium blight disease, however, the line MP18-30 had the lowest intensity of stemphylium blight (7.80%).

Screening of different onion lines for thrips resistance (IET, AINRPOG)

The screening of twelve onion lines along with check variety Agrifound Light Red at RRS, Nashik and NHRDF Red at Karnal revealed that none of the lines including checks was free from thrips.

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

The screening of eleven onion lines along with check variety Agrifound Light Red at RRS, Nashik and NHRDF Red at RRS, Karnal revealed that none of the lines including the checks was free from thrips.

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

The screening of twenty-one onion lines along with check variety Agrifound Light Red at RRS, Nashik and NHRDF Red at RRS, Karnal, showed that none of the lines, including the checks was free from thrips.

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

Screening of seven multiplier onion lines at RRS, Nashik revealed that none of the lines was free from thrips.

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

The trial conducted during *rabi,* 2018-19 at RRS, Nashik the data revealed that transplanting on raised bed under drip irrigation system with soil application of *Bacillus subtilis* @ 5 kg/ha followed by sequential spray of Propineb @ 0.20% at 40, 60, 80 DAT and mixed spray of Carbendazim @ 0.10% + Streptocycline @ 0.02% at 100 DAT proved to be superior for integrated management of foliar diseases in onion. At Karnal, the transplanting on raised bed under drip irrigation system with soil application of *Pseudomonas fluorescens* @ 5 kg/ha and sequential spray of Propineb @ 0.20% at 40, 60, 80 DAT and mixed spray of Carbendazim @ 0.10% + Streptocycline @ 0.02% at 100 DAT proved to be superior for integrated management of foliar diseases in onion. The incidence of Erwinia rot in onion bulbs was not found after harvest at both the places.

Integrated crop health management in onion seed crop

The study conducted during *rabi,* 2018-19 at RRS, Nashik and Karnal on seed production revealed that marigold used as trap crop for thrips and soil application of *T.viride* + *Ps.fluorescens* @ 5 kg/ha followed by sequential spray of Fipronil @ 1ml/L + Chlorothalonil @ 2g/L at 45 DAP, Carbosulphan @ 2ml/L + Propineb @ 2g/L at 60 DAP, Profenofos @ 1ml/L + Mancozeb @ 2.5g/L at 75 DAP, and Cypermethrin 1ml/L + Carbendazim @ 1g/L at 90 DAP proved to be superior for integrated crop health management of thrips as well as foliar diseases in onion seed crop at both the places.

Effect of silica-based surfactant on the efficacy of different insecticides against onion thrips (*Thrips tabaci*)

The combined data from studies conducted for two consecutive years at RRS, Nashik and Karnal during *rabi* 2017-18 and 2018-19 showed that foliar spray of Fipronil 5% @ 1.0 ml/L + surfactant (silica based) @ 0.5ml/L at 30 DAT and subsequently at 15 days intervals proved superior for thrips management and increased the yield of onion at both the places.

Studies on development of organic module for management of diseases and pests in onion (*Allium cepa* L.)

The study conducted during *rabi* 2018-19 at RRS, Nashik on onion variety NHRDF Red -3 showed that spray of Profenofos @ 0.05% at 15 DAT, Dimethoate @ 0.06% at 25 DAT, Mancozeb @ 0.25% at 35 DAT, Carbosulfan @ 0.05% at 45 DAT, Chlorothalonil @ 0.25% at 55 DAT, Spinosad @ 56g ai/ha at 65 DAT and Propiconazole @ 0.1% at 75 DAT proved superior for the management of thrips as well as foliar diseases in onion crop.

Impact of thrips diversity on epidemiology of *Iris Yellow Spot Virus* in onion seed crop (AINRPOG)

The trial conducted at RRS, Karnal during *rabi* 2018-19 revealed that Iris yellow spot virus appeared at 120 DAP with 60% incidence and 1.8% severity, while the lowest thrips population (3.4 nymphs/plant) were recorded at 60 DAP. The maximum temperature as well as relative humidity ranged from 21.66 to 25.11% and 71.86 to 88.14%, respectively. The minimum temperature as well as relative humidity varied from 5.41 to 10.50% and 54 to 69%, respectively.

Late *Kharif,* 2018-19

Evaluation of different onion lines for disease resistance during late *Kharif* (IET, AINRPOG)

The evaluation of different onion lines against foliar diseases at Nashik revealed that the line OLK-18-48 proved superior with lower intensity (2.80%) of stemphylium blight whereas check

variety NHRDF Red-4 showed an intensity of 3.40%. At Karnal, there was no significant variation for intensity as well as incidence of stemphylium blight among the lines.

Evaluation of different onion lines for disease resistance during late *kharif* (AVT-I, AINRPOG)

The evaluation of different onion lines against foliar diseases at Nashik rated the lines OLK-18-08 and OLK-18-15 superior with lower intensity (2.80%) of stemphylium blight, whereas the check variety NHRDF Red-4 exhibited an intensity of 3.80%). At Karnal, the lines did not show any significant variation in intensity as well as incidence of stemphylium blight.

Screening of different onion lines for thrips resistance (IET, AINRPOG)

Fifteen onion lines alongwith check variety NHRDF Red-4 were screened at RRS, Nashik. The results showed the lowest foliage damage by thrips (24.20%) in line OLK18-46, which was at par with lines OLK18-38, OLK18-69, OLK18-71 and check variety NHRDF Red-4, while the highest foliage damage (38.60%) was recorded in line OLK18-53. At Karnal, the data revealed that over all thrips foliage damage was 20% in all the lines including check variety NHRDF Red at 75 DAT. None of the lines, including the check was free from thrips at both the places.

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

Screening of fourteen onion lines alongwith check variety NHRDF Red-4 at RRS, Nashik revealed that the lowest foliage damage due to thrips (24.0%) was in line OLK18-01, while the highest damage (36.30%) was in line OLK18-08. At Karnal, the over all thrips foliage damage was 20% in all the lines including check variety NHRDF Red. None of the lines, including the check was free from thrips at both the places.

Kharif, 2019

Survey and monitoring of major diseases of onion and garlic (AINRPOG)

At Nashik, the intensity of stemphylium blight (18.0%), purple blotch (12.0%) and anthracnose (11.60%) diseases was recorded in onion during November, 2019. The highest incidence of black mold (26%) was recorded in stored onion bulbs during September, 2019. At Karnal, the higher intensity of stemphylium blight (10.72%) was recorded in onion crop during November, 2019. The highest incidence of black mold in onion bulbs (25%) and garlic (9%) were recorded in storage during July and September, 2019, respectively.

Survey and monitoring of major diseases and insects of onion

The occurrence of major diseases and insects of onion was studied at taluka- Deola, Kalwan, Yeola, Satana and Chandwad districts in Nashik (Maharashtra) and Karnal district (Haryana) during *kharif* season, 2019. Five villages were selected for the survey in each taluka and five onion fields as well as onion storage (100 nos.) in each village were covered for observation on major diseases and insects in 75 fields of 35 villages from June to November, 2019 at Nashik. At Karnal 25 onion storages and one onion field in two villages of Karnal district were surveyed from July to November, 2019.

At Nashik

Black mold, bacterial soft rot and other storage diseases

The twenty-five onion storages were surveyed on 26.08.2019 in five villages in taluka Kalwan, Nashik. Onion bulbs in these storage showed the black mold incidence varying from 9.0 to 19.0%

after four months of storage. The highest black mold incidence (19.0%) was recorded in storage at village Juni Bhendi in taluka Yeola. The bacterial rot incidence ranged from 2-6% in different onion storages of the above surveyed five villages.

Evaluation of different lines of onion for disease resistance (IET, AINRPOG)

The studies on the evaluation of different red onion lines during *kharif* 2019 conducted at Nashik revealed that none of the lines was free from stemphylium blight disease, including Agrifound Dark Red. However, line OAV19-05 proved to be superior with lowest intensity of stemphylium blight (7.40%) and purple blotch (5.0%) while the check variety Agrifound Dark Red showed an intensity of stemphylium blight and purple blotch of the order of 15.70% and 6.80%, respectively.

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

The evaluation of different red onion lines during *kharif* 2019 conducted at Nashik revealed that none of the lines including Agrifound Dark Red was free from stemphylium blight disease. However, line OBV19-51 proved superior with the lowest intensity of stemphylium blight (7.80%) and line OBV19-49 with lowest intensity of purple blotch (5.40%), while the check variety Agrifound Dark Red showed intensity of stemphylium blight and purple blotch as high as 16.60% and 8.0%, respectively.

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

The evaluation of different red onion lines during *kharif* 2019 conducted at Nashik revealed that none of the lines including Agrifound Dark Red, was free from stemphylium blight and purple blotch disease. However, line OCV19-55 was superior with the lowest intensity of stemphylium blight (9.20%) and line OCV19-64 with the lowest intensity of purple blotch (5.20%). The check variety Agrifound Dark Red showed intensity of stemphylium blight and purple blotch as 15.60% and 6.60%, respectively.

Evaluation of different lines of white onion for disease resistance (IET, AINRPOG)

The evaluation of different white onion lines conducted at Nashik during *kharif* 2019 revealed that none of the lines, including check variety Agrifound White was free from stemphylium blight. However, line OAV19-23 proved over all superior with the lowest intensity of stemphylium blight (7.60%) and purple blotch (4.20%), while the check variety Agrifound White showed intensity of stemphylium blight and purple blotch to the extent of 18.60 and 7.80%, respectively.

Evaluation of different lines of red onion hybrid for disease resistance (IET, AINRPOG)

Evaluation of different red onion hybrid lines conducted at Nashik during *kharif* 2019 revealed that none of the lines was free from stemphylium blight and purple blotch diseases. However, line OAH19-33 proved superior with the lowest intensity of stemphylium blight (7.80%) and purple blotch (3.40%).

Effect of different fungicide groups with insecticides for control of foliar diseases of onion and their residues in bulbs after harvest

The data of trials conducted at RRS, Nashik during *kharif*, 2018 and 2019 on onion variety Agrifound Dark Red revealed that the sequential spray of Pyraclostrobin+Metiram @ 0.25% + Deltamethrin @ 0.1% at 30 DAT, Trifloxistrobin+Tebuconazole @ 0.1% + Cyperpethrin @ 0.1% at 45 DAT, Zineb+Hexaconazole @ 0.25% + Fipronil @ 0.1% at 60 DAT, Carnebdazim+Mancozeb @

0.25%+Curacron @ 0.1% at 75 DAT proved to be superior for management of foliar diseases with 61.15% control of stemphylium blight and 43.50% purple blotch over untreated control. However, the highest benefit : cost ratio (11.88:1) was recorded in the treatment sprays of Propiconazole @ 0.1% + Deltamethrin @ 0.1% at 30 DAT, Epoxiconazole @ 0.1% + Cyperpethrin @ 0.1% at 45 DAT, Tricyclazole @ 0.1% + Fipronil @ 0.1% at 60 DAT, Hexaconazole @ 0.1% + Curacron @ 0.1% at 75 DAT) due to low cost of pesticide followed by 9.21:1 of spray of Pyraclostrobin + Metram @ 0.25% + Deltamethrin @ 0.1% at 30 DAT, Trifloxistrobin + Tebuconazole @ 0.1% + Cypermethrin @ 0.17% at 45 DAT, Zineb + Hexaconazole @ 0.25% + Fipronil @ 0.1% at 60 DAT, Carbendazim + Mencozeb @ 0.25% + Curacron @ 0.1% at 75 DAT.

At Karnal, sprays 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 proved better for management of foliar diseases with 49.24% control of stemphylium blight over untreated control. The purple blotch disease and thrips did not appear in any of the treatments, including untreated control during the entire cropping period. The onion bulbs were found free from pesticide residue.

Management of purple blotch in *kharif* onion through sequential spray of different fungicides with bio-pesticides and their residue status

The trial conducted at RRS, Nashik during *kharif*, 2019 on onion variety Agrifound Dark Red revealed that spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin+Tebuconazole @ 0.2% at 60 DAT + spray of *T. viride* @ 5.0g/L at 75 DAT proved to be superior for management of purple blotch disease with lowest intensity of 6.10% in comparison to the intensity in untreated control (9.30%) at Nashik. At Karnal, the purple blotch did not appear on onion crop during the entire cropping season in any treatment, including untreated control.

Screening of different onion lines for thrips resistance (IET, AINRPOG)

Ten onion lines alongwith check variety Agrifound Dark Red were screen at RRS, Nashik and Karnal. The results showed that none of the lines was found free from thrips including the check at both the places.

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

Screening of six onion lines, alongwith check variety Agrifound Dark Red at RRS, Nashik and Karnal revealed that none of the lines were free from thrips including the check.

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

Screening of six onion lines, alongwith check variety Agrifound Dark Red at RRS, Nashik and Karnal revealed that none of the lines including the check was free from thrips at both the places.

Screening of different white onion lines for thrips resistance (IET, AINRPOG)

Screening of six onion lines, alongwith check variety Agrifound White at RRS, Nashik and Karnal revealed that none of the lines including the check was free from thrips at both the places.

Screening of different red onion hybrid lines for thrips resistance (IET, AINRPOG)

The studies on six onion hybrid lines both at RRS, Nashik and Karnal revealed that none of the lines, including the check was free from thrips at both the places.

Post Harvest Management (*Rabi*, 2018-19, Late *Kharif*, 2018-19 and *Kharif*, 2018)

Plant Genetic Resources and Crop Improvement

Rabi, 2018-19

Storage performance of onion germplasm (AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the lowest sprouting (0.40%) was recorded in check variety Agrifound Light Red and it was followed by line-555. The lowest decay loss (1.06 %) was recorded in check variety NHRDF Red-3 and it was followed by lines-746 and 871. The lowest PLW (15.04%) and total loss (24.07%) were recorded in lines-618 and 705, respectively and it was followed by lines-683, 746, 773 and 871 in respect of total loss.

Storage performance evaluation of onion lines (IET, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the lowest sprouting (2.29%) and decay loss (0.63%) were recorded in lines OA-18-09 and OA-18-13, respectively, at par with lines OA-18-01, OA-18-03, OA-18-13, check varieties NHRDF Red-2 and NHRDF Red-4 in respect of sprouting. The lowest PLW (18.67%) and total loss (25.73%) were recorded in lines OA-18-13 and OA-18-01, respectively, at par with lines OA-18-01, OA-18-03, OA-18-09, Agrifound Light Red and NHRDF Red-2 in respect of PLW and with lines OA-18-13 and NHRDF Red-2 regarding total loss.

At Karnal, five months after storage, the lowest sprouting (0.59%) and decay loss (0.56%) were recorded in line OA-18-01 and it was found at par with lines OA-18-03 and OA-18-22 in respect of sprouting and with lines OA-18-03, OA-18-13 and OA-18-22 regarding decay loss. The lowest PLW (14.04 %) and total loss (15.19 %) were recorded in line OA-18-01, which was at par with line OA-18-03.

Storage performance of onion lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the PLW exhibited non-significant differences. The lowest sprouting (0.08%) and decay loss (0.29%) were recorded in lines OB-18-56 and OB-18-69, respectively and these were at par with line OB-18-51 and check variety Agrifound Light Red in respect of sprouting and line with OB-18-70 regarding decay loss. The lowest total loss (20.59%) was recorded in line OB-18-51 which was at par with lines OB-18-56, OB-18-70 and check variety Agrifound Light Red.

At Karnal, five months of storage showed the lowest sprouting (0.60%) and decay loss (1.49%) in lines OB-18-51 and OB-18-70, respectively and these were at par with lines OB-18-53, OB-18-56 and OB-18-72 in respect of sprouting and lines OB-18-51, OB-18-53, OB-18-56 and OB-18-72 regarding decay loss. The lowest PLW (18.67%) and total loss (20.91%) were recorded in line OB-18-51, which was at par with lines OB-18-53, OB-18-56 and OB-18-70.

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

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the lowest sprouting (2.12%) and decay loss (0.87%) were noted in check variety NHRDF Red-2 and it was at par with lines OC-18-73, OC-18-79, OC-18-87 and OC-18-94 in respect of sprouting and lines OC-18-63 and OC-18-81 regarding decay loss. The lowest PLW (17.42%) and total loss

(21.58%) were recorded in line OC-18-73 and NHRDF Red-2, respectively, being at par with lines OC-18-63, OC-18-75, OC-18-79, OC-18-87, OC-18-92, OC-18-94 and NHRDF Red-2 in respect of PLW and with line OC-18-94 regarding total loss.

At Karnal, five months after storage, no sprouting was recorded in line OC-18-59 and it was at par with lines OC-18-73, OC-18-87 and OC-18-94. The lowest decay loss (0.07%) was recorded in line OC-18-59. The lowest PLW (15.57%) and total loss (15.64%) were recorded in line OC-18-59, which was at par with lines OC-18-73, OC-18-75, OC-18-87 and OC-18-94 in respect of PLW and with lines OC-18-73 and OC-18-87 regarding total loss.

