



43rd

Annual Report
2020-21



National Horticultural Research and Development Foundation
New Delhi



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**National Horticultural Research and
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New Delhi

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Preface

It is a matter of privilege to present the 43rd Annual Report of the National Horticultural Research and Development Foundation (NHRDF) for the year 2020-21. The report includes research and developmental activities, extension services and laboratories activities carried out at NHRDF Regional Research Stations/laboratories, Krishi Vigyan Kendra, seed production and distribution and implementation of various projects.

During the year under report, NHRDF conducted various research trials on different crops under ICAR-All India Network Research under report 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 Technologies of onion, garlic, okra, tomato etc. The quality seed of improved and notified varieties of vegetable crops, especially onion, garlic, potato, drumstick, chilli, tomato, okra, cowpea and other crops were produced and distributed to farming community across the country.

NHRDF also imparted training on improved production technologies of onion, garlic and mushroom production to Agriculture/Horticulture Officers, field functionaries as well as farmers from India and abroad. It also successfully implemented various projects funded by different agencies in the country. Besides, based on the surveys for inputs and rates of produce in local markets, the cost of cultivation for major onion, garlic and potato growing states, have been derived and presented in this report.

The apex committees 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 sincerely 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 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 high-quality publication.



Place: New Delhi
Date: 29-08-2023


(Rajbir Singh)





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 Laboratory |
| NAFED | : | National Agricultural Marketing Federation of India Ltd. |
| NHM | : | National Horticulture Mission |
| NRL | : | National Referral Laboratory |
| NRCG | : | National Research Center for Grape |
| NHRDF | : | National Horticultural Research and Development Foundation |
| NVIUC | : | National Vegetable Initiative for Urban Cluster |

| | | |
|------|---|---------------------------------------|
| NPKS | : | Nitrogen Phosphorus Potassium Sulphur |
| OGL | : | Open General License |
| PHRC | : | Post-Harvest Research Complex |
| PLW | : | Physiological loss of weight |
| RKVY | : | Rashtriya Krishi Vikash Yojna |
| PRA | : | Pesticides Residue Analysis |
| R&D | : | Research and Development |
| RRS | : | Regional Research Station |
| SAU | : | State Agricultural University |
| SAUs | : | State Agricultural Universities |





Executive Summary

1

The national scenario of onion and garlic production has shown a considerable increase during the past 44 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 2020-21, research and developmental work was carried out on onion, garlic, okra, Dolichos bean, tomato and drumstick, etc.

The studies were undertaken for evaluation of onion germplasm, varietal trials, promising lines of red and white onion, bolting behaviour, 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, biocontrol 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 biopesticides, insects, growth regulators, pheromone mulching and environmental factors were conducted under Plant Health Management. Storage studies on onion in different experiments were undertaken under Post Harvest Management.

Similarly in garlic, studies were undertaken on evaluation of germplasm, varietal trials, 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 dolichos bean 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 1142064.345 kg of seeds of improved varieties of different vegetable & spice



crops, besides wheat, soybean and maize were distributed during the year 2020-21. The programmes of different projects, namely Monitoring of Pesticide Residue at National Level (MPRNL), under ICAR-IARI, and Krishi Vigyan Kendra have been successfully implemented during 2020-21.



Introduction

2

The National Horticultural Research and Development Foundation (NHRDF) was established on 03rd November, 1977 under the 'Societies Registration Act, 1860' XXI at New Delhi. The Head Office cum registered office of NHRDF is located at "Bagwani Bhawan", 47, Pankha Road, Institutional Area, Janakpuri, New Delhi having longitude: 77.1020585° and latitude: 28.6088852°. The NHRDF is a center 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), Division of Plant Protection since 01 April 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 vegetables, vermicompost, bio-pesticide and honey and their distribution as well as other laboratory facilities. The NHRDF generates some revenue through these technical services 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 25 vegetable crops.



The Vision, Mission and Mandate

3

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.

Mandate

The mandate of the NHRDF is:

- ◆ To undertake, carry on or help in the research and other scientific investigations 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 carry on research for assessing demands of the agricultural produce of the Indian origin in foreign countries by conducting extensive survey and undertake research and development of horticultural produce with export potential and to motivate farmers to grow such varieties of horticultural produce with the 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.

(i) Managing Committee

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, 4 eminent horticultural scientists and Director, NHRDF as a Member Secretary. The -166th Management Committee Meeting was held on 20 March, 2021 at Bagwani Bhawan, New Delhi under the Chairmanship of Dr. Bijender Singh, Hon'ble President, NHRDF. The list of the Managing Committee Members is given in Annexure-IV



166th Managing Committee Meeting of NHRDF

(ii) Scientific Advisory Committee

The NHRDF has a Scientific Advisory Committee headed by Deputy Director-General (Horticulture Science), ICAR, DARE, MOAFW, GOI, New Delhi. It consists of eminent horticultural scientists from different institutes of ICAR and State Agricultural Universities (SAUs) in the respective disciplines as Members and Director NHRDF as a Member Secretary. 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 80th Scientific Advisory Committee meeting was held on 21st October, 2020. The list of Members of the Scientific Advisory Committee is given in Annexure-V



80th Scientific Advisory Committee

The Infrastructure

5

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 centers 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.



RC, Deoria, U.P

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.

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



RRS, Chitegaon, Nashik

The Bio-control Laboratory has been established at Nashik & 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 KVK, 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. Stakeholders. NHRDF have established Meteorological Observatory with automatic weather station at KVK, Ujwa and 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 Farms.