Storage performance of multiplier onion lines (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that after four months storage, the PLW and total loss exhibited non-significant differences, however, no sprouting was recorded in any of the lines except MP-18-30. The lowest decay loss (0.15%) was recorded in line MP-18-27 and it was at par with lines MP-18-23 and MP-18-32.

Performance of red onion advance lines

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the lowest PLW (21.02%) and total loss (23.86%) were recorded in advance line-852 and NHRDF Red-2, respectively, and these were found at par with advance line-804, 913 and check variety NHRDF Red-2 in respect of PLW, and with advance lines-804, 852, 873 and 913 regarding total loss. At Karnal, after five months of storage, the lowest PLW (13.31%) and total loss (14.15%) were recorded in advance lines-807 and 920, respectively, and these were at par with advance lines-752, 804, 854, 920, check varieties NHRDF Red-2 and NHRDF Red-4 in respect of PLW, and with advance lines-752, 804, 807, NHRDF Red-2 and NHRDF Red-4 with respect to total loss.

Performance of white onion advance lines

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that five months after storage, the lowest total loss (40.49%) was recorded in advance line-857 and it was found at par with advance lines-784, 865, 878, 885 and Agrifound White. At Karnal, five months of storage showed, the lowest PLW (19.13%) and total loss (22.13%) in advance line-827, which was at par with advance lines-784, 799 and 886 in respect of PLW, and with advance line-799 regarding total loss.

Post Harvest Management

Late *Kharif*, 2018-19

Storage performance of onion lines (IET, AINRPOG)

The trial conducted at RRS, Nashik during late *kharif* 2018-19 revealed that at four months after storage, the lowest PLW (16.81%) and total loss (17.31%) were recorded in line OLK-18-69 and OLK-18-67, respectively, which were at par with lines OLK-18-33, OLK-18-38, OLK-18-46, OLK-18-48, OLK-18-55, OLK-18-59 and OLK-18-67 in respect of PLW, and with lines OLK-18-33, OLK-18-38, OLK-18-46, OLK-18-59 and OLK-18-69 regarding total loss.

Storage performance of onion lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during late *Kharif* 2018-19 revealed that after four months storage, the lowest PLW (14.49%) and total loss (20.18%) were recorded in lines OLK-18-11 and OLK-18-01, respectively, and thses were at par with lines OLK-18-01, OLK-18-03, OLK-18-13, OLK-18-17, OLK-18-24, OLK-18-28 and check variety NHRDF Red-4 in respect of PLW, and with lines OLK-18-03, OLK-18-13, OLK-18-15, OLK-18-24, OLK-18-28 and NHRDF Red-4 regarding total loss.

Storage performance of red onion advance lines against bolting behaviour

The trial conducted at RRS, Nashik during late *kharif* 2018-19 revealed that at three months after storage, the lowest PLW (12.55%) and total loss (13.10%) were recorded in advance lines - 683 and 581, respectively, and these were at par with advance lines - 581, 780, 880, 890, check varieties Bhima Red and NHRDF Red-4 in respect of PLW, and with advance lines- 683, 780, 880, 890, 913 and check variety NHRDF Red-4 regarding total loss.

Post Harvest Management

Kharif, 2018

Storage performance of onion lines (IET, AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2018 showed that three months after storage, the PLW and total loss exhibited non-significant differences. At Karnal, the lowest PLW (4.83%) and total loss (30.33%) at two months after storage were recorded in line OA-18-10 and OA-18-08, respectively, and it was found at par with lines OA-18-10 and OA-18-18 in respect of total loss.

Storage performance of onion lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2018 revealed that three months after storage, the lowest total loss (41.40%) was recorded in line OB-18-06 and it was found at par with lines OB-18-01, OB-18-03 and OB-18-13. At Karnal, the lowest PLW (5.67%) and total loss (34.67%) at two months after storage were recorded in line OB-18-16 and it was found at par with lines OB-18-06, OB-18-07 and OB-18-13 in respect of PLW, and with lines OB-18-07 and OB-18-13 regarding total loss.

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

The trial conducted at RRS, Nashik during *kharif* 2018 showed that three months after storage, the lowest PLW (18.90%) and total loss (32.73%) were recorded in line OC-18-48 and OC-18-32, respectively, and these were at par with lines OC-18-19, OC-18-23, OC-18-24, OC-18-26, OC-18-32, OC-18-37, OC-18-41 and OC-18-43 in respect of PLW, and with lines OC-18-19, OC-18-21, OC-18-23, OC-18-24, OC-18-28, OC-18-37, OC-18-41 and OC-18-48 regarding total loss. At Karnal, the lowest PLW (2.10%) and total loss (27.62%) at two months after storage were recorded in line OC-18-19 and it was at par with lines OC-18-21, OC-18-23 and OC-18-45 in respect of total loss.

Storage performance of multiplier onion lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2018 revealed that after two months storage, the lowest PLW (19.42%) and total loss (20.00%) were recorded in line MP-18-25, however, at three months after storage the lowest PLW (34.83%) and total loss (36.58%) were recorded in line MP-18-27, though the variation was found non-significant.

Post Harvest Management

Crop Production System Management

Rabi, 2018-19

Effect of Foliar application of Boron, Sulphur and $CaCl_2$ on storage life of onion bulbs (AINRPOG)

The storage study conducted to assess the impact of foliar application of Boron, Sulphur, Zinc and $CaCl_2$ on storage performance on onion variety Agrifound Light Red during *rabi* 2016-17,

2017-18 and 2018-2019 showed that foliar application of $ZnSO_4$ (0.5%) at 45, 60 and 75 DAT was superior in terms of lowest total loss after five months of storage, but it was found at par with foliar application of Boric acid (0.25%) at 30, 45 and 60 DAT and foliar application of $CaCl_2$ (0.5%) at 60, 75 and 90 DAT.

Post Harvest Management

Plant Health Management

Rabi, 2018-19

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

At Nashik, the raised bed and drip irrigation system with soil application of *Bacillus subtilis* @ 5 kg/ha followed by sequential spray of Propineb 0.20% at 40, 60, 80 DAT, and mixed spray of Carbendazim @ 0.10%+Streptocycline @ 0.02% at 100 DAT performed superior with lowest incidence of Erwinia rot, black mold, sprouting, PLW as well as total losses in onion bulbs of variety Agrifound Light Red during the storage period of five months. Bacterial brown rot and basal rot did not appear during the entire storage period in onion bulbs.

At Karnal, the lowest incidence of black mold as well as lowest PLW and total loss were recorded after five months of storage in raised bed and drip irrigation with soil application of AMC @ 12.50 kg/ha and sequential spray of Propineb 0.20% at 40, 60, 80 DAT, mixed spray of Carbendazim @ 0.10%+Streptocycline @ 0.02% at 100 DAT. The lowest sprouting was recorded in Flat bed with surface irrigation after five months of storage in untreated control. Lowest total losses were recorded after five months of storage in raised bed and drip irrigation with Soil application of *Pseudomonas fluorescens* @ 5 kg/ha and sequential spray of Propineb 0.20% at 40, 60, 80 DAT, mixed spray of Carbendazim @ 0.10%+Streptocycline @ 0.02% at 100 DAT. The storage data showed non-significant variations for all the parameters recorded at monthly intervals during the period of five months storage of onion variety Agrifound Light Red, except sprouting at two and three months of storage. Erwinia rot, bacterial brown rot and basal rot did not appear during the entire storage period in onion bulbs.

Garlic

Plant Genetic Resources and Crop Improvement

Rabi, 2018-19

Collection, evaluation and conservation of garlic germplasm (AINRPOG)

The trial conducted at RRS, Karnal during *rabi* 2018-19 revealed that the highest gross yield (252.35 q/ha) and marketable yield (252.17 q/ha) were recorded in line G-392, at par with line G-456. High total soluble solids (43.63%) were recorded in line G-268 and it was found at par with lines G-363, G-405, G-344, G-73, G-324, G-273, G-404, G-203, G-278, G-372, G-417, G-407, G-69, G-377, G-392, G-290, G-394, G-365, G-27 (R), G-182, G-406, G-425, G-1, G-299, G-213, G-304, G-18 and G-451.

Performance evaluations of garlic lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 showed that the highest gross yield (110.56 q/ha) and marketable yield (104.63 q/ha) were recorded in check variety Yamuna Safed-9, at par with line GN17-03. High total soluble solids (36.20 %) were recorded in line GN17-05 and

it was found at par with lines GN17-03, GN17-08 and GN17-12. At Karnal, the highest gross yield (154.91 q/ha) and marketable yield (154.91 q/ha) were recorded in check variety Yamuna Safed-8. The highest total soluble solids (38.08 %) and dry matter contents (39.64 %) were recorded in line GN-17-03, which was at par with check variety Yamuna Safed-8.

Performance evaluation of garlic lines (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that the highest gross yield (109.78 q/ha) and marketable yield (100.19 q/ha) were recorded in line GN-15-83, which was found at par with Yamuna Safed-9. High total soluble solids (35.72%) and dry matter contents (37.08%) were recorded in Yamuna Safed-9 and it was found at par with lines GN-15-52, GN-15-55, GN-15-68, GN-15-71 and Yamuna Safed-3 in respect of total soluble solids, and with lines GN-15-52, GN-15-55, GN-15-65, GN-15-68, GN-15-71 and Yamuna Safed-3 regarding dry matter contents. At Karnal, the highest gross yield (169.58 q/ha) and marketable yield (169.12 q/ha) were recorded in Yamuna Safed-8. High total soluble solids (38.67%) and dry matter contents (40.03%) were recorded in line GN-15-52 and it was found at par with lines GN-15-65, GN-15-68, GN-15-71, GN-15-72, GN-15-83 and Yamuna Safed-8.

Evaluation of short-day garlic genotype for bold size cloves with good shelf life in subtropical condition

The trial conducted at RRS, Karnal during *rabi* 2018-19 showed that the highest gross yield (152.06 q/ha) and marketable yield (151.28 q/ha) in advance line G-378, which was at par with advance line G-66. The highest total soluble solids (37.28%) and dry matter contents (38.69%) were recorded in line G-411, at par with lines G-260, G-281, G-415, G-426 and check variety G-282.

Performance evaluation of garlic advance lines

The trial conducted at RRS, Karnal during *rabi* 2018-19 revealed the highest gross yield (197.92 q/ha) in advance line G-397. High marketable yield (151.31 q/ha) was recorded in advance

line G-418 but it was found at par with advance lines G-7, G-403, check variety Yamuna Safed-5 and Yamuna Safed-8 in respect of marketable yield, and with advance line G-7, Yamuna Safed-5 and Yamuna Safed-8 regarding marketable yield. The highest total soluble solids (42.50%) were recorded in advance lines G-397 and G-414, which were at par with advance lines G-6, G-347, G-413, G-418, G-422, G-441 and G-444. High dry matter contents (45.35%) were recorded in advance line G-414, at par with advance lines G-397, G-413, G-422 and G-441.

Post Harvest Management

Plant Genetic Resources and Crop Improvement

Rabi, 2018-19

Collection, evaluation and selection of garlic germplasm (AINRPOG)

The trial conducted at Karnal during *rabi* 2018-19 revealed the lowest PLW and total loss (2.37 %) in line G-350 and it was found at par with line G-366, G-25, G-32, G-73, G-294, G-331, G-273, G-7, G-278, G-329, G-372, G-60, G-407, G-69, G-3, G-290, G-39, G-71, G-427, G-420, G-67, G-173, G-27 (R), G-425, G-4, G-435, G-437, G-310, G-298 and G-432 at 90 days after storage.

Storage performance of garlic lines (AVT-I, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 showed no sprouting in any line. No decay loss was noted in lines GN-17-12, GN-17-16 and Yamuna Safed-9. The lowest PLW (11.33%) and total loss (13.45%) were recorded in Yamuna Safed-3 and line GN-17-05, respectively at par with line GN-17-05 in respect of PLW, and with Yamuna Safed-9 regarding total loss at 180 days after storage.

At Karnal, no sprouting and decay losses were recorded in any line. The lowest PLW as well as total loss (7.73%) were recorded in line GN-17-19 at 180 days after storage.

Storage performance of garlic lines (AVT-II, AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2018-19 revealed that after 135 days of storage, the lowest total loss (10.38%) was recorded in line GN-15-68, at par with lines GN-15-55, GN-15-83, Yamuna Safed-3 and Yamuna Safed-9. However, at 180 days after storage, lowest PLW (12.67%) and total loss (14.08%) were recorded in line GN-15-62 and GN-15-68, respectively, though the variation was found non-significant.

At Karnal, no sprouting and decay loss were recorded 180 days after storage in any line. The lowest PLW as well as total loss (10.48%) were recorded in line GN-15-65, which at par with all the lines except GN-15-71 and GN-15-83.

To study the performance of advance lines of garlic

The trial conducted at Karnal during *rabi* 2018-19 revealed that the lowest PLW as well as total loss (5.35%) were recorded in advance line G-422 and it was found at par with advance lines G-413 and G-414 at 135 days after storage.

Evaluations of short-day garlic genotypes for bold size of cloves with shelf life in sub tropical condition

The trial conducted at Karnal during *rabi* 2018-19 showed the lowest PLW as well as total loss (5.67%) in line G-415 at 135 days after storage.

Crop Production System Management

Rabi, 2018-19

Effect of zinc and boron application on yield and storage quality of garlic (AINRPOG)

The experiment conducted at RRS Nashik on garlic variety Yamuna Safed-3 (G-282) during *rabi* 2016-17, 2017-18 and 2018-2019 revealed that the treatment Soil application of Zinc Sulphate @ 10.0 kg/ha as basal was superior in terms of total bulb yield (8.78 t/ha), marketable yield (7.95 t/ha) and highest benefit : cost ratio (3.17:1), and was at par with foliar application of micronutrient mixture @ 0.5% at 45 and 60 DAT.

Fertilizer scheduling through drip irrigation system in garlic (AINRPOG)

The experiment conducted during *rabi* 2018-19 at RRS, Karnal revealed that the treatment drip irrigation at 100% PE through drip system-Irrigation at alternate day100% RDF (100:50:50:50 kg NPKS/ha) + organic manures 5 t/ha at 6 days interval Full dose of organic manure applied as a basal before planting proved superior as compared to the other treatments in terms of marketable bulb yield and dry matter. The highest benefit: cost ratio (2.43:1) was recorded in drip irrigation at 100% PE through drip system-Irrigation at alternate day 80% RDF (80:40:40:40 kg NPKS/ha) + organic manures 5 t/ha at 6 days interval full dose of organic manure applied as a basal before planting.

Comparative studies on machine dibbing and manual dibbing of garlic cloves for garlic production

The study conducted on garlic variety Yamuna Safed–4 (G-323) at RRS, Karnal during *rabi*, 2018-19 revealed that the clove planted upward (Conventional) proved to be the best in terms of growth and yield, and gave highest gross as well as marketable yield (101.30 q/ha & 89.90 q/ha), respectively.

Standardization of fertigation schedule with plant growth regulators on growth, yield and storage of garlic.

The experiment conducted during *rabi* 2018-19 at RRS, Karnal on garlic variety Yamuna Safed-3 (G-282), to standardize the fertigation schedule and impact of foliar application of growth regulators on storage performance revealed that at five months after storage, the lowest loss due to PLW as well as total loss (8.58%) were recorded in the treatment 80% RDF (NPKS in 8 splits) *i.e.,* 80:40:40:24 and Foliar application of Cycocel @ 1000 ppm at 55 and 75 DAP. However, the highest good bulb recovery (117.20 q/ha) was achieved in treatment 100% RDF (NPKS in 8 splits) *i.e.* 100:50:50:30 and Foliar application of Gibberelic acid (GA_3) @ 50 ppm at 45 and 60 DAP.

Plant Health Management

Rabi, 2018-19

Evaluation of advance lines of garlic for disease resistance (AVT-I, AINRPOG)

The evaluation of garlic lines revealed that line GN17-12 was superior with the lowest intensity of stemphylium blight (5.60%) and it was found at par with line GN17-08 and check variety Yamuna Safed-3 at Nashik.

At Karnal, line GN17-12 exhibited the lowest intensity of stemphylium blight (3.73%) and it was at par with line GN17-14. The check variety Yamuna Safed-8 had an intensity of 6.10%.

Evaluation of advance lines of garlic for disease resistance (AVT-II, AINRPOG)

The evaluation of garlic lines showed that line GN15-68 was superior with the lowest intensity of stemphylium blight (7.0%) and it was at par with lines GN15-52, GN15-55, GN15-65, GN15-83, and check variety Yamuna Safed-3 at Nashik.

At Karnal, line GN15-65 showed that lowest intensity of stemphylium blight (4.87%) and it was found at par with lines GN15-55, GN15-62 and GN15-71. The check variety Yamuna Safed-8 had an intensity of 6.03%.

Screening of different garlic lines for thrips resistance (AVT-I, AINRPOG)

The studies on screening of garlic lines at Nashik, revealed that the foliage damage due to thrips ranged from 25.40 to 39.30%. The lowest thrips foliage damage (25.40%) was recorded in check variety Yamuna safed-3 at 75 DAP and it was found at par with line GN17-12 (25.50%), while the highest foliage damage (39.30%) was recorded in the line GN17-14. The highest gross and marketable yields (109.42 and 99.72q/ha) were recorded in check variety Yamuna Safed -3.