The Recommendations

6

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 stake holders. The findings of the trials concluded at different Regional Research Stations of NHRDF during *kharif*, 2019 and *rabi* 2019-20 at Nashik, Karnal and Boudh are given here under in brief:

Onion

- ◆ The field experiment conducted on onion variety Agrifound Dark Red during *kharif*, 2017, 2018 and 2019 at RRS, Karnal revealed that the highest weed control efficiency and marketable yield were recorded in the treatment three hand weedings. However, the highest Benefit : Cost ratio (2.68:1) was recorded in combined spray of oxyflurofen @ 1.0 ml + quizalofop ethyl @ 2.0 ml at transplanting and second at 30 DAT.
- ◆ The combined 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% + Cypermethrin @ 0.1% at 45 DAT, Zineb + Hexaconazole @ 0.25% + Fipronil @ 0.1% at 60 DAT, Carbenbadazim + Mancozeb @ 0.25% + Curacron @ 0.1% at 75 DAT proved to be superior for management of foliar diseases in terms of percent disease control (PDC) of stemphylium blight as 61.15% and purple blotch as 43.50% 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% + Cypermethrin @ 0.1% at 45 DAT, Tricyclazole @ 0.1% + Fipronil @ 0.1% at 60 DAT and Hexaconazole @ 0.1% + Curacron @ 0.1% at 75 DAT) due to low cost of pesticides. Purple blotch 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 tested after harvesting.
- ◆ Under the Nashik (Maharashtra) and Karnal (Haryana) climatic conditions, three times hand weeding proved to be superior than other treatments in terms of plant growth, yield and better weed control as well as highest benefit : cost ratio (1.95:1) and (2.04:1) recorded at Nashik and Karnal, respectively. Among the herbicide treatments, highest benefit : cost ratios of (1.77:1) and (1.15:1) were recorded at Nashik and Karnal, respectively in the treatment combined spray of pendimethalin @ 1.5 ml + quizalofop ethyl application @ 1.0 ml/l first before seed sowing and 45 DAS.

- ◆ At Nashik, the highest weed control efficiency (89.04%) was achieved in the treatment 'Plastic mulch'. However, in the herbicide-based treatments, the highest benefit : cost ratio (1.59: 1) and higher weed control efficiency were recorded in the case of Pendimethalin 30% EC 5.0 ml/l before planting + one hand weeding at 30-40 days after planting and combined application of Oxyflurofen 23.5% EC 0.75 ml/L + Quizalofop Ethyl 5% EC 1.0 ml/L at 60 days after planting.
- ◆ At Karnal, the highest number of umbels, 1000 seed weight, seed yield and weed control efficiency were recorded in the treatment Plastic mulch. However, the highest benefit : cost ratio (1.88 : 1) was recorded in treatment Pendimethalin 30% EC 5.0 ml/L application before planting + one hand weeding at 30-40 days after planting and combined application of Oxyflurofen 23.5% EC 0.75 ml/L + Quizalofop Ethyl 5% EC 1.0 ml/L at 60 days after planting.
- ◆ The pooled data of trials conducted during *rabi*, 2018-19 and 2019-20 at RRS, Nashik and Karnal revealed that transplanting of onion seedlings on raised bed under drip irrigation system with soil application of *Bacillus subtilis* @ 5 kg/ha, followed by spray of Propineb @ 0.20% at 40, 60 and 80 DAT and mixed spray of Carbendazim @ 0.10% + Streptocycline @ 0.02% at 100 DAT proved to be superior as the integrated management of foliar diseases in onion with highest B:C ratio (3.35:1) at Nashik. Thus, it can be recommended to the farmers of Nashik district of Maharashtra.
- ◆ At Karnal, the transplanting of onion on raised bed under drip irrigation system with soil application of *Pseudomonas fluorescens* @ 5 kg/ha, followed by spray of Propineb @ 0.20% at 40, 60 and 80 DAT and mixed spray of Carbendazim @ 0.10% + Streptocycline @ 0.02% at 100 DAT proved to be superior as the integrated management of foliar diseases in onion with highest B:C ratio (4.71:1). Thus, it can be recommended to the farmers of Karnal district of Haryana.
- ◆ The pooled data of two years study conducted during *rabi* 2018-19 and 2019-20 revealed that standard IPM module 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 @ 56 g/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.

Garlic

- ◆ The fertigation using 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha proved superior in terms of highest yield with benefit : cost ratio (1.84:1).
- ◆ Foliar application of growth regulator gibberalic acid (GA_3) @ 50 ppm at 45 & 60 DAP performed superior to other treatments in respect of yield and it was found at par with foliar application of NAA @ 50 ppm at 45 & 60 DAP. The highest benefit : cost ratio (1.89:1) was recorded amongst all other treatments.
- ◆ The combination of fertigation and growth regulators *i.e.* fertigation using 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha and foliar application of gibberalic acid (GA_3) @ 50 ppm at 45 & 60 DAP proved superior than other treatments in terms of highest yield. However, the highest benefit : cost ratio (1.86:1) was recorded in fertigation with 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha and foliar application of NAA @ 50 ppm at 45 & 60 DAP.



Plate No. 1

Onion Genotypes under ICAR-AINRPOG Testing



L-863



L-883



L-857



L-849



L-913



L-920

Plate No. 2

Garlic Genotypes under ICAR-AINRPOG Testing



G-417



G-389



G-304



G-363

(A) Field Studies

Onion

Plant Genetic Resources and Crop Improvement

Rabi, 2019-20

Collection, evaluation and utilization of onion germplasm

The trial conducted at RRS, Nashik during *rabi* 2019-20 the highest gross yield (387.47 q/ha) and marketable yield (371.05 q/ha) showed in the line 683 and it was found at par with the lines 628, 773, 782, 798, 820, 830, 888 and 915 in respect of gross yield and with the lines 782, 820, 830, 888 and 915 in respect of marketable yield.



Onion crop

Varietal evaluation of red onion lines- AVT-II (AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2019-20 the highest gross yield (361.72 q/ha) and marketable yield (349.38 q/ha) showed in the check variety NHRDF Red-4 and it was at par with the variety NHRDF Red-3 in respect of gross yield as well as marketable yield. At Karnal, the highest gross yield (412.06 q/ha) and marketable yield (363.52 q/ha) were recorded in the check variety NHRDF Red and it was at par with the line ORVC-19-32 in respect of marketable yield.