At Karnal, the data revealed that the over all thrips foliage damage (20%) was recorded in all the lines, along with check variety Yamuna Safed -8 at 75 DAP. The highest gross and marketable yields (156.17 and 149.99 q/ha) were recorded in the line GN17-12 which was at par with lines GN17-03 and GN17-08.

Screening of different garlic lines for thrips resistance (AVT-II, AINRPOG)

The screening of garlic lines at Nashik showed that the foliage damage due to thrips ranged from 21.80% to 41.90%. The lowest foliage damage (21.80%) was recorded in the line GN15-65 at 75 DAP, while the highest damage (41.90%) was in line GN15-71. The highest gross yield (106.35 q/ha) was recorded in line GN15-52 and it was found at par with all the other lines except GN15-55, GN15-62 and GN15-83. The highest marketable yield (99.84 q/ha) was recorded in line GN15-62 and it was found at par with check variety Yamuna Safed-3.

At Karnal, the over all thrips damage of 20% was recorded in all the lines including check variety Yamuna Safed-8 at 75 DAP. The highest gross and marketable yields (140.73 and 132.40 q/ha) were recorded in line GN15-68 where the gross and marketable yield were found at par with lines GN15-71, GN15-72 and check variety Yamuna Safed -8.

Studies on development of organic module for management of diseases and pest in garlic

The study conducted during *rabi,* 2018-19 at RRS, Karnal on garlic variety Agrifound White revealed that module at Soil application of Vermicompost @ 3.0 t/ha + *T. viride* @ 5.0 kg/ha + *P. fluorescens* @ 5.0 kg/ha + Foliar spray of Samrat plus @ 3.0 ml/L at 30 DAP + Visilon 8083 @ 3.5 ml/L at 40 DAP + Clout @ 2.5 ml/L at 50 DAP + Ultra-PK @ 2.5 g/L at 60 DAP + Samrat plus @ 3.0 ml/L at 70 DAP + Visilon 8083 @ 3.5 ml/L at 80 DAP + Clout @ 2.5 ml/L at 90 DAP was superior for the control of diseases and the modules 'Soil application of neem cake @ 3.0 t/h + *T. viride* @ 5.0 kg/ha + *P. fluorescens* @ 5.0 kg/ha + *M. anisopliae* @ 5.0 kg/ha + Foliar spray of neem oil @ 4.0 ml/L at 30 DAP + *B. bassiana* @ 5.0 g/L at 40 DAP + *T. viride* @ 5.0 g/L at 50 DAP + *V. lecanii* @ 5.0 g/L at 60 DAP + *P. fluorescens* @ 5.0 g/L at 70 DAP + *M. anisopliae* @ 5.0 g/L at 80

DAP + *T. viride* @ 5.0 g/L at 90 DAP' and 'Soil application of *T. viride* @ 5.0 kg/ha + *V. lecanii* @ 5.0 kg/ha + Foliar spray of *B. bassiana* @ 5.0 g/L at 30 DAP + *T. viride* @ 5.0 g/L at 40 DAP + *V. lecanii* @ 5.0 g/L at 50 DAP + *T.viride* @ 5.0 g/L at 60 DAP + *M. anisopliae* @ 5.0 g/L at 70 DAP + *T. viride* @ 5.0 g/L at 80 DAP + *B. bassiana* @ 5.0 g/L at 90 DAP for control of thrips in garlic.

Kharif, 2019

Dolichos Bean

Plant Genetic Resources and Crop Improvement

Evaluation of *Dolichos* bean bush type-AVT-I (AICRP-VC)

The trial conducted at RRS, Nashik during *Kharif* 2019 revealed that the highest yield (147.64 q/ha) was recorded in 2018/DOLBVR-2 and it was statistically at par with check variety Konkan Bhushan.

Evaluation of Dolichos bean bush type-AVT-II (AICRP-VC)

The trial conducted at RRS, Nashik during *Kharif* 2019 also showed the highest yield (150.33 q/ha) in line 2017/DBBVAR-2 and it was at par with check variety Kokan bhushan.

Tomato

Crop Production System Management

Response of tomato to foliar application of micronutrients (AICRP-VC) at Nashik

The study conducted during *kharif* 2018 at RRS, Nashik on tomato variety 1057 revealed the highest fruit yield (161.7 q/ha) and benefit cost ratio (4.49: 1.0) with foliar application of mixture of all micronutrients at 40, 50 and 60 days after transplanting.

Response of tomato to foliar application of micronutrients (AICRP-VC) at Karnal

The study conducted at RRS, Karnal on tomato variety Arka Rakshak during *kharif* 2019 revealed the highest fruit yield (310.77 q/ha) and benefit: cost ratio (6.95:1.0) under the foliar application of mixture of all micronutrients without B at 40, 50 and 60 days after transplanting.

Okra

Plant Health Management

Seasonal incidence of major insect pest of okra (AICRP-VC)

In the trial conducted during *Kharif* 2019 at Nashik, the highest population of white fly (22.90 nymphs/3 leaves / plant), jassid (5.0 nymphs/3 leaves/plant), shoot borer infestation (38.88%) and fruit borer infestation (42.06%) were recorded during 31st, 37th and 40th standard weeks respectively, in okra. In tomato, the highest population of white fly (18.60 nymphs / 3 leaves / plant) was recorded during 35th standard week, while the highest jassid population (4.80 nymphs/3 leaves/plant) was recorded during 35th and 37th standard weeks and fruit borer infestation (36.0%) was recorded during 43rd standard week.

At Karnal, the highest population of whitefly (6.80 nymphs/3 leaves / plant), aphid (38.20 nymphs/3leaves/plant), jassid (66.86 nymph /3 leaves / plant) and fruit borer infestation (35.34 %) were recorded during 40th, 43rd and 46th standard weeks respectively in okra. In tomato, the highest whitefly population (3.27 nymphs/3 leaves / plant) and fruit borer infestation (45.16%) were recorded during 42nd, 43rd and 49th standard weeks.

Tomato

Seasonal incidence of major insect pests of tomato (AICRP-VC)

The trial conducted during *Kharif* 2019 at Nashik, showed the highest population of white fly (18.60 nymphs / 3 leaves / plant) during 35th standard week, while the highest jassid population (4.80 nymphs/3 leaves/plant) was recorded during 35th and 37th standard weeks and fruit borer infestation (36.0%) was recorded during 43rd standard week.

At Karnal, the highest population of whitefly (3.27 nymphs/3 leaves / plant) and fruit borer infestation (45.16%) were recorded during 42nd, 43rd and 49th standard weeks.

8B

Laboratory Studies / Services

Bio-control Laboratory

Nashik

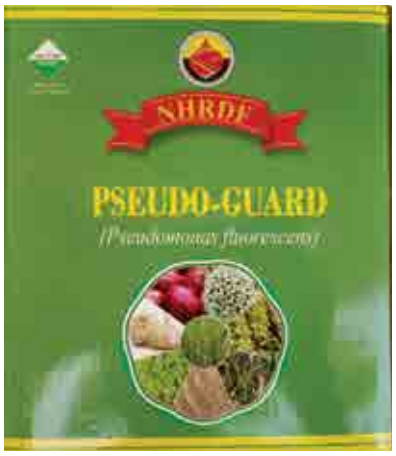
Trichoderma viride (TRICHO-VIR)

Talcum base

Mass production of TRICHO-VIR was carried out and a total of 68.08 q. of TRICHO-VIR was prepared, packed and distributed to the farmers under different schemes for the management of soil-borne fungal diseases in different vegetables.

Liquid base

Mass production of liquid base TRICHO-VIR was also carried out and a total of 248.50 liters of it was prepared, packed and distributed to the 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 horticultural crops especially in grape and pomegranate.



Pseudomonas fluorescens (PSEUDO- GUARD)

Mass production of Pseudo-Guard was carried out and a total of 1.68 q it Pseudo-Guard was prepared, packed and distributed to the farmers under different schemes for the management of soil-borne diseases in different vegetables.

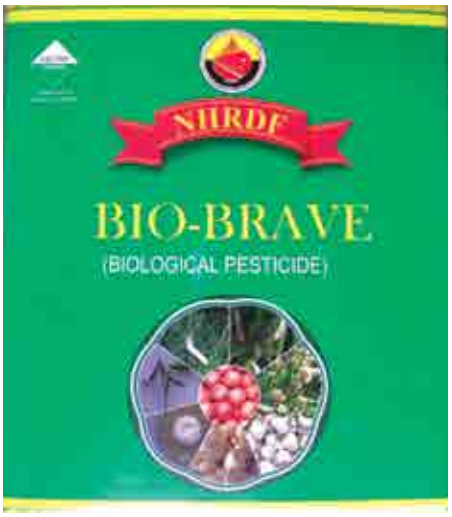
SNPV (S-Guard)

Mass production of the Spodoptera Nuclear Polyhedrosis Virus (SNPV) was carried out and a total of 50700 LE, were prepared, packed and distributed to the farmers for management of *Spodoptera litura* in vegetable and horticultural crops.

Karnal

Beauveria bassiana (BIO-BRAVE)

Mass production of Bio-Brave was carried out and a total of 17.13 q of BIO-BRAVE in talc base formulation was prepared and distributed to the farmers for the management of insects and pests in vegetable crops.



Entomology Laboratory

Karnal

Honey production

A total of 133.0 kg honey was produced from honey bee unit at RRS, Karnal and the entire quantity was distributed on cost basis for the maintenance of bee unit.

Mushroom Spawn Production Laboratory

New Delhi

Good quality spawns of different edible species of mushroom namely button mushroom, Oyster mushroom, milky mushroom, fresh mushroom and P. compost were produced in the laboratory. A total of 5258.0 kg of spawns of different species of mushroom were produced and 4474.0 kg of spawns were distributed to the mushroom growers in Delhi, Uttar Pradesh, Haryana, Punjab and Uttarakhand. Good quality pasteurized compost (8400 kg) was also produced and distributed to the mushroom growers.

Oyester mushroom (P. florida)

Button mushroom (A. bisporus)

Milky mushroom (C. indica)

Ganoderma Lucidum (Lingzhi)

Pesticide Residue Analysis Laboratory

Nashik

A total of 2263 samples of different matrix *viz.*, grapes, wine, chemicals, onion and other fruits and vegetables were analysed for agrochemicals residue as well as chemicals for quality standards in Pesticide Residue Analysis Laboratory.

Plant Pathology Laboratory

Nashik

Identification of diseases and plant pathogens

A total of 586 samples were tested in the laboratory. Onion bulbs, potato, cabbage and French bean samples were tested for exporters. The soil samples as well as bio-products were analyzed for estimation of nematode population, fungal count, identified diseases of vegetable, fruits and management practices made accordingly.

Laboratory Experiments

In vitro quality test of talcum and liquid formulation of Tricho-vir and Pseudo-Guard

In vitro experiments were conducted for quality test of talcum base *T. viride* produced in Bio-control Laboratory. The colony count of *T. viride* was recorded in the talcum base formulation followed by the serial dilution method using potato dextrose agar medium. The colony count after mixing of *T. viride* culture, talcum powder and carboxy methyl cellulose ranged from 2.0 $x10^6$ – 2.66 x 10^6 per gram in the talcum base. In liquid formulation of *T. viride*, the colony ranged from 2.66 $x10^6$ to 3.33 x 10^6/ml in the product. The colony count after mixing of *Ps. fluorescens* culture and talcum powder were recorded to be 1.66 $x10^8$ -2.0 x 10^8 per gram.

Fruit bud differentiation in grape

A total of 53 samples of grape canes received from the farmers in Nashik area of Maharashtra were observed under stereoscopic binocular microscope for fruit bud differentiation and the reports were issued accordingly.

Plant Physiology Laboratory

Nashik

A total of 4257 samples of onion and garlic received from different field trials were analysed for total soluble solids, dry matter, moisture, leaf area, leaf dry matter, pyruvic acid, reducing sugar, non-reducing sugar as well as total sugar.

Karnal

A total of 614 samples of onion and garlic received from different field trials were analysed for total soluble solids, dry matter and pyruvic acid contents.

Seed Testing Laboratory

New Delhi

A total of 1636 seed samples of vegetables, cereals, pulses, oil seeds and flowers seed were received and tested for the germination, moisture and physical purity (GMP).

Soil Testing and Biochemistry Laboratory

Nashik

A total of 2146 samples of soil, irrigation water, plant petiole, grape wine, table grapes, organic manure, FYM, and vermi-compost were tested.

Soil Health Card Mission

A total of 1114 soil samples received from Kalwan taluka of Nashik under RKYV project of Maharashtra Government for soil health card mission were tested in the laboratory and 1114 Soil Health Cards were generated for distribution to the concerned farmers.

KVK Products

KVK Ujwa, Delhi

The 155.49 Q of certified seed of wheat, mustard and palak seed was produced under the seed chain by certification agencies and provided to Delhi, Haryana and Uttar Pradesh farmers. The 1135 Q vermicompost, kitchen garden kits, honey 666 kg and vegetable seedling was sold during the year 2019-20.

9

Agriculture Economics

Cost of Production of Onion, Garlic and Potato's

Onion, garlic and potato are important vegetable crops and grown in India on large scale as well as come under TOP (Tomato, Onion & Potato) crop scheme under the Ministry of Food Processing and Industry, Govt. of India. These crops are cultivated in almost all the 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 increase 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 field manually. Depending upon the aims, the crop in *khraif season*, requires 5-7 irrigations, 10-15 in late *kharif* and 15-18 during *rabi* session. Due to frequent irrigations and use of high fertilizers, 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 the cloves in the main field. Like the onion and 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 increase the cost of production.

The Potato crop is cultivated mainly in *rabi* season, however, in the states of Madhya Pradesh, Odisha, Maharashtra and Karnataka, *kharif* crop is also grown. Like onion and garlic crops, 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 increase 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 upto 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. 334 to 632 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. 564 to 932 per quintal, upon the labour wages, cost of seed, other inputs and yield of onion (**Table 3**).
- The cost of production of *kharif* onion produced through locally grown bulblets in Coimbatore district at Tamil Nadu was Rs. 1137/q, while it was Rs. 1733/q for crop raised by transplanting seedlings (**Table 3**).
- The cost of production of *rabi* onion bulb varied from Rs. 478 to 1196/q raised by seedlings (**Table 4**).
- The cost of production of garlic ranged from Rs. 1770 to Rs. 3342/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 528 to Rs 815.

Area and Production of Onion, Garlic and Potato

The production of onion, and garlic crop increased during the period under report. Onion production was accounted more by around 14.74%, -5.94% potato and -1.70% garlic as compared to 2018-19. The state -wise area, production and productivity of onion, garlic and potato during 2019-2020 are given in **Table 7, 8, 9,** respectively.

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 11.49 lakh tones, 33.32% less than the previous year (2018-19). The onion was exported mainly to Malaysia, Singapore, Bangladesh, Nepal, Sri Lanka, Mauritius and Gulf countries (**Table 10 & 12**).

The export of garlic was 7797 MT, 41% lesser than previous year. The garlic was exported mainly to Canada, Mexico, Australia, Thailand, Sri Lanka, Nepal, Taiwan, Bangladesh and Poland (**Table 13**).

The Potato was exported mainly to Nepal, Brazil Germany, Maldives, Arab Emirates, the USA, Oman and UK. A total export of potato was 427075.26 MT, about 13.97% more than Previous year. The export garlic are given in **Table 14**.

10

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 and Farmer's Welfare

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

Department of Agriculture Research and Education – Indian Council of Agriculture 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
- Rain 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

Transfer of Technology

(A) Extension

The NHRDF is involved in extension education of farmers and trainers since its inception. The object behind that 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 and other exportable vegetable crops under this programme. The NHRDF implemented extension education programmes through demonstrations, trainings, filed day meetings, providing literature and arranging exhibitions, seminars and group visits through different centres located almost all over the country for onion, garlic and other vegetables. The extension centres implementing the transfer of technology programmes are given below:

S. No.	NHRDF Centre	State Covered
1.	Bhatinda	Punjab
2.	Boudh	Odisha
3.	Chitegaon	Maharashtra
4.	Coimbatore	Tamil Nadu
5.	Delhi	Delhi
6.	Deoria	Uttar Pradesh
7.	Hubli	Karnataka
8.	Indore	Madhya Pradesh & Chhattisgarh
9.	Karnal	Haryana, H.P., J&K, Uttarakhand
10.	Kurnool	Andhra Pradesh & Telangana
11.	Kota	Rajasthan
12.	Kombai	Tamil Nadu
13.	Lasalgaon	Maharashtra
14.	Patna	Bihar, Jharkhand, West Bengal and NE states
15.	Mahua	Gujarat
16.	Rajkot	Gujarat
17.	Sinnar	Maharashtra
18.	Krishi Vigyan Kendra	NCT Delhi

(B) Electronic Media Coverage

S. No.	Topic	Programme	Date & time of telecast/broadcast
	Dr. P. K. Gupta, Director		
1.	*Pyaj ka ropan evam lehsun ki dekhbhal*	All India Radio, Indraprashta	09 Jan, 2020, 7.00 pm
2.	*Krishi Utthan Main KVK ki upyogita*	DD Kisan, Hello Live	19 Jan, 2020, 6.00 pm
3.	*Pyaj Evam Lehsun ki Dekhbhal*	– do –	22 Jan, 2020, 6.00 pm
4.	*Rabi pyaj evam lehsun ki katai va bhandaran*	– do –	24 May, 2020, 6.30 pm
5.	*Solar Farm Demonstration Unit*	– do –	20 Oct, 2020, 5.30 pm
6.	*Kharif onion ki utpadan takneek*	– do –	16 Sep, 2020 6.00 pm
7.	MIDH Schemes of GOI	Chaupal Charcha DD Kisaan	9 July, 2020, 9.00 am
	Dr. Sujay Pandey, AD (Entomology)		
1.	*Madhumakhi Palan Paramparik Krishi ke sath ek aadunik vayavasay"*	DD Kisan, Hello Live	05 Mar, 2020, 6.00 pm to 7.00 pm
	Dr. (Mrs) Ritu Singh, SMS (Home Science)		
1.	*Krishi Main Mahila on kee Bhagdari*	DD Kisan, Hello Live	13 Jan, 2020, 6.00 pm
2.	Food Processing	– do –	5 Jun, 2020, 6.00 pm
3.	*Vishwa Mahila Diwas*	– do –	9 Mar, 2020, 6.30 pm
	Sh. Rakesh Kumar, SMS (Horticulture)		
1.	*Bail wali sabzi ki kheti*	DD Kisan, Hello Live	18 Feb, 2020 6.30 to 7 pm
2.	*Nursery worker sahayak Mali ka kaushal vikas per parishan*	– do –	07 Mar, 2020, 6.00 pm
3.	Package & practices of summer season crops during COVID-19	– do –	07 May, 2020, 6.00 pm
4.	*Bagwani Faslon Ke Samasamvik Karya*	– do –	14 May, 2020, 6.00 pm
5.	*Kharif mausam main sabjiyon ki samsamayik karya*	– do –	24 Aug, 2020, 6.00 pm
	Dr. D. K. Rana, SMS (Plant Protection)		
1.	*Gehu ki katai ke smay Corona se savdhan*	All India Radio	21 April, 2020, 6.00 pm
	Dr. Samar Pal Singh, SMS (Agromet)		
1.	Agriculture practices with prevention measurement of COVID-19	DD Kisan, Hello Live	07 May, 2020, 6.00 pm
2.	*Kisan gosthi on direct seeded rice*	– do –	22 May, 2020, 6.00 pm
	Sh. Kailash, SMS (Agriculture Extension)		
1.	*Pardhan Mantri Nidhi Kisan Yojana*	– do –	21 Feb, 2020, 6.00 pm
2.	*Krishak Utpadak Sangathan*	– do –	14 May, 2020, 6.00 pm
	Dr. S. K. Tiwari, STO (Seed)		
1.	Cultivation of Cucurbitaceous Vegetables	All India Radio Gram Sansar & Krishi Jagat	4 Feb, 2020, 6.05 pm

S. No.	Topic	Programme	Date & time of telecast/broadcast
2.	*Corona Virus se bachao hetu chhat per Sabzi Bagwani*	All India Radio Gram Sansar & Krishi Jagat	2 June, 2020, 2.30 pm
3.	*Shitkalin Sabji utpadan*	Gaon Kisan	01 Oct, 2020 4.00 pm
4.	Cold storage and Micro Irrigation	Chopal Charcha	1 Oct, 2020, 9.00 am
	Sh. S. C. Tiwari, STO (Plant Pathology)		
1.	Mushroom Production Technologies	All India Radio	28 Dec, 2020, 6.30 pm
	Sh. A. K. Mishra, STO (Horticulture)		
1.	*Pyaj or Lehsun kee khodai or savadhaniyan*	Hello kisan of Akashvani (AIR) Kota	11 Feb, 2020, 6.30 pm
2.	Post Harvest Management of Garlic	Radio Talk	05 May, 2020

	KVK, Ujwa, Delhi			
1.	Central Govt. Schemes	Rakesh Kumar, Dr. Samarpal Singh, Sh. Kailash and Sh. Brijesh Yadav	Chaupal Charcha DD Kisaan	28 July, 2020, 9.00 am
2.	Coverage of training programme under Poshan Maah 2020	Mrs. Ritu Singh		25 Sept, 2020

(C) Visitors

A total of 2026 farmers, 973 students and 106 officers, from different states of the country visited NHRDF to know the research and developmental activities in horticultural crops, especially the onion and garlic. The details are given here under.

Sr. No.	Name	Designation & Organization	Date
	BOUDH, ODISHA		
1.	Sh. Lalatendu Mishra, ORS	Collector & DM, Boudh	21.08.2019
2.	Sh. Surya Das	PD, DRDA, Boudh	11.09.2019
3.	Sh. Suresh Pant, IFS	Berhampur Circle, Govt. of Odisha	19.09.2019
4.	Sh. Jacobina Sethy	DFO	19.09.2019
5.	Dr. Rabi Pattanaik	Associate Dean, College of Horticulture, Chillida, Sambalpur	06.08.2019
6.	Dr. Lilymoony Tripathy	Associate Professor, College of Horticulture, Chillida, Sambalpur	06.08.2019
7.	Sh. Himanshu Acharya	ADH, Boudh	06.11.2019 & 13.11.2019
8.	Sh. Gyana Ranjan Diggal	AHO, Harbhanga	06.11.2019 & 13.11.2019

Sr. No.	Name	Designation & Organization	Date
9.	Sh. Dipti Sagarika Sahoo	AHO, Cuttack	06.11.2019 & 13.11.2019
10.	Sh. Lalatendu Mishra, ORS	Collector, Boudh	22 & 23.10.2019
11.	Sh. Mahidhar Ram	Hon'ble MLA, Kantamal, Boudh	23.10.2019
12.	Sh. N.C. Jyoti Ranjan Naik	OAS, Sub Collector	24.10.2019
13.	Sh. Suryamani Moharana	Asst. Director of Horticulture, Boudh	22, 23, 24 and 31.10.2019
14.	Sh. Surendra Pradhan	Manager, Central Cooperative Bank, Odisha	24.10.2019
15.	Dr. Pravat Chandra Pradhan	Jr. Scientist, PFDC, OUAT, Bhubneshwar	23.10.2019 and 24.10.2019
16.	Dr. Banani Mohanty, IAS	Additional Secretary to Govt. of Odisha	31.10.2019
17.	Sh. Sangram Pattanaik, IAS	Agronomist, Department of A&FW	31.10.2019
18.	Sh. Rama Chandra Nail	Deputy Director of Agriculture, Odisha	31.10.2019
19.	Dr. Sanjaya Kumar Dash	Dean, College of Agriculture Engineering and Nodal Officer, Govt. of Odisha	26.02.2022
		HEAD OFFICE DELHI	
1.	Dr. B.N.S. Murthy	Horticulture Commissioner, Ministry of Agriculture & Farmers Welfare, Govt. of India	04.07.2019
2.	Sh. C. B. Singh	Assistant General Manager, APEDA, New Delhi	06.07.2019
3.	Dr. Balraj Singh	Project Coordinator, ICAR, AICRP on Honey Bees and Pollinators, New Delhi and Ex V.C, Agriculture University, Jodhpur, Rajasthan	03.02.2020
4.	Dr. Kuldeep Singh	Director, ICAR-NBPGR, New Delhi	10.02.2020
5.	Dr. Brahm Singh	Director (Formerly), DRDO, Ministry of Defense, Govt. of India	13.02.2020
		INDORE	
1.	Sh. R. S. Tomar	Seed Certification Officer, Indore (Madhya Pradesh)	26.04.2019
2.	Sh. Banshi Lal Gujar	Board Member, NHB, Mandsaur	26.07.2019
3.	Sh. P.S. Kushwaha	NAFED, New Delhi	02.09.2019
4.	Dr. Rewa Singh	Joint Director Agriculture, Indore	29.11.2019
5.	Dr. M. Jadav	COA, DARP, Indore	10.10.2019
6.	Dr. O. P. Girothia	COA, DARP, Indore	10.10.2019
7.	Sh. Abhay Jain	MPSSCA, Indore	10.10.2019
8.	Sh. B. L. Malvia	DDA, Rajgarh	11.10.2019
9.	Dr. R.S. Goswami	Director, Animal & Agriculture, Ratlam	21.01.2020
10.	Dr. R. S. Goswami	NABARD, Ratlam	03.02.2022

Sr. No.	Name	Designation & Organization	Date
		KARNAL	
1.	Dr. Samar Singh	Director Extension, Horticulture University, Karnal, (Haryana)	16.04.2019
2.	Dr. V. K. Pandita	Prinicipal Scientist & Head, Regional Research Station, ICAR-IARI, Karnal (Haryana)	16.04.2019
3.	Dr. Satbir Singh Jhakar	Department of Seed Sci. & Tech. CCS HAU, Hisar (Haryana)	17.09.2019
4.	Dr. Grewal	Ex. Principal Scientist, PAU, Ludhiana	11.03.2020
		KOTA	
1.	Dr. Sunil Kumar	SMS, Agronomy, KVK, Anta	05.10.2019
2.	Dr. N. B. Malav	AD(H), District-Baran	15.10.2019
3.	Sh. Ramrasad Meena	Dy. Director Agriculture & PD ATMA, Jhalawar	17.02.2020
		NASHIK	
1.	Dr. V. B. Mahajan	Principal Scientist, ICAR-DOGR, Pune, (Maharashtra)	15.04.2019
2.	Sh. Rajaram Patil	SMS (Agri.), KVK, Nashik, (Maharashtra)	15.04.2019
3.	Dr. Madan Lal	DHO, Karnal	26.08.2019
4.	Dr. Ram Pal Singh	SMS, TDC, Panipat	26.08.2019
5.	Dr. Ramesh Kushwah	DHO, Sonipat	26.08.2019
6.	Sh. Harbhajan Singh	Vice President, NHRDF	04.09.2019
7.	Dr. Ramesh Palson	DHO, Yamuna Nagar	11.09.2019
8.	Dr. Jogindra Birla	DHO, Kurukshetra	11.09.2019
9.	Dr. Satya Narayan	SMS, LSTF, Ladwa, Karnal	11.09.2019
10	Dr. Soran Singh	SMS, CSTF, Ladwa, Karnal	11.09.2019
11.	Dr. Anshul Anand	DHO, Kaithal	11.09.2019
12.	Dr. R. S. Punia	SMS, Gharondha, Karnal	11.09.2019
13.	Dr. Ram Raj Meena	Assistant Professor, Agriculture University, Hissar	17.09.2019
14.	Dr. K. Keshavulu	Director & MD, TSSDCL, Hyderabad	21.01.2020
15.	Sh. Rajesh Verma, IAS	Special Secretary, Govt. of India, New Delhi	14.02.2020
16.	Sh. V.L.N. Prasad	Under Secretary, Govt. of Telangana	22.02.2020
		RAJKOT	
1.	Dr. G. J. Katariya	Assitt. Director (H), Rajkot	11.09.2019
2.	Dr. V. D. Khanpara	Rtd. Professor, Agronomy, JAU, Junagarh	05.10.2019
3.	Dr. A. V. Khanpara	Principal, Poly. Agri. College, Halvad, Morbi	05.10.2019
4.	Sh. Rajesh Patel	Director, Fishfa Biogenices, Rajkot	07.10.2019
		SINNAR	
1.	Mr. Kirti Vardhan	Deputy Secretary, Ministry of Jalshakti, New Delhi	02.08.2019

Sr. No.	Name	Designation & Organization	Date
2.	Dr. Vasumana, IAS,	Secretary, Jalshakti Mantralaya, New Delhi	13.08.2019
3.	Sh. V L N Prasad, IAS	Govt. of Telagana	22.02.2020
		KURNOOL	
1.	Dr. C V C M Reddy	Senior Scientist, RARS, Nandyal (Kurnool)	18.04.2019
2.	Sh. M. V. Shesha Reddy	Asst. Director Agriculture, Kurnool	21.11.2019
		LASALGAON	
1.	B. K. Prusty	Directorate of Marketing. and Inspection, MOAFW, Govt. of India (New Delhi)	24.04.2019
2.	Dr. R. K. Tomar	Joint Director (Horticulture), Department of Horticulture, UP Govt., Lucknow	11.10.2019
3.	Sh. Rajesh Verma, IAS	Special Secretary, Govt. of India, New Delhi	14.02.2020
		PATNA	
1.	Dr. B. K. Mandal	Senior Scientist & Head-KVK, Shiekhpura	09.11.2019
2.	Dr. Shambhu Kr. Ray	Senior Scientist & Head KVK, Lakhisarai	16.11.2019
3.	Dr. Surendra Chourasia	Senior Scientist & Head KVK, Arval	25.11.2019
4.	Dr. Arvind Kumar Singh	Senior Scientist & Head KVK, Motihari	29.11.2019
5.	Sh. Vikash Kumar	Assistant Director Horticulture, Bhagalpur	27.02.2020
6.	Sh. Shambhu Prasad	Assistant Director Horticulture, Nawada	08.03.2020
7.	Sh. Shailendra Kumar	Assistant Director Horticulture, Shekhpura	17.03.2020
		MAHUVA	
1.	Dorairaj Kuppurangam	Member of International Competence Center for Organic Agriculture, Bengaluru	13.11.2019
2.	Dr. G. M. Pate	Consultant of Pedilite Ind., Ahmedabad	18.11.2019
3.	Sh. Shivabhai Jairambhai Gohil	Ex. MLA, Talaja	14.10.2019

(D) Trainings

Trainings imparted by NHRDF Centers to Agricultural/Horticultural Officers/Farmers of India and international participants :

Date	Duration (Days)	No. of farmers/ students*	District & state/ Country	Sponsored by
		DELHI		
4-6 March, 2019	3	10	Delhi	MIDH
25 May – 01 June, 2019	8	4	Sri Lanka	Agriculture Department, Sri Lanka
16-19 September, 2019	3	19	Delhi	MIDH

Date	Duration (Days)	No. of farmers/ students*	District & state/ Country	Sponsored by
29 -31 December, 2019	3	29	Delhi	MIDH
06 -10 January, 2020	5	42	Rajsthan	ATMA
13 – 15 January, 2020	3	19	National Level	MIDH
10 -12 February, 2020	3	19	Delhi	MIDH
NASHIK				
04 -08 April, 2019	5	31	Bhilwada (Rajasthan)	ATMA, Bhilwada
31 May- 06 June, 2019	5	11	Bari (Bangladesh)	BARI, Bangladesh
17-21 September, 2019	5	32	Bundi (Rajasthan)	ATMA, Bundi
24-28 September, 2019	5	32	Bundi (Rajasthan)	ATMA, Bundi
26-30 November, 2019	5	50	Akola (Maharashtra)	ATMA, Akola
1 January, 2020	1	25	Kutra, Sundergarh	ATMA, Sundergarh
06 -10 January, 2020	5	42	Rajasthan	ATMA, Kota
03- 07 February, 2020	5	42	Rajasthan	ATMA, Kota
11-15 February, 2020	5	33	Baran (Rajasthan)	ATMA, Baran
13 -14 February, 2020	2	20	Kalahandi/ Odisha	MIDH
19 February, 2020	1	75	Angul/ Odisha	Foundation for Ecological Society, ---
24-26 February, 2020	3	15	Erandol	ATMA, Erandol
24-26 February, 2020	3	15	Dharangaon	ATMA, Dharangaon
24-26 February, 2020	3	15	Bhadgaon	ATMA, Bhadgaon
24 Feb.- 01 March, 2020	5	30	Chittorgarh (Rajasthan)	ATMA, Chittorgarh
28 Feb. – 05 March, 2020	5	30	Bhilwada (Rajasthan)	ATMA, Bhilwada
BOUDH				
23-24. October 2019	2	150	Boudh (Odisha)	ADH, Boudh
17-18 October, 2019	2	21	Madanpur Khurd (Odisha)	Maa Durga Sanskrutika Parisada & Pathagara, Madanpur
29-30 November, 2019	2	22	Bhubaneswar (Odisha)	NIGAM, Bhubaneswar
10 -11 December, 2019	2	20	Rampur, Kalahandi (Odisha)	ATMA, Kalahandi
10 - 14 December, 2019	5	20	(Odisha)	ATMA, Malkangiri
17 -19 December, 2019	3	20	(Odisha)	ATMA, K. Guma, Malkangiri
24 – 26 December, 2020	3	20	(Odisha)	ATMA, Sorada Ganjam
28 December, 2020	1	20	(Odisha)	ATMA, Bari, Jajpur
27 January, 2020	1	70	Boudh	Mission Shakti

Colour Plate No. 5

Trainings Imparted to Agriculture/Horticulture Officials and Farmers

International Training at Delhi

Delhi

Nashik, Maharashtra

Nashik, Maharashtra

Boudh, Odisha

Karnal, Haryana

Colour Plate No. 6

Exposure Visit of Farmers at NHRDF Centers

Haryana Farmers at Nashik

Jammu & Kashmir Farmers at Karnal

Farmers Tatanagar (Jharkhand) at Nashik

Farmers of Mandsaur district at Indore

Farmers from Madhya Pradesh at Nashik

Farmer from Uttar Pradesh at Karnal

Colour Plate No. 7

NHRDF Centres Participated in Exhibitions

NHRDF, Mahuva participated in KRISHI MELA. 2019 APMC Mahuva.