Varietal evaluation of red onion lines for early maturity- IET (AINRPOG)

The trial at RRS Nashik during *rabi* 2019-20 revealed the highest gross yield (372.24 q/ha), marketable yield (359.11 q/ha), minimum days to maturity (86 days) and minimum days to harvest (92 days) in the line OREA-19-50 which was at par with the check variety NHRDF Red-4 in respect of gross and marketable yield. At Karnal, the highest gross yield (424.73 q/ha), marketable yield (410.29 q/ha), minimum days to maturity (88 days) and minimum days to harvest (95 days) were recorded in the line OREA-19-48 and it was at par with the check varieties NHRDF Red, ALR and NHRDF Red-3 in respect of gross yield.

Varietal evaluation of white onion lines- AVT-I (AINRPOG)

The trial at RRS Nashik during *rabi* 2019-20 revealed the highest gross yield (339.39 q/ha) in the line OWVB-19-79 and it was at par with the line OWVB-19-77 and check variety Agrifound White in respect of average bulb weight and gross yield, while maximum marketable yield (318.62 q/ha) was recorded in the line OWVB-19-77 which was at par with the line OWVB-19-79 and the check variety Agrifound White. At Karnal, the highest gross yield (411.49 q/ha) and marketable yield (370.68 q/ha) were recorded in the line OWVB-19-77, which was at par with the line OWVB-19-79.

Varietal evaluation of white onion lines for high TSS- IET (AINRPOG)

The trial at Nashik during *rabi* 2019-20 showed the gross yield (343.56 q/ha) and marketable yield (328.86 q/ha) in the line OWTA-19-87 which was at par with the check variety Agrifound White in respect of 20 bulb weight and average bulb weight. It was also at par with the line OWTA-19-96 in respect of gross yield and with the line OWTA-19-96 and check variety Agrifound White in respect of marketable yield. The highest TSS (16.47 %) was recorded in the line OWTA-19-94 and it was at par with the line OWTA-19-96. At Karnal, the highest gross yield (413.22 q/ha) and marketable yield (389.85 q/ha) were recorded in the check variety Agrifound White and it was at par with the line OWTA-19-85 in respect of gross yield. The highest TSS (16.33 %) was recorded in the line OWTA-19-89 which was at par with the lines OWTA-19-91 and OWTA-19-94.

Evaluation of white onion germplasm-(AINRPOG)

In the trial conducted at RRS, Karnal during *rabi* 2019-20, the highest gross yield (249.39 q/ha) and marketable yield (227.22 q/ha) were recorded in the line L-355 which was at par with the line W-177 in respect of gross and marketable yields. The highest TSS (13.00 %) was recorded in the line W-203.

Performance of red onion advance lines

The trials conducted at RRS, Nashik during *rabi* 2019-20 showed the highest gross yield (351.97 q/ha) and marketable yield (336.73 q/ha) in the check variety NHRDF Red-3, which was at par with the advance lines L-825, L-849 and check variety NHRDF Fursungi. At Karnal, the highest gross yield (508.15 q/ha) and marketable yield (399.52 q/ha) were recorded in the advance line L-804 and it was at par with L-848 in respect of marketable yield.



Late *kharif* 2019-20

Performance of red onion lines against bolting behaviour

The trial conducted at RRS, Nashik during late *kharif*, 2019-20 resulted in the highest weight of 20 bulbs (1.26 kg), gross yield (351.79 q/ha) and marketable yield (338.21 q/ha) in check variety NHRDF Red-3, which was at par with the line L-883. No bolters were recorded in the line L-735, so also in the lines L-850, L-883, L-887 and check variety NHRDF Red-3.

Evaluation of red onion lines for late *kharif* - AVT-II (AINRPOG)

In the trial conducted at RRS, Nashik and Karnal during late *kharif*, 2019-20 revealed that at Nashik highest weight of 20 bulb (1.20 kg), average weight of bulb (60.05 g), gross yield (345.46 q/ha) and marketable yield (331.11 q/ha) were recorded in check variety NHRDF Red-4. At Karnal, no bulb formation was found in all the lined including check varieties.

Evaluation of red onion hybrid lines for late *kharif* - IET (AINRPOG)

In the trial conducted at RRS, Nashik during late *kharif*, 2019-20 revealed that the highest weight of 20 bulbs (1.24 kg) and average weight of bulb (62.17 g) were recorded in the line OAH-05 and it was found at par with OAH-13, while the highest gross yield (323.61 q/ha) and marketable yield (313.43 q/ha) were recorded in OAH-13 which was at par with OAH-05. The highest reducing sugar content (4.04%) was recorded in OAH-02, whereas, the highest non-reducing sugar content (5.31%) was recorded in OAH-05.

Kharif, 2020

Collection, evaluation and utilization of onion germplasm

The trial conducted at RRS, Nashik during *kharif*, 2020 showed the highest bulb equatorial diameter, polar diameter, 20-bulbs weight, gross yield and marketable yield in line 812. The highest average bulbs weight and 'A' grade bulbs were recorded in check Agrifound Dark Red. The highest TSS content was recorded in line 906 and it was found at par with lines 850, 882 and 884. The highest pyruvic acid was recorded in line 861 and it was at par with lines 750, 812, 863, 864, 866, 868, 880, 881, 882, 884, 887, 906, 922, 926, check Agrifound Dark Red and check Phule Baswant -780.