NHRDF, Rajkot participated in Kharif Krishi Mahotsava at APMC Rajkot.

NHRDF Karnal participated in Farmers-Scientists workshop at ICAR-IIWBR, Karnal.

NHRDF Delhi participated in Krishi Vigyan Mela at IARI, Pusa, New Delhi

NHRDF Kota participated in Krishi Vigyan Mela at Baran (Rajasthan)

Colour Plate No. 8

Higher Official at NHRDF Centers

Sh. Rajesh Verma, IAS, Special Secretory, Dept. of Agriculture & Farmers Welfare, Govt. of India visited RRS, Nashik

Dr. Banani Mohanty, IAS, Additional Secretary, Govt. of Odisha, at NHRDF Boudh

Sri Gobardhan Debta, Under Secretary to Government of Odisha., visited NHRDF, Boudh

NABL Auditor team visited NHRDF, Nashik for assessment of Residue Analysis Laboratory.

ICAR-DOGR, Pune Team visits Nashik

Dr. H. P. Singh, Ex. DDG (Hort.), ICAR, Horticulture Commissioner, Govt. of India, New Delhi visited Nashik

Dr. K. Keshavulu, Director & MD, Telangana State Seeds Development Corporation Ltd. (TSSDCL), Hyderabad visited, Nashik

Colour Plate No. 9

Field Day

NHRDF, Karnal arranged Field Day on onion at Village- Rasulpur, Kaithal (Haryana)

NHRDF Patna arranged Field Day on onion at Dharhara, Dumrao, Buxar (Bihar)

NHRDF Boudh arranged Field Day on onion at Tureikela, Bolangir (Odisha)

KVK Ujwa, Delhi organized Field Day on Mustard at Ghumanhera, Delhi

NHRDF Hubli organized rabi onion Field Day at Basavanbagewadi (Karnataka)

NHRDF Kota organized rabi onion Field Day at Jhalwara (Rajasthan)

12

Krishi Vigyan Kendra - Major Activities

1. Front line demonstrations

A total of 280 frontline demonstrations in *Kharif* (2019) and (*Rabi)* 2019-20 season were conducted, covering an area of 106 ha on oilseeds, pulses, cereal and vegetable crops under different schemes.

Front Line Demonstration on Summer Moong

2. Vocational Training

The NHRDF KVK at Ujwa, Delhi is playing a vital role in empowering farmer, farm women and youths of the Delhi by organizing various need based self employment and income generating training programmes. These are given below:

S. No.	Title	Duration (21 days)	No. of Trainees
1.	Mushroom Production Technology	10-31th October, 2019	21
2.	Food Processing	16th November, 2019. - 6th December, 2019	20
3.	Bee Keeping	09 – 29th January, 2020	17
4.	Vermicomposting	25th February, 2019 - 1st March, 2019	20

3. Sponsored Programmes conducted by KVK

A. Promotion of Agricultural Mechanization for *In-situ* Management of Crop Residues in the state of NCT Delhi.

Under the CRM Project, Krishi Vigyan Kendra, Delhi conducted demonstrations, capacity building activities (various extension activities including training, awareness campaigns, press notes, wall writing, hoarding, travelling seminar, farmer-scientist interaction, kisan mela, National Conference) *etc*.. Krishi Vigyan Kendra adopted villages under CRM Project and performed the activities given in the table below to create awareness among farmers/farm women towards harmful effects of crop residue burning for saving of precious soil and environmental resources through sustainable crop residue management.

S. No.	Name of Programme	No. of Programme	No. of Farmers Participated
01.	Awareness-Cum-Training Programme	8	220
02	Training Programme	4	100
03	National Conference	1	1500
04.	Demonstration (ha.)	50	76
05.	Publicity through Wall Writing, Hoarding and literature distribution		

Publicity Material such as Pamphlets and Folder Jingle Message

Kisan Mela under Jal Shakti Abhiyan

The KVK organized two mega events "Kisan Mela" on 03/08/2019 and 17/08/2019 at village Ghumenhera, and KVK campus respectively. The main objective of the event was to create awareness among the farmers and other stakeholders on water conservation in Nazafgarh and Kapashera blocks of South-West district of Delhi. During the mela exhibition through different informative stalls on conserving water in fields, solar power harvesting was organized.

Sh. Gulab Singh, MLA and Ms. Soumya Sharma, IAS Asst. Commissioner, Farmers and student gathering in Kisan Mela, Ghumenhera, South-West, Delhi visiting the exhibition during the Kisan Mela.

Display of Models by students and prize distribution ceremony for poster making and model making competition in Kisan Mela

Awarded Students for Model and Kisan Poster Making Competition

Farmers augesting gathering during Jal Shakti under Jal Shakti Abhiyan Mela at KVK Campus

Farmers Participation in Kisan Mela at KVK Campus

Plantation Drive of Amala & Bale by Shri Madhup Vyas, IAS, Development Commissioner, Govt. of NCT Delhi

Glimpse of other activities performed under Jal Shakti Abhiyan

Plantation by Miss Saumya Sharma, IAS, Assistant Commissioner, South-West, Delhi at KVK campus Ujwa, Delhi.

13

Seed and Planting Material

Seed is the primary agri-input for production of agricultural/horticultural crops. The expected results of most advanced technology will not be achieved without using quality seed/planting material. Timely availability of seed of recommended varieties is of utmost importance in maximizing per unit returns and productivity. In 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. The NHRDF is engaged in Nucleus, Breeder, Foundation and Truthful Labeled seed of improved varieties of onion, garlic, potato and others vegetables.

During 2019-20 NHRDF produced and distributed 6.49 q of Nucleus/breeder, 31.20 q of Foundation, 48.18 q of Certified and 751.98 q of Truthful seed of different onion varieties. In case of garlic, 160.07 q of Nucleus/breeder, 254.41 q of Foundation, 287.49 q of Certified and 5030.86 q of Truthful Labeled garlic seed/cloves were also produced and distributed.

Table 1 : Quantity of seed produced and distributed (2019-20)

Sr. No.	CROP	Varieties	Seed produced (q)	Seed distributed (q)
1.	Bitter Gourd	PH-2 (Hybrid)	0.07	0.05
2.	Bottle Gourd	PH-3, Pusa Naveen	9.52	5.90
3.	Brinjal	Pusa Uttam	0.26	0.07
4.	Cauliflower	S.A.-Sabour Agrim	0.60	0.69
5.	Chilli	K-1	11.51	5.52
6.	Coriander	RKD-18, GDLC-1	147.04	20.37
7.	Cowpea	CP-4,CP-6	122.33	53.18
8.	Cucumber	Swarna Sheetal	0.00	0.01
9.	Drumstic	PKM-1	74.95	12.90
10.	Garlic	G-50/G-282/G-323/G-384/G-404, G-313	5572.75	3195.48
11.	Methi	PEB, Ajmer methi-3, G-2	79.49	19.03
12.	Musk Melon	Pusa Madhuras	3.62	2.20
13.	Mustard	Pusa Vijay	0.00	4.27
14.	Okra	Arka Anamika	0.00	27.03
15.	Onion	ADR/ALR/NHRDF Red/NHRDF Red-2 & NHRDF Red-3, NHRDF Red-4	834.14	1775.60
16.	Paddy	Pusa- 44	0.00	28.68
17.	Palak	Pusa All Green	15.14	9.86
18.	Pea	AP-3/G-10	1049.05	117.38
19.	Potato	Kufri Bahar/ Kufri Pukhraj/ Kufri Khyati/ Kufri Jyoti/ Kufri Ashoka	7279.00	6802.79
20.	Pumpkin	Ousa Vishwash	0.00	0.01
21.	Radish	Pusa Chetki	2.64	0.14
22.	Soyabean	JS-335	39.60	142.35
23.	Sponge Gourd	Kashi Divya	0.44	0.05
24.	Tomato	PKM-1/Arka Rakshak	8.14	4.24
	Total		**15250.28**	**12227.76**

14

Publications

Research Papers/Book Chapters

- Gupta, P. K. and Bhasker P. (2019). Innovative approaches for production of onion and garlic. *Shodh Chintan* (11), 2019: Pp 264-269
- Gupta R. C. and Gupta P. K. (2020). Tips for integrated management of root-knot nematode in garlic (*Allium sativum*). *Agriculture and food News letter* (3), Vol. 2 2020: Pp 185-186
- Gupta, R. C. and Pandey S. (2019). Root-knot nematode in garlic caused by Meloidogyne species: first record from Karnal district of Haryana state. *Journal of Spices and Aromatic Crops* Vol. 27 (2), 2018: Pp 158-160
- Pathak M. K., Pandey M. K., Gupta R. C., Sharma H. P. and Gupta, P. K. (2020). Management of thrips for garlic production. *Agriculture and food enews letter* (2), Vol.2 2020: Pp 354-356
- Pandey M. K, Pathak M. K., Gupta R. C., Sharma H. P. and Gupta, P. K. (2020). Management of powdery mildew disease for quality production of pepper. *Agriculture and food enews letter* (2), Vol. 2 2020: Pp 362-364
- Pathak M. K., Pandey Sujay, Pandey M. K., Gupta R. C., Sharma H. P. and Gupta P. K. (2020): Evaluation of different insecticides for management of onion thrips. *Journal of Entomology and Zoology studies* 2020, 8(1): Pp 1463-1468
- Bhasker, P., Gupta, P. K. and Sharma, H. P. (2020): Role of salicylic acid on growth, yield, quality and disease pest reaction of onion (*Allium cepa* L.) cv Agrifound Light Red. *SAARC Journal of Agriculture*. 18(1): Pp 39-49
- S.S. Ray, S. Mamta, M.M. Kimothi, Pradeep Kumar, Seema Sehgal, K.R. Manjunath, B. K. Bhattacharya, K. N. Choudhary, Uday Raj, K.J. Hebbar, C.S. Murthy, S.V.C. Kameswara Rao, P.L.N. Raju, B.K. handique, C. Goswami, H.P. Sharma, K.K. Singh, A.K. Upadhayay and Mamta Saxena (2019). Horticultural crop assessment and development using remote sensing, Chapter-41 pages 609-623, published in book "Shaping the Future of Horticulture" by Dr. K.L. Chadha, Dr. S.K. Singh, Dr. Jai Prakash & Dr. V.B. Patel.
- Bhaskar P., Gupta P. K. and Sharma H. P. (2020), Protection of onion seed crop against hailstorm damage, *Indian Journal of Seed Research*, pp: 48
- Bhaskar P., Gupta P. K., Rayte B. P. and Ambare T. P. (2020) Modern NHRDF onion storage structure of onion under sub-tropical condition, *Vegetable Science*, Chapter: 47, p. 261-265
- Singh Ritu (2020). Reducing nutritional Anemia by iron supplementation in adolescent girls in rural area of Delhi, *Journal of Community Mobilization and Sustainable Development*, 15, p. 175-180.

15

Administration

Staff Position

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

A) Appointments

1. Shri Rahul Dabas joined as Financial Advisor cum Accounts Officer at New Delhi on 01/05/2019.
2. Shri Vivek Kumar joined as Sr. Accounts Assistant at New Delhi on 25/10/2019.
3. Shri Ravi Shokeen joined as Sr. Administrative Assistant at New Delhi on 01/11/2019.

B) Transfers

1. Shri G.C. Kondaiah, Attendant transferred from Kombai (Dindigul) to Rajkot and joined duty on 07/05/2019 at Rajkot.
2. Shri Ajit Patra, TO (H) transferred from Boudh to Karnal and joined duty on 10/05/2019 at Karnal.
3. Shri Ram Tirth Gupta, Attendant transferred from Rajkot to Deoria and joined duty on 13/05/2019 at Deoria.

C) Retirements

1. Shri Suresh Babu, Technical Assistant, Karnal on 30/06/2019
2. Shri Ram Pyare Gupta, SAA, Janakpuri, New Delhi on 31/07/2019
3. Shri Bhasker Londe, Attendant, Sinnar on 31/07/2019
4. Shri Ratan Lal, Attendant, Karnal on 31/03/2020

D) Condolence meetings

1. Late Smt. Krishna Mishra mother of Dr. Rajneesh Mishra, Dy. Director, RRS Boudh demise on 22/06/2019.
2. Late Smt. Urmila Srivastava mother of Shri M.K. Srivastava, Dy. Director, HO, New Delhi demise on 04/11/2019.
3. Late Shri Ram Araj Gupta father of Sri Deep Narayan Gupta, Technical Asstt., Kota demise on 25/12/2019.

4. Late Smt. Surja Devi mother of Sri Amar Bahadur Verma, Sr. Technical Officer, Bathinda demise on 11/01/2020.
5. Late Smt. Sanwari Devi mother of Sri Krishan Nath Prajapati, Attendant, RRS Nashik demise on 14/01/2020.
6. Late Shri Siby J. Monippally, Member, Managing Committee of NHRDF & Husband of Mrs. Beena Siby, Cochin demise on 19/01/2020.
7. Late Sri Shambhu Nath Upadhyay father of Sri Akash Kumar Upadhyay, Tech. Officer, Kurnool demise on 26/02/2020.

16

Human Resource Development

A) Trainings

S. No.	Name of officer / staff	Title of training	Duration	Organized by
1.	**Sh. Vikram Singh** Organic Chemist, RRS, Nashik	ISO/IEC 17025:2017 & Internal Audit	04 Days- 13 to 16/06/2019	ICMR-NIOH, Ahmedabad
2.	**Dr. R. C. Gupta** Asstt. Director (Pl. Path) & **Sh. M.K. Pathak** Tech. Officer, RRS, Nashik	Plant Quarantine National Regulations & Procedures	05 Days- 15 to 19/07/2019	NIPHM, Hyderabad
3.	**Sh. Krishna Nath** Prajapati, Attendant, RRS, Nashik	Pre and Post Harvest Sampling of Fruits and Vegetables for Pesticide Residue Analysis	01 Day- 05/08/2019	ICAR-NRCG, Pune
4.	**Sh. Vikram Singh** Organic Chemist, RRS Nashik	Refresher group training course on Pesticide Residue Analysis	05 Days- 19 to 23/11/2019	IARI, New Delhi
5.	**Sh. R. P. Shukla** Tech. Officer (RA) & **Sh. Avinash Mishra** Tech. Officer (RA), RRS, Nashik	one day awareness programme on Integrated assessment	01 Day- 23/11/2019	Pilot Test House, Andheri, Mumbai
6.	**Sh. M. K. Pathak** Tech. Officer (Ent.) & **Sh. M.K. Pandey** Tech. Officer (Pl. Path.), RRS, Nashik	Grading and Marking of Fruits and Vegetables	01 Day- 04/12/2019	Agmark Laboratory, Mumbai
7.	**Dr. P. K. Gupta** Director (Acting), HO, New Delhi	Improving E-Governance in Agriculture	05 Days- 02 to 06/12/2019	MANAGE, Hyderabad
8.	**Sh. S. Purushothaman** **Dr. R.P. Pandey** & **Sh. M. K. Pandey**	Environment Friendly Indigenous Crop Protection and Resource Management Alternatives	06 Days – 20 to 25/01/2020	IARI, New Delhi

S. No.	Name of officer / staff	Title of training	Duration	Organized by
9.	**Dr. Sujay Pandey** Asstt. Director (Ent.), RRS, Karnal **Sh. A. K. Mishra** Sr. Tech. Officer (H), Kota & **Sh. Kailash** SMS (AE), KVK, Ujwa, New Delhi	Documenting Success Stories	05 Days- 03 to 07/02/2020	MANAGE, Hyderabad (NDRI, Karnal)
10.	**Sh. M.K. Pathak** Tech. Officer (Ent.), RRS, Nashik	Mass Production of NPV *(Spodoptera Litura)*	03 Days- 24 to 26/02/2020	ICAR-NBAIR, Bengaluru

B) Meetings, Seminars, Workshops

Date	Particulars
	Dr. P. K. Gupta, Director, New Delhi
25-04-2019	Meeting with Hon'ble Vice-Chancellor, MG Chitrakoot regarding feasibility of *kharif* onion production in Bundelkhand area and delivered a lecture to P.G. students on Horticulture Scenario of the Country.
16-05-2019	Meeting of NHRDF Award-2018 Committee at Krishi Anusandhan Bhawan-II, New Delhi.
24-05-2019	Review Committee Meeting to finalize the 2nd Advance Estimates of area & production of horticultural crops at Krishi Bhawan, New Delhi.
03-06-2019	Along with Dr. Arpita Sharma, SMS (Agromet), Shri Kailash, SMS (Extension) and Shri Brijesh Kumar, PA (Soil Science) from KVK, Delhi attended Financial Literacy Week organized by Regional office, RBI, New Delhi.
04-06-2019	Meeting with Development Commissioner, Govt. of Delhi along with Shri Rakesh Singh, SMS (Horticulture), KVK, Delhi at Delhi Secretariat, Delhi regarding setting up of solar power system at Krishi Vigyan Kendra, Ujwa, Delhi.
07-06-2019	Round Table Conference on "Climate Change and Food Insecurity in Africa: The Policy Priorities" organized by AIFA, at The Hotel Lalit, New Delhi.
08-06-2019	Vegetable seed production programme, organized by Seed Division, DAC&FW, MOA&FW, Govt. of India and presented the seed production details at NASC Complex, Pusa, New Delhi along with Dr. S. K. Tiwari, STO (Seed), NHRDF, New Delhi.
22-23-06-2019	XXXVII Group Meeting of AICRP (VC), organized by ICAR-IIVR, Varanasi at TNAU, Coimbatore along with Dr. P. Bhasker, TO (Pl. Phy), NHRDF, Nashik, Mr. M. Sarvanan, TO (Horticulture), NHRDF, Coimbatore.
23-25-06-2019	Annual Zonal Workshop of KVKs of zone-II along with Mrs. Ritu Singh, SMS (Home Science), Dr. Samarpal Singh, SMS (Agronomy), and Dr. Raghuveer Singh, SMS (Animal Science), KVK Delhi organized by ICAR-ATARI, Jodhpur at MPUA&T, Udaipur (Rajasthan).