Evaluations of red onion lines for *kharif* -AVT-I (AINRPOG)

The trial conducted at Nashik during *kharif* 2020 showed the highest gross and marketable yields in line RVB-20-14. The highest reducing sugar content was recorded in line RVB-20-12. At Karnal, the highest gross yield was recorded in line RVB – 20-09 and it was at par with all other lines except RVB-20-05 and RVB-20-07. The highest marketable yield was recorded in line RVB-20-14 which was at par with all other lines except line RVB-20-05 and RVB-20-07. The highest TSS and pyruvic acid contents were recorded in line RVB-20-05, where the TSS was found at par with lines RVB-20-07 and RVB-20-09, pyruvic acid with line RVB-20-07, RVB-20-09, RVB-20-14 and RVB-20-18. The highest reducing sugar content was recorded in lines RVB-20-09, which was at par with line RVB-20-07 and check Agrifound Dark Red. The highest non-reducing sugar and total sugar contents were recorded in RVB-20-14 and it was at par with lines RVB-20-12 and RVB-20-18.

Evaluation of white onion lines for *kharif* - AVT-I (AINRPOG)

The trial at Nashik during *kharif* 2020 showed the highest bulb equatorial diameter and gross yield in line WVB-20-46, whereas the highest marketable yield was recorded in check Agrifound



White, at par with lines WVB–20-42 and WVB–20-46. At Karnal, the highest gross yield and marketable yield as well as the highest average bulb weight were recorded in line WVB–20-44, where the bulb average weight was found at par with line WVB–20-38 and check Agrifound Dark Red.

Evaluation of promising onion lines during *kharif* season for bolting resistance in Karnal region of Haryana

In the trial conducted at RRS Karnal during *kharif* 2020 showed the highest average bulb weight and gross yield were recorded in line L-883 and it was at par with L-887 and check Agrifound Dark Red. The highest marketable yield was recorded in Agrifound Dark Red and it was at par with L-887 and L-883. The highest bulb equatorial diameter was recorded in line L-887 and it was at par with lines L-821, L-884, L-913, L-883, Bhima Dark Red and Agrifound Dark Red. Doubles were absent in lines L-821, L-846, L-913 and check Bhima Dark Red. Bolters were also not present in lines L-821, L-824, L-846 and L-913. The highest TSS content was found in line L-846, at par with line L-821, L-884, L-906 and Bhima Dark Red

Varietal evaluation of *kharif* onion varieties under Boudh conditions of Odisha

The trial was conducted at RRS, Paljhar during *kharif* 2020, where in all growth parameters and yield parameters of different onion varieties showed non-significant variations.

Crop Production System Management

Rabi, 2019-20

Weed management studies in direct seeded onion for *rabi* season

The trial was conducted during *rabi*, 2018-19 and 2019-20 on onion variety NHRDF Red-4 at RRS, Nashik during *rabi*, 2017-18, 2018-19 and 2019-20 on onion variety Agrifound Light Red. At both the places, the treatment three times hand weeding proved superior over other treatments in terms of plant growth, yield and better weed control as well as highest benefit : cost ratio *i.e.* 1.95:1 and 2.04:1 recorded at Nashik and Karnal, respectively. Among the herbicide treatments, the highest benefit : cost ratio *i.e.* 1.77:1 and 1.15:1 were recorded at Nashik and Karnal, respectively in the treatment combined spray of pendimethalin @ 1.5 ml + quizalofop ethyl application @ 1.0 ml/L before seed sowing and then 45 DAS.

Weed management in onion seed crop

The experiments were conducted during *rabi*, 2017-18, 2018-19 and 2019-2020 on onion variety Agrifound Light Red at Nashik and NHRDF Red at Karnal. The results at Nashik revealed that the treatment three times hand weeding performed superior in terms of highest seed yield. The highest weed control efficiency (89.04%) was recorded in the treatment Plastic mulch. However, the highest benefit : cost ratio (1.59: 1) and higher weed control efficiency were recorded in the herbicide-based treatment Pendimethalin 30% EC 5.0 ml/L before planting + one hand weeding at 30-40 days after planting and combined application of Oxyflurofen 23.5% EC 0.75 ml/L + Quizalofop Ethyl 5% EC 1.0 ml/L at 60 days after planting.

The results of experiments at Karnal revealed the highest number of umbels, 1000-seed weight, seed yield and weed control efficiency in the treatment Plastic mulch. However, the highest benefit : cost ratio (1.88:1) was recorded in case of Pendimethalin 30% EC 5.0 ml/L application before planting + one hand weeding at 30-40 days after planting and combined application of Oxyflurofen 23.5% EC 0.75 ml/L + Quizalofop Ethyl 5% EC 1.0 ml/L at 60 days after planting.



Fertilizer scheduling through drip irrigation system in onion (AINRPOG)

The experiment was conducted at RRS, Nashik during *rabi* 2017-18, 2018-19 and 2019-20 on onion variety Agrifound Light Red to standardize the fertilizer scheduling through drip irrigation. The three years, combined results revealed that the treatment drip irrigation at 100% PE through drip system - Irrigation at alternate day 100% RDF (110:40:60:30 kg NPKS/ha) - fertigation at 6 days interval + 5 t organic manure; Full dose of organic manure applied as basal dose before transplanting recorded the highest macronutrient and micronutrient uptake, and it proved superior to other treatments in terms of bulb yield and highest benefit : cost ratio (3.23:1).

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

The field experiment was conducted at RRS Nashik on onion variety Bhima Shakti to standardize the direct sowing technique of onion seed through onion seed drill during *rabi* 2019-20. The transplanting of 50 days old seedlings (the seed sowing in nursery for transplanting crop and main field for direct seeded crop sowing was done on same day) proved to be superior over other treatments in terms of gross yield and marketable yield. However, the highest benefit : cost ratio (3.63:1) was recorded in the treatment direct seeding: pelleted seed.

Weed management studies in onion seed crop (AINRPOG)

The trial conducted at RRS, Karnal during *rabi* 2019-20 on onion variety NHRDF Red revealed that the highest seed yield and benefit : cost ratio (1.78:1) were recorded in the treatment Oxyflurofen 23.5% EC @ 0.25 kg a.i./ha (PE) followed by one hand weeding at 40 DAP. While, the treatments Oxyflurofen 23.5% EC @ 0.25 kg a.i./ha (PE) followed by Quizalofop-p-ethyl 5% EC @ 75 g a.i./ha + Chlorimuron ethyl 25% WP @ 9 g a.i./ha (POE) and treatment Oxadiargyl 80% WP @ 0.09 kg a.i./ha (PE) followed by Quizalofop-p-ethyl 5% EC @ 75 g a.i./ha + Chlorimuron ethyl 25% WP @ 9 g a.i./ha (POE) showed phyto-toxicity effect and severely impacted on onion seed crop, resulting in plant mortality.