Date	Particulars
31-05-2019 to 02-06-2019	10th ICAR-AINRPOG Group Meeting along with Sh H. K. Sharma, Dy. Director (Seed), Dr. Sharad Tiwari, Sr. Tech. Officer (Seed), New Delhi, Sh B. K. Dubey, Dy. Director (Plant Breeding), Dr. Sujay Pandey, Asstt. Director (Ent.), Sh S. Purushothaman, Sr. Tech. Officer (Pl. Path.), Karnal (Haryana), Dr. R. C. Gupta, Asstt. Director (Pl. Path.), Dr. P. Bhasker, Tech. Officer (Pl. Phy.) and Sh M. K. Pathak, Tech. Officer (Ent.), Nashik at Division of Vegetable Science, ICAR-IARI, New Delhi.
02-07-2019	Felicitation programme of Dr. Bijender Singh, Chariman, NAFED at Constitution Club of India, Rafi Marg, New Delhi
04-07-2019	Potato Seed Production in Krishi Bhawan, New Delhi under the Chairmanship of DG. ICAR, DARE, MOA&FW, New Delhi
19-07-2019	Meeting along with Dr. J.K. Tiwari, Asstt. Director, NHRDF, Patna with Dr.M.D. Ojha and Dr. Sanjay Kumar Singh, Associate Professor & Principal, Nalanda Horticulture College, Nalanda.
19-07-2019	Meeting along with Dr. J.K. Tiwari, Asstt. Director, NHRDF, Patna with Dr. Nand Kishor, IFS, Director, Horticulture & Mission Director, Govt. of Bihar, Patna and Dr. N. Vijaya Laxmi, IAS, Secretary, Dept. of Animal Husbandry & Dairy, Govt. of Bihar.
20-07-2019	Meeting along with Dr. J.K. Tiwari, Asstt. Director, NHRDF, Patna with Dr. S. Siddharth, IAS, Principal Secretary, Dept. of Finance, Govt. of Bihar, Patna.
08-08-2019	Meeting with the Jt. Secretary & Mission Director (MIDH), MOA&FW, Govt. of India Krishi Bhawan, New Delhi along with Shri H. K. Sharma, DD (Seed) and Dr. S. K. Tiwari, STO (Seed), NHRDF, New Delhi.
16-08-2019	Meeting with Mr. Madhup Vyash, IAS, Secretary cum Development Commissioner, Govt of NCT, Delhi.
19-08-2019	Meeting with Dr. Bijaj Kertan Upadhyay, IAS, Director, Directorate of Horticulture, Govt of Odisha and Dr. Sourav Gang, IAS, Principal Secretary Department of Agriculture & Farmer Empowerment, Govt of Odisha.
20-08-2019	Meeting with Sri, Latendu Mishra, ORS, District Magistrate cum Collector, Distt. Boudh, Odisha.
22-08-2019	Meeting with Dr. D. P. Ray, Ex-Vice-Chancellor, OUAT, Bhubaneswar for seeking in guidance for Hi-Tech seed production nursery at RRS, Boudh.
22-08-2019	Meeting with Mr. Arun Sahu, Hon'ble Agriculture Minister of Odisha for signing MOU for seed production of vegetable crops by RRS, Boudh along with Dr. Rajneesh Mishra, Dy. Director & Incharge, NHRDF Boudh & Mr. Ranjeet Dash Tech. Officer.
26-08-2019	Meeting with Dr, S.K. Chadha, IFS, Managing Director, NAFED in his office regarding progress of construction of Onion storage in MP and other official matters.
28-08-2019	Review of project proposal under operation green (TOP) as a Technical member at Panchseel Bhawan, Ministry of Food Processing & Industry, Govt of India under chairmanship of Joint Secretary.
02-09-2019	27th Variety sub-release committee meeting on horticulture crops under chairmanship of Dr. A.K. Singh, Dy. Director General (Horticultural Crop), ICAR DARE, at Krishi Bhawan organized by Seed Division, MoAFW, Govt. of India.

Date	Particulars
09-09-2019	National Conference on Crop Residue Management for farmers at NASC campus organized by MoA&FW, GOI as a Co-organizing Secretary along with KVK & NHRDF Staff.
12-09-2019	Meeting with Mrs. Manisha Saxena, IAS, Secretary of Urban Development, Tourism, Govt of NCT of Delhi Secretariat.
23-09-2019	3rd Area Estimation of Horticultural crop at Krishi Bhawan, New Delhi under the chairmanship of Sr. Advisor organized by Horticulture Division, Govt of India.
30-09-2019	Review meeting of Potato Breeder Seed under chairmanship of Shri Ashwani Kumar, Joint Secretary (Seed), MoA&FW, GOI, at Krishi Bhawan, along with Dr. S. K. Tiwari, STO (Seed) HO. New Delhi.
20-11-2019	Inter-Ministerial Approval Committee (IMAC) meeting in Ministry of Food Processing Industries, August Kranti Marg, New Delhi.
17-01-2020	National Conference on Zaid Crop and Horticulture at NASC campus, Delhi organized by `Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India along with Dr. S. K. Tiwari, STO (S) & Dr. R.P. Pandey, TO (Seed) NHRDF, Delhi & Shri. Rakesh Kumar, SMS (Hort), KVK Delhi.
21-01-2020	2nd advance estimate of Horticulture crop of 2018-19 & 1st estimate of 2019-20 organized by Horticulture Division, Department of Agriculture, Cooperation & Farmers Welfare, Government of India.
05-02-2020	Annual conference of KVK of Haryana & Delhi under zone-II, Jodhpur, ICAR-ATARI, Jodhpur on Annual Action Plan-2020 along with SMS (Hort), Plant Protection & PA (Soil).
14-16-02-2020	Indian Horticulture Summit-2020 on "Mitigating climate changes for doubling farmers income through diversification" at MGCGV, Chitrakoot, M.P. and delivered a lecture on "NHRDF varieties of onion & garlic.
16-02-2020	Indian Seed Congress organized by Indian Seed Association at Aero-city Delhi along with Dr. S.K. Tiwari, STO(S).
18-19-02-2020	International convention on "Perspective to face contemporary challenges of agriculture development" organized by ICAR, Bhartiya Kisan Sangh and Bhartiya Agri-economic Research centre, New Delhi.
24-02-2020	Meeting on "Kissan Rail" project organized by National Horticulture Board, MoF&FW, Government of India at Krishi Bhawan, New Delhi.
28-02-2020	XI National KVK Conference-2020 on the theme- "Empowering Youth for Technology led Farming", organized by ICAR, New Delhi held at NASC Complex, New Delhi alongwith SMS (Horticulture, Agronomy) PA(Soil) KVK Delhi.
28-31-01-2020	Global Potato Conclave on "Road Map for better world as a panellist at Mahatma Mandir, Gandhi Nagar, Gujarat and gave lecture on "Potato Crop Production Management of Post-Harvest" organized by ICAR-CPRI, Shimla and Indian Potato Association Shimla
	Shri H. P. Sharma, Joint Director, Nashik
25-05-2019	47th AGRESCO MEET, 2019 along with Shri T. P. Ambare, STO (Hort.), NHRDF, Nasik and made a presentation on NHRDF activities at MPKV, Rahuri.

Date	Particulars
07-11-2019	"Potential Export Hub of Nashik "organized by DGFT of Maharashtra at NIMA, Nashik.
08-11-2019	Scientific Advisory Group Meeting of Krishi Vigyan Kendra, Yashwantrao Chavan Maharashtra Open University, Nashik (MS)
	Dr. Rajneesh Mishra, Dy. Director, RRS, Boudh, Odisha
18-04-2019	"Brain Storming Session on Overview of Agriculture Policy in Odisha" at IMAGE, Bhubaneswar chaired by Shri G.K. Dhal, IAS, Agriculture Production Commissioner and Dr. Saurabh Garg, Principal Secretary, Department of Agriculture & Farmers Empowerment, Govt. of Odisha.
	Shri B. K. Dubey, Dy. Director, Karnal
10-06-2019	Meeting at HSHDA, Panchkula for onion seed supply to Haryana State during *kharif,* 2019 along with Shri Shashi Kumar, TO (Horticulture), NHRDF, Karnal.
13-06-2019	Meeting with Director Agriculture, Shimla for supply of quality onion and other vegetable seeds during 2019 along with Shri R. B. Singh, AD (H) and Shri Shashi Kumar, TO (Horticulture), NHRDF, Karnal.
31-08-2019	Workshop on "Protected cultivation of horticultural crops" at Maharana Pratap Horticulture University, Uchani, Karnal.
	Dr. R. C. Gupta, Asst. Director (Pl. Pathology), Nashik
05-08-2019	Meeting on "Management strategy for false army worm- A new exotic pest of maize" in Maharashtra along with Shri T. P. Ambare, STO, Chitegaon at Office of the Dist Collector, Nashik (MS)
22-08-2019	Meeting on "Integrated pest and disease management in horticultural crops" at Regional Agriculture Extension Management Training Institute, Govt. of Maharashtra, Nashik (MS).
28-11-2019	411th CIB & RC meeting headed by Dr. S.K Malhotra, Agriculture Commissioner and Chairman of CIBRC and presented the status of *Trichoderma viride* and SNPV registration under Section 9 (3b) of Insecticide Act 1968 at Ministry of Agriculture & Farmers Welfare, New Delhi.
12-12-2019 & 17-12-2019	Meeting on "Integrated management of insect, pest and diseases of grape" organized by CIPMC, DPPQS, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi, held at Nashik.
	Dr. J. K. Tiwari, AD(H), Patna
23-10-2019	Dr. J. K. Tiwari, AD(H) alongwith Dr. H. M. Singh, STO (H), attended seminar arranged by World Vision-at Ghazipur-Vaishali on 23.10.2019.
14/21-11-2019	Training programme arranged by BAIF chandi, the lecture delivered on onion crop with introduction of NHRDF during farmers training on 14 & 21 November 2019.
	Shri Vikram Singh, Organic Chemist, Nashik
15/19-07-2019	Workshop on "Plant quarantine, national regulation and procedure" held at NIPHM, Hyderabad.
16-09-2019	The stack holder consultation for finalizing procedure for export of grape for the year 2019-20" at NRL, Pune.

Date	Particulars
	Shri A. K. Mishra, STO (H), Kota
31-08-2019	Krishi Mela organized by KVK Anta & State Department of Agriculture and delivered a lecture on onion and garlic production techniques and their post-harvest management.
23-12-2019	Governing Body meeting of ATMA under the chairmanship of District Collector Kota.
11-12-2019 & 20-12-2019	Farmer's training arranged by Chambal Fertilizer at Laserda & Dahikheda, districts Bundi & Jhalawar and delivered lecture on Improved Production Techniques of Onion and Garlic.
22-10-2019 & 13-11-2019 & 18-11-2019	District Level Farmers training under MIDH arranged by ADH Baran at KVK-Anta and by DDH Kota at Agriculture University Kota and delivered lecture on Improved Production Techniques of Onion and Garlic.
	Shri Prem Swaroop, STO (H), Deoria
22-07-2019	Farmers' fair organized by the department of Horticulture under District Horticulture Mission along with Shri A. K. Sharma, Tech. Officer and delivered a lecture on onion and garlic production.

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Finance and Accounts

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

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

The NHRDF received ₹ 5,05,13236.22 by interest from fixed deposits, ₹ 31,01,793.80 from the distribution of planting material and farm produce, ₹ 2,22,19,262.00 from the laboratory service charges, ₹ 18,49,60,927.70 from seed procurement proceeds and ₹ 28,800.00 as annual subscription. The total expenditure during 2019-20 was ₹ 26,64,59,951.38 which was in excess by ₹ 13,21,110.36 over the total receipts during the year.

The details of Statement of Affairs and Income & Expenditure are given in Annexure- I to III.

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 2020

ANNEXURE - I

Previous Year 31.03.2019	EXPENDITURE PARTICULARS	CURRENT YEAR 31.03.2020	Previous Year 31.03.2019	INCOME PARTICULARS	CURRENT YEAR 31.03.2020
84,289.00	Audit fees & Expenses	84,558.00	2,715,234.00	Farm Produce Revenue	3,101,793.80
36,320.00	Benevolent Fund	15,840.00	52,163,851.59	Interest Received / Accrued	52,179,335.52
42,637.00	Books and Periodicals	66,648.00	29,617,682.00	Laboratory Charges	22,219,262.00
721,342.00	Extension Services	805,607.00	15,900.00	Subscription Fees	28,800.00
5,425,704.00	Farm Expenses	6,337,855.00	44,531.40	Membership Fees	-
921,082.00	Insurance Charges	996,498.00	184,559.65	Closing Stock of NHRDF Publication	165,384.65
9,893,198.50	Lab Expenses	8,840,504.00	484,924.51	Deficit for the Year	25,427,003.61
1,109,309.00	Legal & Professional Fees	4,346,199.00			
900,539.00	Medical Expenses	779,157.00			
1,110,145.00	Meeting Expenses	1,053,972.00			
642,399.00	Municipal & Non-Agril. Taxes	690,498.00			
54,290,407.00	Salary and Allowances	63,281,732.00			
365,575.00	Staff Welfare	228,000.00			
359,359.00	Telephone Expenses	320,201.77			
60,640.00	Traning & Seminar	54,511.16			
506,500.00	Conveyance Expenses	998,123.00			
2,723,184.00	Gratuity Expenses	4,597,374.00			
5,756,641.00	Depreciation	9,439,742.00			
277,412.65	Opening Stock of NHRDF Publication	184,559.65			
85,226,683.15	**Total ₹**	**103,121,579.58**	**85,226,683.15**	**Total ₹**	**103,121,579.58**

As per our report of even date
For Natesh & Associates
Chartered Accountants
FRN: 106957 W

(R.Natesh)
Proprietor
[M.No.36481]
Date:-31.12.2020

NATESH AND ASSOCIATES
CHARTERED ACCOUNTANTS
NASIK

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

Income & Expenditure Account (Seed Division) for the year ended 31st March 2020

ANNEXURE - II

Previous Year 31.03.2019	EXPENDITURE PARTICULARS	CURRENT YEAR 31.03.2020	Previous Year 31.03.2019	INCOME PARTICULARS	CURRENT YEAR 31.03.2020
71,710.59	Bank Charges	145,458.35	14,327,302.00	Closing Stock of seed	12,125,738.00
1,086,489.00	Medical Expenses	1,254,951.00	97,584,912.32	Seed & Bulb Distribution	184,960,927.70
5,225,680.00	Office Rent & Maintenance	6,394,897.04	2,741,236.00	PHRC Receipts	2,648,722.00
12,516,469.00	Opening Stock of Seeds	14,327,302.00			
30,723,431.92	Procurement of Seeds & Bulbs	76,867,792.06			
356,430.00	Postage and Telegram	351,257.00			
659,166.06	Printing and Stationery	246,664.00			
41,325,031.00	Salary and Allowances	51,380,348.00			
804,225.00	Staff Welfare	746,687.00			
3,027,084.50	Travelling and Conveyance	1,791,736.50			
2,692,599.00	Vehicle Maintenance	2,441,051.50			
5,631,734.00	Water & Electricity	5,835,943.00			
2,902,053.00	Gratuity Expenses	15,966,310.00			
3,997.00	TDS Expenses	-			
2,642,666.00	Compensation & Discount	93,725.00			
28,005.00	Interest on TDS	6,111.00			
4,956,679.25	Surplus for the year	21,885,154.25			
114,653,450.32	**Total ₹**	**199,735,387.70**	**114,653,450.32**	**Total ₹**	**199,735,387.70**