Effect of zinc and boron application on onion seed crop (AINRPOG)

The experiments conducted during *rabi* 2019-20 at RRS, Sinnar, Nashik showed that the treatment Foliar application of micronutrient mixture @ 0.5 % @ 30, 45 and 60 days after planting (Composition: Fe- 2.5%, B- 0.50%, Zn-3.0%, Cu-1.0%, Mn- 1.0%) proved the best in terms of highest number of seeds per umbel, 1000-seed weight, seed yield and highest benefit : cost ratio (3.76: 1).

Evaluation of onion cultivars for water stress tolerance under field condition:

The field experiment was conducted during *rabi*, 2019-20 at RRS, Nashik which showed that the variety Agrifound Light Red had highest drought tolerance efficiency (62.71%) and least drought susceptibility index (0.64) due to water stress as compared to all other varieties. Under water stress condition, the highest leaf relative water content (78.01%) was recorded in the variety Bhima Shakti, followed by NHRDF Red (76.92%).

Kharif, 2020

Response of onion to organic farming:

The field experiment was conducted on onion variety Agrifound Dark Red during *kharif*, 2020 at RRS Karnal which revealed that the highest gross yield and marketable yield along with highest A grade bulbs were recorded in treatment (T₄) i.e. Farmyard manure 3500 kg ha⁻¹ + Vermicompost 3500 kg ha⁻¹, and Neem cake 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. The highest



nitrogen, potassium and iron contents were recorded in the same treatment. The highest benefit: cost ratio (2.01:1) was recorded in treatment (T_9) i.e. conventional farming involving inorganic fertilizer: 100:50:50:30 kg NPKS ha⁻¹ with chemical plant protection and weed management measures.

Evaluation of different *kharif* onion varieties under Boudh (Odisha) condition

The trial was conducted at RRS, Paljhar during *kharif* 2020 wherein, all the growth and yield parameters of different onion varieties showed non-significant variations.

Plant Health Management

Rabi, 2019-20

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

The occurrence of major diseases of onion and garlic were recorded at the research farm, Chitegaon, Nashik during *rabi*, 2019-20. The data revealed that among the foliar diseases, stemphylium blight incidence ranged from 26.0 to 80.0% and intensity from 2.80 to 19.40% in onion bulb during the cropping period. The higher incidence of stemphylium blight (80.0%) and intensity (19.40%) were recorded during April, 2020. Stemphylium blight incidence (50.0%) and intensity (5.80%) in garlic and purple blotch incidence (45.0%) and intensity (4.0%) were the highest during February 2020.

The occurrence of major diseases of onion and garlic were recorded at the research farm, RRS, Karnal during of *rabi*, 2019-20. The data revealed that stemphylium blight disease incidence ranged from 40.0 to 100.0% and intensity from 2.64 to 23.92% in onion bulb crop during that period. Higher incidence of stemphylium blight (100.0%) and intensity (23.92%) were recorded in May, 2020. In garlic crop, 100% incidence of stemphylium blight was recorded in February–March 2020 and highest intensity (17.84%) during the month of March, 2020.

Survey and monitoring of major diseases and insects of onion and garlic

The occurrence of major diseases and insects of onion were recorded at Yeola Taluka (villages- Deshmane, Jalgaon Neyur, Purangaon, Erandgaon and Andershool), Niphad Taluka (villages-Chandori, Pimplas, Chatori, Gavandgaon and Berewadi), and Taluka-Sinnar (Villages-Naigaon, Jaygaon, Maparwadi, Kedarapur Datli and Gulvanch) of district Nashik, during the survey in late *kharif* and *rabi* season, 2019-20. Five villages were selected for survey in each taluka and five onion fields in each village for observations of major diseases and insects in 75 different fields of 15 villages of Nashik.

In Haryana, the occurrence of major diseases of garlic was studied at Punchkula (Villages-Ratiwala, Tippi, Khetparali), and Yamuna Nagar (Villages-Manka, Mulana) districts during the survey in *rabi* season, 2019-20. Five villages and five garlic fields in each village were selected for the survey.

Nashik

Stemphylium blight (*Stemphylium vesicarium*)

The survey was done in onion crop for studying the occurrence of diseases at 25 different farmers' fields in 5 villages on 28.12.2019 during late *kharif* and *rabi* season. The farmers had used L-883, Agrifound Dark Red and local onion variety for late *kharif* and *rabi* seasons. Onion crop was under bulb development and vegetative stage of late *kharif*, which were transplanted on different dates in the month of September (28.09.2019), October (4.10.2019 to 28.10.2019)



and November (03 to 28.11.2019). The stemphylium blight incidence varied from 0 to 90% with intensity from 0 to 17.20% in onion during the month of December 2019. The highest incidence (90%) and intensity (17.20%) of stemphylium blight were recorded in onion field of farmer Sh. Anil Maruti Shinde in Yeola, transplanted during the month of September 2019.

The survey was done in different onion growing fields (25 nos.) for the occurrence of diseases in *rabi* onion in the various villages on 28.01.2020. The farmers had transplanted onion seedlings on different dates from December 2019 (05 to 27.12.2019) to January 2020 (07 to 18.01.2020). Onion crop was at vegetative stage. The farmers had used local onion variety for *rabi* season. Stemphylium blight was found in all the onion fields with disease incidence ranging from 0 to 50% and intensity from 0 to 8.40% in the month of January 2020. The highest stemphylium blight incidence (50.0%) and intensity (8.40%) were recorded in the field transplanted on 05/12/2019 of farmer Sh. Kondaji Khelukar in Village-Pimplas, Taluka-Niphad.