As per our report of even date
For Natesh & Associates
Chartered Accountants
FRN: 106957 W

(R.Natesh)
Proprietor
[M.No.36481]
Date: -31.12.2020

NATESH AND ASSOCIATES
CHARTERED ACCOUNTANTS
NASIK

(Vijaya)
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

Statement of Affairs as on 31st March 2020

ANNEXURE - III

Previous Year 31.03.2019	Particulars	Sche-dule	Current Year 31.03.2020	Previous Year 31.03.2019	Particulars	Sche-dule	Current Year 31.03.2020
	CORPUS/DEVELOPMENT FUND			77,379,377.15	**FIXED ASSETS**	F	97,458,350.15
288,860,638.90	Op. Balance		292,657,215.64				
-675,178.00	Less during the period			77,379,377.15	**Total (₹)**		**97,458,350.15**
-484,924.51	Less deficit R&D		-25,427,003.61		**INVESTMENTS**		
4,956,679.25	Add Surplus Seed Division		21,885,154.25	728,000,000.00	Fixed Deposits	G	759,100,000.00
292,657,215.64	**Total (₹)**		**289,115,366.28**	**728,000,000.00**	**Total (₹)**		**759,100,000.00**
	RESERVES & SURPLUS	A			**CURRENT ASSETS**		
231,588,852.39	Reserve (R&D)		253,076,675.59	79,854.00	Cash in Hand		59,579.00
377,209,706.90	Revolving Fund (Seed)		409,209,706.90	73,717,321.08	Cash at Bank	H	35,976,128.14
608,798,559.29	**Total (₹)**		**662,286,382.49**	23,207,802.75	Sundry Debtors	I	58,664,477.33
	CURRENT LIABILITIES			20,002,768.00	Interest Receivable		13,859,596.00
1,330,469.84	Sundry Creditors	B	1,971,948.84	14,327,302.00	Closing Stock of Seeds		12,125,738.00
1,330,469.84	**Total (₹)**		**1,971,948.84**	184,559.65	Closing Stock of NHRDF Publication		165,384.65
	OTHER LIABILITIES			290,893.00	Prepaid Expenses		419,412.00
2,695,872.00	Earnest Money	C	2,282,812.00	-	LIC (GP and Superannuation Scheme)		500,000.00
4,298,461.00	Security Payable	D	5,223,980.00	31,515,797.00	**Grant Project Account**	E	-
69,136.00	TDS Payable		765,109.00				
1,954,787.00	PF Trust dues payable		2,052,794.00				
9,018,256.00	**Total (₹)**		**10,324,695.00**	**163,326,297.48**	**Total (₹)**		**121,770,315.12**
	PROVISIONS				**LOANS AND ADVANCES**		
60,347,696.00	Project Expenses Payable		23,773,575.00	843,672.30	Security Deposits Receivable	J	855,022.30
660,710.75	Salary Payable		497,536.75	5,936,417.00	TDS Receivable		12,008,487.00
883,072.00	Bonus payable		815,144.00				
59,000.00	Audit Fees Payable		64,900.00				
-	Provision for GST		103,279.00				
25,814.41	Provision for Imprest Expenses		397,762.21				
-	**Grant Project Account**	E	1,210,881.00				
1,691,680.00	Staff Advance / Expenses Payable	K	596,204.00				
13,290.00	**Benevolent Fund Trust**		34,500.00				
63,681,263.16	**Total (₹)**		**27,493,781.96**	**6,780,089.30**	**Total (₹)**		**12,863,509.30**
975,485,763.93	**Total (₹)**		**991,192,174.57**	**975,485,763.93**	**Total (₹)**		**991,192,174.57**

As per our report of even date
For Natesh & Associates
Chartered Accountants
FRN: 106957 W

NATESH AND ASSOCIATES CHARTERED ACCOUNTANTS NASIK

(R.Natesh)
Proprietor
[M.No.36481]
Date:-31.12.2020

(Vijayta)
Asstt. Accts. Officer

(Rahul Dabas)
FACAO

(Dr. P.K. Gupta)
Director (Acting)

Cost of Production of Onion Seed Crop 2019-20

Table 2 : Cost of production of onion seed crop 2019-20

Rs/ha

S. No.	Operations / Variety →	Gujarat						Maharashtra		
		ADR	L-883	ALR	NHRDF Red-3	NHRDF Red-4	AW	ADR	NHRDF Red-3	ALR
1	Land rent for six months	15000	15000	15000	15000	15000	15000	12000	12000	12000
2	Bulb cost (q.)	125000	125000	100000	100000	100000	125000	125000	100000	100000
3	Land Preparation	13300	13300	13300	13300	13300	13300	17680	17370	17370
4	Manures & Fertilizers	24247	24247	24247	24247	24247	24247	26576	28676	28676
5	Planting/sowing	7480	7480	7480	7480	7480	7480	20750	19950	19950
6	Weeding & Hoeing	18565	18565	18565	18565	18565	18565	17500	17000	17000
7	Plant Protection	3065	3065	3065	3065	3065	3065	17728	17728	17728
8	Irrigation	30000	30000	30000	30000	30000	30000	8420	8420	8420
9	Harvesting, curing, sorting, grading & packing	12550	12550	14550	14550	14550	14550	30410	29890	29970
10	Transportation	3000	3000	3000	3000	3000	3000	1304	6050	6050
11	Overhead charges	2000	2000	2000	2000	2000	2000	-	-	-
12	Supervisory charges	4200	4200	4200	4200	4200	4200	12575	12575	12575
13	Total (Rs)	258407	258407	235407	235407	235407	260407	289942	269658	269738
14	Bank interest	9044	9044	8239	8239	8239	9114	10148	9438	9441
15	**Grand total cost (Rs)**	**267451**	**267451**	**243646**	**243646**	**243646**	**269521**	**300090**	**279096**	**279179**
16	Average Yield (kg)	500	500	500	500	500	500	475	550	500
	Final cost per kg (Rs)	535	535	487	487	487	539	632	507	558

Contd...

S. No.	Operations	Variety →	Karnataka		Rajasthan			
			CO-ON-5	A. Rose	ADR	NHRDF Red	NHRDF Red-3	ALR
1	Land rent for six months		15000	15000	15000	15000	15000	15000
2	Bulb cost (q.)		75000	37500	125000	82500	82500	100000
3	Land Preparation		13900	13900	11400	11400	11400	11400
4	Manures & Fertilizers		29600	29600	27645	27645	27645	27645
5	Planting/sowing		8300	8300	5880	5880	5880	5880
6	Weeding & Hoeing		13500	13500	10600	10600	10600	10600
7	Plant Protection		15000	15000	4790	4790	4790	4790
8	Irrigation		8400	8400	22800	27300	27300	27300
9	Harvesting, curing, sorting, grading & packing		9000	9000	10800	10800	10800	10800
10	Transportation		6000	6000	2500	2500	2500	2500
11	Overhead charges		2000	2000	2000	2000	2000	2000
12	Supervisory charges		3000	3000	3600	3600	3600	3600
13	Total (Rs)		198700	161200	242015	204015	204015	221515
14	Bank interest		6954	5642	8471	7141	7141	7753
15	**Grand total cost (Rs)**		**205654**	**166842**	**250485**	**211155**	**211155**	**229268**
16	Average Yield (K)		450	500	500	500	500	500
	Final cost per kg (Rs)		457	334	501	422	422	459

Table 3 : Cost of production of onion bulb during *Kharif* 2019

S. No.	Operations / Variety →	Maharashtra	Gujarat			Tamil Nadu (Multiplier)		Punjab	Uttar Pradesh	Rajasthan		Andhra Pradesh
			ADR	L-883	Bulblets	Bulb	Seedling			Seedlings	Bulblets	
1	Land rent for six months	12000	15000	15000	20000	36000	36000	15000	15000	20000	20000	30000
2	Seed cost (kg.)	8800	17600	17600	37500	56250	7500	20000	12000	11000	37500	9000
3	Land Preparation	17370	10300	10300	7544	20000	20000	14900	9700	10000	8500	12000
4	Nursery raising cost	7300	9530	9530	0	0	3000	1250	6450	6000	0	4000
5	Manures & Fertilizers	28644	24005	24005	21492	20767	20767	18012	10344	9400	15132	17220
6	Transplanting	22775	13850	13850	14750	12600	12600	7500	10500	13000	12000	13000
7	Weeding & Hoeing	16650	9850	9850	14080	19250	14250	5000	11050	9300	9000	7750
8	Plant Protection	21565	2475	2475	7050	9060	8310	9350	9680	4700	4700	11125
9	Irrigation	9990	20000	20000	15600	5400	5400	0	7200	5200	6500	7375
10	Harvesting, curing, sorting, grading & packing	37890	13750	13750	15750	19080	24816	7000	22500	16200	28200	28800
11	Transportation	12000	13770	13770	11750	4680	4680	5000	500	10000	10000	6000
12	Overhead charges	-	2800	2800	2000	2340	2820	2000	-	0	0	1700
13	Supervisory charges	4650	2000	2000	4250	7500	7500	2500	-	0	0	5000
14	Total (Rs)	199634	154930	154930	171766	212927	167643	107512	114924	114800	151532	152970
15	Bank interest	9982	5423	5423	6012	3726	2934	5376	4022	4592	6061	5354
16	**Grand total cost (Rs)**	**209615**	**160352**	**160352**	**177778**	**216653**	**170577**	**112888**	**118946**	**119392**	**157593**	**158324**
17	Average Yield (q)	225	275	275	235	125	150	200	200	160	160	185
	Final cost per quintal (Rs)	932	583	583	757	1733	1137	564	595	746	985	856

Table 4 : Cost of production of *Rabi* onion bulb 2019-20

S. No.	Operations / Variety →	Gujarat	Maharashtra	Tamil Nadu	Punjab	Karnataka		Haryana
			NHDRF Red-3			A. Rose	CO-ON-5	
1	Land Rent for six months	15000	12000	36000	15000	15000	15000	55000
2	Seed Cost (kg)	13000	18400	20000	23000	1625	13500	12000
3	Land Preparation	10300	17370	20000	14900	13900	13900	12000
4	Nursery raising	3380	7250	3000	1200	800	800	3200
5	Manures & Fertilizers	24005	28683	24874	22751	18127	18127	13910
6	Transplanting	14000	21600	14700	10000	7500	7500	11000
7	Weeding & Hoeing	9850	16650	19250	6000	13500	13500	13000
8	Plant Protection	2525	20765	14000	13500	15000	15000	3000
9	Irrigation	20000	9990	7200	6600	8400	8400	4200
10	Harvesting, curing, sorting, grading & packing	13750	42000	27195	12000	9000	9000	12375
11	Transportation	16575	12000	8760	6000	6000	6000	6000
12	Overhead charges	2000	-	3285	2000	2000	2000	2500
13	Supervisory charges	2800	4650	7500	3000	3000	3000	3000
14	Total (Rs)	147185	211358	205764	135951	113852	125727	151185
15	Bank interest @ 3.5% (6 months)	2576	3698	3601	6798	5693	6286	2646
16	**Grand Total of production cost**	**149760**	**215056**	**209365**	**142748**	**119545**	**132014**	**153831**
17	Average Yield (q/ha)	265	260	175	245	250	245	220
	Final production cost/q. (Rs.)	565	867	1196	583	478	538	699

Contd...

S. No.	Operations	Uttar Pradesh	Bihar	Rajasthan	Andhra Pradesh	Odisha
1	Land Rent for six months	15000	20000	25000	30000	10000
2	Seed Cost (kg)	12000	11000	10000	11000	9000
3	Land Preparation	9800	8700	10000	10400	5300
4	Nursery raising	5250	10500	6000	6000	22400
5	Manures & Fertilizers	7844	26700	15345	21100	17664
6	Transplanting	13125	18000	12800	15000	0
7	Weeding & Hoeing	10750	19500	9000	9750	19600
8	Plant Protection	10700	13575	5155	9165	1800
9	Irrigation	11700	18000	8500	10000	6000
10	Harvesting, curing, sorting, grading & packing	18125	26250	31100	31600	40600
11	Transportation	12000	7500	10000	7000	0
12	Overhead charges	-	3000	4000	2000	-
13	Supervisory charges	-	3000	5000	5000	-
14	Total (Rs)	126294	185725	151900	168015	132364
15	Bank interest @ 3.5% (6 months)	2526	9286	7595	5881	6618
16	**Grand Total of production cost**	**128820**	**195011**	**159495**	**173896**	**138982**
17	Average Yield (q/ha)	250	300	250	275	260
	Final production cost/q. (Rs.)	515	650	638	632	534

Table 5 : Cost of production of garlic 2019-20

S. No.	Operations Variety →	Gujarat	Rajasthan	Punjab	Bihar	Haryana	Tamil Nadu	Uttar Pradesh	Odisha
1	Land Rent for six months	15000	25000	15000	20000	55000	37500	15000	10000
2	Seed Cost (q.)	84000	70000	65000	70000	75000	75000	75000	75000
3	Land Preparation	11850	5200	14900	8700	11000	13750	8000	23300
4	Manures & Fertilizers	24551	19033	22751	28416	13674	32800	9944	22527
5	Planting	10000	12000	11500	34500	0	12000	13125	14000
6	Weeding & Hoeing	13100	18625	6000	18000	16750	22500	15325	16800
7	Plant Protection	3065	11740	13500	10238	7500	21500	12200	1800
8	Irrigation	22000	24000	9600	30000	5600	4200	15200	8000
9	Harvesting, curing, sorting, grading & packing	13100	23750	8500	24000	22625	26256	21000	33600
10	Transportation	5000	7200	7000	2500	4000	18750	6400	8750
11	Overhead charges	2000	4500	2000	3000	2000	4695	-	0
12	Supervisory charges	4200	5000	3000	3000	3000	7500	-	0
13	Total (Rs)	207866	226048	178751	252354	216149	276451	191194	213777
14	Bank interest	7275	7912	6256	8832	7565	9676	10516	7482
15	**Total Cost (Rs)**	**215141**	**233960**	**185007**	**261186**	**223714**	**286127**	**201710**	**221259**
16	Average Yield (q)	65	70	100	125	75	125	75	125
	Final cost per quintal (Rs)	**3310**	**3342**	**1850**	**2089**	**2983**	**2289**	**2689**	**1770**

Table 6 : Cost of Production of Potato during 2019-20

S. No.	Operations	Punjab	Haryana	Bihar	Odisha
1	Land Rent for six month	15000	55000	10000	10000
2	Seed Cost (qt)	90000	45000	51000	57000
3	Land Preparation	16150	7000	8700	14100
4	Sowing and planting cost	2500	8900	24000	22400
5	Manures & Fertilizers	24230	17385	27000	18142
6	Weeding & Hoeing	5250	1200	15750	16800
7	Plant Protection	16800	3500	13062	1800
8	Irrigation	7500	4700	15000	3500
9	Haulm cutting, Harvesting, curing, sorting, grading & packing	11000	19625	22500	28000
10	Transportation	12000	6000	6000	0
11	Overhead charges	2000	2000	-	0
12	Supervisory charges	3000	3000	3000	0
13	Total (Rs)	205430	173310	196012	171742
14	Bank interest	7190	6066	7840	6011
15	**Total Cost (Rs)**	**212620**	**179376**	**203852**	**177753**
16	Average Yield (q)	325	340	250	250
17	**Final cost per quintal (Rs)**	**654**	**528**	**815**	**711**

Table 7 : State-wise area, production and productivity of onion during 2019-20

S. No.	State/Ut	Area ('000 ha)	Share (%)	Production ('000 MT)	Share (%)	Productivity (tonnes/ha)
1	Andhra Pradesh	43.00	3.00	981.00	3.76	22.81
2	Arunachal Pradesh					
3	Assam	8.16	0.57	88.89	0.34	10.90
4	Bihar	58.00	4.05	1313.00	5.03	22.64
5	Chhattisgarh	25.33	1.77	402.70	1.54	15.90
6	Gujarat	58.00	4.05	1422.00	5.45	24.52
7	Haryana	24.00	1.68	610.00	2.34	25.42
8	Himachal Pradesh	3.06	0.21	65.11	0.25	21.27
9	Jammu & Kashmir	4.32	0.30	77.84	0.30	18.03
10	Jharkhand	19.77	1.38	293.27	1.12	14.83
11	Karnataka	160.00	11.18	2275.00	8.72	14.22
12	Kerala	0.01		0.10	0.00	9.18
13	Madhya Pradesh	173.89	12.15	4270.70	16.37	24.56
14	Maharashtra	618.00	43.18	10683.00	40.94	17.29
15	Manipur	0.58	0.04	5.59	0.02	9.61
16	Meghalaya	0.56	0.04	5.04	0.02	8.98
17	Mizoram	0.27	0.02	1.80	0.01	6.67
18	Nagaland	0.61	0.04	5.72	0.02	9.40
19	Odisha	27.47	1.92	291.55	1.12	10.61
20	Punjab	10.34	0.72	236.49	0.91	22.88
21	Rajasthan	75.00	5.24	1242.00	4.76	16.56
22	Sikkim	0.63	0.04	35.35	0.14	56.45
23	Tamil Nadu	40.00	2.79	435.00	1.67	10.88
24	Telangana	9.50	0.66	163.20	0.63	17.18
25	Tripura	0.16	0.01	1.05	0.00	6.43
26	Uttar Pradesh	28.00	1.96	454.00	1.74	16.21
27	Uttarakhand	4.46	0.31	45.47	0.17	10.20
28	West Bengal	37.39	2.61	669.80	2.57	17.91
29	Others	0.87	0.06	16.71	0.06	19.30
	Total	**1431.37**	**100.00**	**26091.37**	**100.00**	**18.23**