Twenty-five farmers' fields (25 nos.) were visited for diseases of onion crop and data recorded during the survey at different villages of Taluka - Sinnar on 28.02.2020. The crop was mostly at vegetative stage which was transplanted at different dates of January (07 to 28.01.2020) and February (01 to 10.02.2020) in different villages in *rabi* season. The fields had stemphylium blight incidence ranging from 0 to 20% with intensity from 0 to 2.40% during the month of February 2020. The farmers used local onion variety for *rabi* season. Highest incidence (20%) and intensity (2.40%) of stemphylium blight was found in onion field of farmer Sh. Sachin Ashok Vighe in Village- Maparwadi, Sinnar that was transplanted on 07.01.2020.

Purple blotch (*Alternaria porri*)

Purple blotch disease was recorded in onion fields (25 nos.) of farmers during the survey in the villages of taluka- Yeola in Nashik district on 28.12.2019 during late *kharif* and in *rabi* season. Purple blotch incidence varied from 0 to 55% with intensity of 0 to 7.20% during the month of December 2019. Highest incidence (55%) and intensity (7.20%) of purple blotch were recorded in onion field of farmer Sh. Anil Maruti Shinde in Yeola, that was transplanted during the month of September 2019.

Purple blotch was absent in all the onion growing fields (25 nos.) surveyed on 28.01.2020 for the occurrence of diseases in *rabi* onion in the various villages of taluka -Niphad.

Similarly, purple blotch did not appear in any onion growing field (25 nos.) surveyed on 28.02.2020 for the occurrence of diseases in *rabi* onion in the various villages of taluka – Sinnar.

Thrips (*Thrips tabaci*)

Thrips were studied in all the onion fields (25 nos.) surveyed in the five villages of taluka- Yeola on 28.12.2019 during late *kharif* and *rabi* season. Incidence ranged from 5 to 40% with thrips population from 7 to 53 nymphs/plant. The highest thrips incidence (40.0%) with intensity (53 nymphs/plant) was recorded in onion field of farmer Sh. Anil Maruti Shinde in village- Deshmane of taluka- Yeola that was transplanted on 28/09/2019.

The survey for thrips infestation in onion crop was done in all the 25 fields of five villages of taluka - Niphad on 28.01.2020. The thrips incidence varied from 0 to 30% with population of 7 to 36 nymphs/plant on onion crop transplanted during the month of December, 2019 (05 to 27.12.2019) to January, 2020 (07 to 18.01.2020). The highest thrips incidence (30%) and population (36 nymphs/plant) were recorded in onion field of farmer Sh. Kondaji Khelukar in Village-Pimplas, Taluka-Niphad that was transplanted on 05/12/2019.



The survey for thrips infestation in onion crop was done also in all the 25 fields in different villages of taluka - Sinnar on 28.02.2020 for *rabi* season and the incidence ranged from 0 to 35% with intensity from 0 to 42 nymphs/plant, transplanted at different dates of January (07 to 28.01.2020) and February (01 to 10.02.2020) in different villages. Highest thrips incidence (35%) and population (42 nymphs/plant) were found in onion field of farmer Sh. Sachin Ashok Vighe in village- Maparwadi, Sinnar that was transplanted on 07.01.2020.

Karnal

Stemphylium blight (*Stemphylium vesicarium*)

In panchkula district, a total of 15 garlic fields were surveyed on 27.2.2020 for occurrence of diseases and the data were recorded. The farmers had used G-50 and local variety. Stemphylium blight was found during survey on 27.02.2020 with disease intensity ranging from 6.90 to 10.90% and incidence from 50 to 80%. The highest stemphylium blight intensity (10.90%) was recorded in garlic field of farmer Sh. Ramchander at village - Ratiwala.

In Yamuna Nagar district, a total of 10 garlic fields were surveyed on same date i.e. 27.2.2020, for occurrence of diseases and data were recorded. The farmers had used G-282, G-50 and local variety. Stemphylium blight was found with disease intensity from 6.20 to 12.60% and incidence from 50 to 100%. The highest stemphylium blight intensity (12.60%) was recorded in garlic field of farmer Sh. Daljeet Singh at village - Manka.

Thrips (*Thrips tabaci*)

No thrips were observed in any garlic field during the survey in Panchkula and Yamuna Nagar districts in *rabi* season, 2019-20.

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

The studies on the evaluation of different red onion lines against foliar diseases revealed that the line ORVA19-16 proved superior with the lowest intensity of stemphylium blight (6.67%), whereas the check variety NHRDF Red-4 recorded the highest intensity of 17.33% at Nashik.

At Karnal, the line ORVA19-05 proved to be superior with lowest intensity of stemphylium blight (2.10%), whereas the NHRDF Red recorded an intensity of 3.13%.

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

The studies on the evaluation of different lines of red onion against foliar diseases showed that the line ORVC19-42 was superior with lowest intensity of stemphylium blight (9.73%), whereas the NHRDF Red-4 recorded high intensity of 17.73% at Nashik.

At Karnal, the line ORVC19-35 proved superior with lowest intensity of stemphylium blight (3.10%), whereas the NHRDF Red recorded the intensity of 3.77%.

Evaluation of different red onion early maturity lines for disease resistance-IET (AINRPOG)

The studies on the evaluation of different red onion early maturity lines against foliar diseases revealed that the line OREA19-43 proved superior with lowest intensity of stemphylium blight (7.90%), whereas the check variety NHRDF Red-4 showed an intensity of 17.10% at Nashik.

The line OREA19-50 was found superior with lowest intensity of stemphylium blight (2.30%), whereas the check variety NHRDF Red recorded an intensity of 3.38%.



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

The studies on the evaluation of different lines of white onion against foliar diseases revealed that the two lines OWVB19-79 and OWVB19-82 proved superior with the lowest intensity of stemphylium blight (9.0%), whereas the check variety Agrifound White recorded high intensity of 15.70% at Nashik. At Karnal, the line OWVB19-82 proved to be superior with lowest intensity of stemphylium blight (2.23%), whereas the check variety Agrifound White recorded an intensity of 3.58%.

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

The studies on the evaluation of different red onion hybrid lines against foliar diseases revealed that the line OREA19-43 proved to be superior at both the places with lowest intensity (10.0% at Nashik and 3.90% at Karnal) of Stemphylium blight.

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

At Nashik, the highest thrips damage scale 3 was recorded in line ORVB19-20, while the lowest scale 2 was recorded in all the other lines including check variety NHRDF Red-4. The highest gross and marketable yield (329.59 q/ha and 307.95 q/ha) were recorded in the line ORVB19-29. The lowest gross and marketable yields (234.52 q/ha and 206.36 q/ha) were recorded in line ORVB19-20.

At Karnal, the thrips damage scale 2 was recorded in all the lines including check variety NHRDF Red. The highest gross and marketable yields (308.61 q/ha and 274.16 q/ha) were recorded in the line ORVB19-29, while gross yield was found at par with NHRDF Red and marketable yield at par with the line ORVB19-27 and NHRDF Red. The lowest gross yield (234.72 q/ha) in the line ORVB19-20 and marketable yield (215.83 q/ha) were recorded in line ORVB19-22.

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

At Nashik, the highest thrips damage scale 3 was recorded in the lines ORVC19-35, ORVC19-40 and ORVC19-42, while the lowest damage scale 2 was recorded in all the other lines including check variety NHRDF Red-4. The highest gross yield (330.91 q/ha) was obtained in line ORVC19-33, while marketable yield was 309.29 q/ha in line ORVC19-32. The gross yield was found at par with lines ORVC19-32, ORVC19-38 and NHRDF Red-4, while marketable yield was found at par with lines ORVC19-33, ORVC19-38 and NHRDF Red-4. The lowest gross and marketable yields (205.43 q/ha and 152.18 q/ha) were recorded in line ORVC19-40.

At Karnal, the thrips damage scale 2 was recorded in all the lines including NHRDF Red. The highest gross and marketable yields (311.11 q/ha and 280.73 q/ha) were recorded in line ORVC19-32. The gross yield was found at par with lines ORVC19-30, ORVC19-33, ORVC19-38 and ORVC19-42 while the marketable yield were found at par with lines ORVC19-30, ORVC19-35, ORVC19-38, ORVC-19-42 and NHRDF Red. The lowest gross and marketable yields (258.14 q/ha and 241.48 q/ha) were recorded in the line ORVC19-42.

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

At Nashik, the highest thrips damage scale 3 was recorded in the line OWVA19-70, while the lowest damage scale 2 was in all other lines, including check variety Agrifound White. The highest gross and marketable yields (280.15 q/ha and 238.37 q/ha) were recorded in the line OWVA19-72. The lowest gross and marketable yields (190.78 q/ha and 144.65 q/ha) were recorded in the line OWVA19-70. At Karnal, the thrips damage scale 2 was recorded in all the lines including check variety Agrifound White. The highest gross and marketable yields (297.50 q/ha and 255.83 q/



ha) were recorded in the line OWVA19-66. The lowest gross yields (189.44 q/ha) were obtained in the line OWVA19-72, while the lowest marketable yield (161.66 q/ha) was recorded in the line OWVA19-70.

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

At Nashik, the highest thrips damage scale 3 was recorded in the line ORHA19-65, while the lowest damage scale 2 was noted in all other lines. The highest gross and marketable yields (351.29 q/ha and 322.30 q/ha) were obtained in the line ORHA19-55. The lowest gross and marketable yields (184.57 q/ha and 148.37 q/ha) were recorded in line ORHA19-65. At Karnal, the thrips damage scale 2 was recorded in all the lines. The highest gross yield (270.37 q/ha) was recorded in the line ORHA19-63, while highest marketable yield (195.55 q/ha) was achieved in line ORHA19-65. The marketable yield was at par with lines ORHA19-53, ORHA19-57 and ORHA19-59. The lowest gross and marketable yields (244.44 q/ha and 132.96 q/ha) were recorded in the line ORHA19-55.

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

The trial was repeated during *rabi* 2019-20 on variety NHRDF Red-4 and NHRDF Red at Nashik and Karnal respectively to confirm the findings of previous years for integrated management of Erwinia rot and foliar diseases in onion bulb production and storage through application of antibiotics, fungicides in combination with soil amendment of bioagents (*Ps. fluorescens*, *B. subtilis*, Arka microbial consortia). Split Plot Design was followed with 3 replications. The seedlings were transplanted on 10/01/2020 at RRS Nashik and on 13/02/2020 at Karnal. The sprinkler was run 15 days before harvesting for 2 hours as artificial rain to create the congenial conditions for Erwinia incidence in onion field and 18.0 mm artificial rainfall was recorded with the help of rain gauge at Nashik. The crop was harvested at maturity on 02/05/2020 at Nashik and on 27/05/2020 at Karnal. The data on disease incidence, intensity, Erwinia incidence and gross as well as marketable bulb yields are presented in Tables- 94 and 97 for Nashik and Karnal, respectively.

The pooled data of trials conducted during *rabi*, 2018-19 and 2019-20 at RRS, Nashik revealed that transplanting on raised bed under drip irrigation system with soil application of *Bacillus subtilis* @ 5 kg/ha, followed by spray of Propineb @ 0.20% at 40, 60 and 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 with highest B:C ratio (3.35:1) at Nashik. At Karnal, the transplanting on raised bed under drip irrigation system with soil application of *Pseudomonas fluorescens* @ 5 kg/ha, followed by spray of Propineb @ 0.20% at 40, 60 and 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 with highest B:C ratio (4.71:1).