Table 8 : State-wise area, production and productivity of garlic during 2019-20

Sl. No.	States/UTs	Area ('000 ha)	Share (%)	Production ('000 MT)	Share (%)	Productivity (tonnes/ha)
1	Andhra Pradesh					
2	Arunachal Pradesh	0.02	0.01	0.01	0.00	0.88
3	Assam	10.66	3.03	67.42	2.29	6.32
4	Bihar	1.65	0.47	2.45	0.08	1.49
5	Chhattisgarh	1.57	0.45	1.68	0.06	1.07
6	Gujarat	12.18	3.46	94.56	3.21	7.76
7	Haryana	3.10	0.88	41.62	1.41	13.44
8	Himachal Pradesh	3.94	1.12	2.58	0.09	0.65
9	Jammu & Kashmir	0.66	0.19	0.53	0.02	0.81
10	Jharkhand	–	–	–	–	–
11	Karnataka	1.71	0.48	8.74	0.30	5.12
12	Kerala	0.19		0.97	0.03	5.19
13	Madhya Pradesh	183.71	52.17	1869.43	63.50	10.18
19	Maharashtra	2.65	0.75	13.83	0.47	5.22
15	Manipur	–	–	–	–	–
16	Meghalaya	–	–	–	–	–
17	Mizoram	0.02	0.01	0.01	0.00	0.52
18	Nagaland	0.28	0.08	2.40	0.08	8.45
19	Odisha	12.44	3.53	45.48	1.54	3.66
20	Punjab	7.75	2.20	92.64	3.15	11.96
21	Rajasthan	68.01	19.31	416.30	14.14	6.12
22	Sikkim	–	–	–	–	–
23	Tamil Nadu	1.24	0.35	7.15	0.24	5.78
24	Telangana	0.02	0.01	0.11	0.00	4.70
25	Tripura	–	–	–	–	–
26	Uttar Pradesh	34.31	9.74	227.34	7.72	6.63
27	Uttarakhand	2.09	0.59	11.44	0.39	5.47
28	West Bengal	3.93	1.11	37.47	1.27	9.55
29	Others	–	–	–	–	–
	Total	**352.14**	**100.00**	**2944.15**	**100.00**	**8.36**

Table 9 : State-wise area, production and productivity of potato during 2019-20

Sl. No.	State/UT	Area ('000 ha)	Share (%)	Production ('000 MT)	Share (%)	Productivity (tonnes/ha)
1	Andhra Pradesh	2.77	0.14	49.86	0.10	18.00
2	Arunachal Pradesh	0.02	–	0.44	–	–
3	Assam	104.75	5.11	756.22	1.56	7.22
4	Bihar	258.00	12.58	7710.00	15.88	29.88
5	Chhattisgarh	43.54	2.12	586.53	1.21	13.47
6	Gujarat	118.00	5.75	3616.50	7.45	30.65
7	Haryana	25.00	1.22	626.00	1.29	25.05
8	Himachal Pradesh	15.00	0.73	196.30	0.40	13.09
9	Jammu & Kashmir	8.03	0.39	197.87	0.41	24.64
10	Jharkhand	48.88	2.38	705.63	1.45	14.44
11	Karnataka	22.00	1.07	272.00	0.56	12.36
12	Kerala	0.49	–	6.57	0.01	13.41
13	Madhya Pradesh	151.00	7.36	3457.30	7.12	22.90
19	Maharashtra	23.00	1.12	455.00	0.94	19.78
15	Manipur	0.05	0.00	0.95	0.00	18.61
16	Meghalaya	18.94	0.92	187.35	0.39	9.89
17	Mizoram	0.09	0.00	0.94	0.00	10.63
18	Nagaland	4.35	0.21	55.64	0.11	12.78
19	Odisha	21.33	1.04	261.39	0.54	12.25
20	Punjab	106.00	5.17	2870.00	5.91	27.08
21	Rajasthan	13.00	0.63	235.24	0.48	18.10
22	Sikkim	19.33	0.94	90.81	0.19	4.70
23	Tamil Nadu	6.00	0.29	110.00	0.23	18.33
24	Telangana	1.11	0.05	24.66	0.05	22.20
25	Tripura	8.05	0.39	145.87	0.30	18.12
26	Uttar Pradesh	570.00	27.79	13000.00	26.77	22.81
27	Uttarakhand	27.00	1.32	366.00	0.75	13.56
28	West Bengal	435.00	21.21	12563.00	25.87	28.88
29	Others	0.62	0.03	13.87	0.03	22.41
	Total	**2051.35**	**100.00**	**48561.93**	**100.00**	**23.67**

Table 10 : Month-wise export of onion during 2016-17 to 2019-20

	Onion Export (Quantity in lakh MT)			
	2016-17	**2017-18**	**2018-19**	**2019-20**
April	1.95	1.6	1.73	1.89
May	2.3	2.09	2.2	1.63
June	1.9	1.24	1.05	1.91
July	1.54	1.42	1.53	1.60
August	1.95	1.58	1.81	1.26
September	1.97	1.44	2.02	1.04
October	2.04	0.87	1.78	0.17
November	1.9	1.14	1.36	0.06
December	2.57	1	1.75	0.23
January	1.9	0.58	1.94	0.09
February	1.99	1.01	2.33	0.04
March	2.15	1.9	2.34	1.54
Total	**24.16**	**15.89**	**21.84**	**11.45**

Source: DGCIS & APEDA

Table 11 : Onion Import during 2019–20

Country	Qty in (MT)	Value (Lakh Rs.)
Afghanistan	63704.77	22426.06
Turkey	36104.71	17079.19
Egypt	23878.58	9516.7
U Arab Emts (UAE)	9335.07	4660.71
The Netherland	3706.2	1640.96
Iran	3097.41	834.87
Sri Lanka	868.19	334.32
China	202	98.65
Australia	173.5	95.14
Russia	79.8	39.83
Malaysia	39.63	14.57
Total	**1,41,189.86**	**56,741.00**

Table 12 : Country-wise onion export from India 2019-20

Qty (MT) Value (Laks Rupees)

Country	Qty	Rs. Lacs	Country	Qty	Rs. Lacs
Bangladesh Pr	259369.92	55014.45	France	304.03	56.62
Malaysia	190693.85	43429.36	China P Rp	342	50.69
U Arab Emts	152529.78	29699.49	Hong Kong	138.96	39.95
Sri Lanka DSR	125756.76	29323.81	Timor-Leste	331	39.74
Nepal	75191.1	9440.76	Kenya	203	35.34
Saudi Arab	54864.38	9229.79	Turkey	201.1	30.64
Qatar	42301.65	8102.86	Taiwan	84	29.02
Kuwait	38642.2	7049.75	Liberia	114.34	21.68
Oman	39737.23	6835.19	Germany	35.63	18.53
Vietnam Soc Rep	32291.59	6352.67	Sierra Leone	87	16.41
Indonesia	35587.8	4971.09	Tanzania Rep	58	12.5
Singapore	20916.31	4804.28	Poland	76	12.11
Bahrain Is	15754.8	2898.43	Australia	20.42	9.68
Maldives	8966.25	2863.98	Serbia Montenegro	54	9.43
Iraq	12928	2091.23	Malta	54	8.87
Thailand	10683.98	2015.44	Switzerland	9.96	7.89
Mauritius	7980	1854.44	Belarus	28	7.05
U K	4187.25	983.39	Lebanon	28	6.81
Brunei	2500	875.28	Malawi	10	5.99
Italy	2838.75	740.66	South Sudan	27	5.53
Reunion	2887	633.64	Iran	87	5.26
Russia	2281	561.75	Sweden	28.75	5.11
Greece	2515.95	485.81	Senegal	29	4.92
The Netherland	929.22	216.98	Libya	29	4.91
Seychelles	896	182.52	Guinea	29	4.85
Mayotte	842.41	170.48	Norway	8.32	3.55
Spain	745	163.69	Japan	4.22	3.37
Comoros	594	125.89	Ireland	4.8	2.84
Slovenia	447	116.41	New Zealand	6.36	2.1
U S A	338.54	89.36	Ghana	14	1.82
Canada	144.96	78.02	Belgium	0.2	0.17
Gabon	225	73.17	Egypt A Rp	0.08	0.05
Somalia	487	70.53	South Africa	0.01	0.04
Romania	395	61.53	**Total**	**11,49,896.86**	**2,32,069.60**

Source: DGCIS & APEDA

Table 13 : Garlic importing countries during 2019-20

Qty (MT) Value (Laks Rupees)

Country	Qty	Rs. Lacs	Country	Qty	Rs. Lacs
U S A	468.04	1198.79	Canada	16.38	17.18
Thailand	3237.00	1167.89	Timor-Leste	28.00	15.08
Bangladesh Pr	1032.40	649.78	Maldives	17.23	13.50
Vietnam Soc Rep	836.30	451.83	Comoros	14.00	11.96
Malaysia	738.11	295.61	Kuwait	14.31	10.97
U Arab Emts	489.99	291.45	Singapore	13.95	5.36
Taiwan	283.40	173.56	Bahrain IS	3.89	3.99
Nepal	270.15	133.97	Australia	3.26	2.78
Oman	37.63	90.68	U K	1.15	0.91
Djibouti	78.00	63.99	Japan	0.55	0.70
Gabon	56.00	58.66	Belgium	0.05	0.17
Sri Lanka DSR	49.62	55.50	Turkey	0.14	0.10
Qatar	36.43	44.72	Hong Kong	0.07	0.04
Suriname	56.00	35.44	Somalia	0.10	0.03
Saudi Arab	15.64	20.45	**Total**	**7,797.79**	**4,815.09**

Source: APEDA

Table 14 : Potato importing countries during 2019-20

Qty (MT) Value (Laks Rupees)

Country	Qty	Rs. Lacs	Country	Qty	Rs. Lacs
Nepal	302669.91	29756.48	Somalia	56.00	8.84
Oman	21946.89	4630.64	Bhutan	14.85	6.42
Indonesia	19087.00	4522.21	Japan	7.00	4.88
Sri Lanka DSR	15819.11	4109.82	Namibia	17.50	2.10
Saudi Arab	14269.13	2950.95	Afghanistan Tis	20.00	2.00
Malaysia	11310.16	2576.10	Australia	1.94	1.86
Turkey	10420.00	2141.91	Mongolia	12.80	1.66
Mauritius	8120.00	2062.57	South Africa	0.40	1.26
Kuwait	7890.66	1617.30	Niger	6.50	0.78
Maldives	5338.57	1442.08	U K	0.43	0.64
U Arab Emts	4395.53	925.73	New Zealand	0.32	0.57
Hong Kong	1404.00	367.14	Canada	0.82	0.52
Qatar	1357.27	277.65	Ireland	0.24	0.37
Seychelles	1139.70	240.29	Botswana	0.14	0.09
Bahrain Is	1101.07	211.09	Germany	0.08	0.06
Vietnam Soc Rep	367.10	84.07	Czech Republic	0.00	0.00
Comoros	172.50	34.13	Norway	0.00	0.00
Singapore	73.65	15.40	**Total**	**4,27,075.27**	**58,009.50**
Brunei	54.00	11.89			

Source: APEDA

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Deputy Director (Horticulture)

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Assistant Director (Horticulture)

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Senior Technical Officer (Horticulture)

6 **Mr. Subash Chandra Tiwari**
Senior Technical Officer (Plant Pathology)

7 **Mr. Sudhir Kumar Singh**
Senior Programmer

8 **Dr. Rajendra Prasad Pandey**
Technical Officer (Soil)

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PS to President

10 **Mr. Amit Kumar**
Typist cum Clerk

11 **Mr. Brijesh Kumar**
General Clerk

12 **Mr. Sabhapati Dubey**
General Clerk

13 **Mr. Santosh Kumar**
Technical Assistant

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Senior Admin Assistant

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Admin Assistant

3 **Miss. Pooja Phogat**
Admin Assistant

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Admin Assistant

5 **Mr. D. D. Dubey**
Driver

6 **Mr. Anil Kumar Sharma**
Driver

7 **Mr. Manjeet Singh**
Driver

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Deputy Director (Personnel)

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Assistant Director (Personnel)

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Senior Administrative Assistant

Finance and Accounts Section

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FACAO

2 **Mrs. Vijayta**
Assistant Account Officer

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Senior Account Assistant

4 **Mr. Subedar Pandey**
Senior Account Assistant

5 **Mr. Vivek Kumar**
Senior Account Assistant

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Attendant

2 **Mr. Sri Kishan Yadav**
Attendant

3 **Mr. Prahlad Singh**
Attendant

4 **Mr. Ajay Kumar Singh**
Attendant

5 **Mr. B. P. Shukla**
Attendant

6 **Mr. Ramesh Kumar Singh**
Attendant

Bathinda (Punjab)

1 **Dr. Alok Kumar Singh**
Assistant Director (Horticulture)

2 **Mr. Amar Bahadur Verma**
Senior Technical Officer (Horticulture)

3 **Mr. Sandeep Kumar Gupta**
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Meteorological Data

RRS, Nashik (Maharashtra)

Month	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
July- 2019	27.30	21.24	84	76	295.40
August- 2019	26.45	20.32	83	75	299.40
September- 2019	26.45	20.43	84	69	192.70
October- 2019	26.45	18.49	75	60	264.00
November- 2019	26.45	15.36	73	53	57.40
December- 2019	19.24	9.50	60	38	-
January- 2020	22.57	8.93	68	44	-
February- 2020	25.39	11.32	67	51	-
March- 2020	31.35	12.40	43.42	30.17	-

RRS, Karnal (Haryana)

Month	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
July- 2019	33.88	24.14	82	71	280.70
August- 2019	26.45	25.37	83	72	131.40
September- 2019	26.45	24.46	83	66	12.80
October- 2019	26.45	17.97	79	47	-
November- 2019	26.45	12.99	72	42	10.20
December- 2019	16.76	6.87	89	69	16.20
January- 2020	16.00	6.60	92	76	63.60
February- 2020	21.20	7.50	86	65	15.40
March- 2020	26.62	11.75	77	60	122.10

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
CIPC	:	Isopropyl N-3•chlorophenyl carbamate
CSS	:	Central Sector Scheme
DAT	:	Days after Transplanting
DAP	:	Days after Planting
DGCI&S	:	Directorate General of Commercial Intelligence and Statistics
DOS	:	Days after sowing
EC	:	Extension Centre
ECs	:	Extension Centres
FYM	:	Farm Yard Manure
ICAR	:	Indian Council of Agricultural Research
IVRS	:	Interactive Voice Response System
KVK	:	Krishi Vigyan Kendra
MIDH	:	Mission for Integrated Development of Horticulture
MPRNL	:	Monitoring of Pesticide Residue at National Level
MT	:	Metric tonnes
NABL	:	National Accreditation Board for Testing and Calibration of Laboratories
NAFED	:	National Agricultural Marketing Federation of India Ltd
NHM	:	National Horticulture Mission
NRL	:	National Referal 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
OGL	:	Open General License
PHRC	:	Post-Harvest Research Complex
PLW	:	Physiological loss of weight
RKVY	:	Rashtriya Krishi Vikash Yojana
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

NHRDF Red-2 (L-355)

NHRDF Fursungi (L-819)

Coll-883

Yamuna Safed

Yamuna Safed-2

Yamuna Safed-3

Yamuna Safed-4

Yamuna Safed-5

Agrifound White

Agrifound Parvati

Agrifound Parvati-2

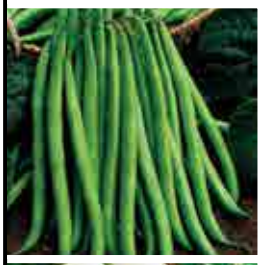
Yamuna Safed-6 (G-324)

Yamuna Safed-7 (G-378)

Yamuna Safed-8 (G-384)

Yamuna Safed-9 (Line-386)

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NHRDF is a pioneer institute in the country for R&D on onion & garlic and developed many varieties. These varieties have export potential and high yielding. We are providing quality service to farming community of India since 1977.

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