Integrated crop health management in onion seed crop

The pooled data of trials conducted during *rabi*, 2017-18, 2018-19 and 2019-20 at RRS, Nashik and *Rabi*, 2018-19 and 2019-20 at 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 @ 1 ml/L + Chlorothalonil @ 2 g/l at 45 DAP, Carbosulphan @ 2 ml/L + Propineb @ 2 g/L at 60 DAP, Profenofos @ 1 ml/L + Mancozeb @ 2.5 g/L at 75 DAP, and Cypermethrin 1 ml/L + Carbendazim @ 1 g/L at 90 DAP (T₁S₃) proved to be superior for integrated crop health management against thrips as well as foliar diseases in onion seed crop at both the places. The



highest B:C ratio (15.67:1) was recorded with T₂S₄, followed by T₁S₃. (13.72:1) at Nashik while at Karnal, the highest B:C ratio (7.34:1) was recorded with T₂S₄, followed by T₁S₃. (4.46:1).

Studies on development of organic module for management of diseases and pests in onion

The pooled results of two years study conducted during *rabi* 2018-19 and 2019-20 revealed 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 @ 56 g ai/ha at 65 DAT and Propiconazole @ 0.1% at 75 DAT proved superior for the management against thrips as well as foliar diseases in onion crop.

Management of *Iris Yellow Spot Virus* and foliar diseases of onion seed crop

The study conducted during *rabi*, 2019-20 at RRS, Sinnar (Nashik) on onion variety Agrifound Light Red showed that soil application of *T. viride* @ 5 kg/ha at planting time and sequential spray of Fipronil @ 1 ml/L + Propineb @ 2g/L at 45 DAP, Carbosulphan @ 2 ml/L + Copper oxychloride @ 3 g/L at 60 DAP, Profenofos @ 1 ml/L + Mancozeb @ 2 g/L at 75 DAP, Cypermethrin @ 1 ml/L + Carbendazim @ 1 g/L at 90 DAP performed superior with lowest intensity of *Iris Yellow Spot Virus* (0.83%), stemphylium blight (8.13%), thrips foliage damage (28.53 %) as well as highest seed yield (8.38 q/ha) of onion.

Integrated management of onion thrips with few insecticides' combinations-An ecofriendly approach

The trial conducted at RRS, Nashik during *rabi* 2019-20 showed that the lowest thrips population with highest gross and marketable bulb yield was recorded with planting of barrier crop, outer row of maize + inner row of wheat on all 4 sides of the plot at least 7 days before seedling transplanting, wheat sown closely and maize at 25 cm intervals, no gap should be there in maize crop and foliar spray of *Verticillium lecanii* @ 5.0 ml/L at 30 DAT + Carbosulfon @ 2.0 ml/l at 45 DAT + *Verticillium lecanii* @ 5.0 ml/L at 60 DAT + Acephate @ 2.0 g/L at 75 DAT.

Late Kharif, 2019-20

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

The studies on the evaluation of different lines of hybrid onion against foliar diseases at Nashik revealed that the line OBV-15 proved superior with lowest intensity of stemphylium blight (5.20%), whereas the check variety NHRDF Red-4 recorded intensity of 5.80%. At Karnal, the line OBV-23 proved superior with the lowest intensity of stemphylium blight (1.37%), whereas the NHRDF Red recorded an intensity of 2.70%.

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

The studies on evaluation of different lines of white onion against foliar diseases, revealed that the line OBV-29 proved superior with lowest intensity (2.17%) of stemphylium blight and it was found at par with lines OBV-34 and check variety Agrifound White.

Evaluation of different red onion hybrid lines for disease resistance in late *kharif* IET (AINRPOG)

The studies on the evaluation of different lines of hybrid onion against foliar diseases at Nashik revealed that the line OAH-05 proved superior with lowest intensity of stemphylium blight (4.60%). At Karnal, the line OAH-08 proved superior with lowest intensity of stemphylium blight (1.83%).



Performance of onion lines for disease resistance during late *kharif* (AINRPOG)

The studies on the evaluation of performance of different lines of onion against foliar diseases revealed that the line OBV-72 was superior with lowest intensity (5.80%) of stemphylium blight, while the check variety NHRDF Red-4 showed an intensity of 7.0%.

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

At Nashik, the thrips damage scale 2 was recorded in all lines including check variety NHRDF Red-4. The highest gross and marketable yields (329.14 q/ha and 309.62 q/ha) were obtained in NHRDF Red-4, where the marketable yield was at par with the lines OBV-18 and OBV-21, and the gross yield was at par with line OBV-21. The lowest gross and marketable yields (237.23 q/ha and 198.45 q/ha) were recorded in line OBV-15. At Karnal the thrips damage scale 1 was recorded in all the lines including NHRDF Red. No bulb formation was observed in any line, including NHRDF Red.

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

The trial could not be arranged due to mortality of seedlings of all lines including check variety Agrifound white at Nashik. However, at Karnal, the thrips damage scale 1 was recorded in all the lines including Agrifound white. The bulb formation failed in all the lines including Agrifound white.

Performance of onion lines for thrips resistance- AVT-II (AINRPOG)

At Nashik, the highest thrips damage scale 3 was recorded in the line OBV-70 and lowest scale 2 in lines OBV-58, OBV-72 and NHRDF Red-4. The highest gross and marketable yields (323.16 q/ha and 308.50 q/ha) were recorded in NHRDF Red-4, while the lowest gross and marketable yields (125.84 q/ha and 110.21 q/ha) was recorded in line OBV-72.

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

At Nashik, the highest thrips damage scale 3 was recorded in the line OAH-13, while the lowest scale 2 was in other two lines. The highest gross and marketable yields (221.50 q/ha and 190.69 q/ha) were recorded in line OAH-13. The lowest gross and marketable yield (142.70 q/ha and 126.52 q/ha) were obtained in line OAH-05. The results at Karnal showed thrips damage scale 1 was recorded in all the lines. The bulb formation was not found in any line.

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 were recorded in onion during November, 2019. The maximum 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 maximum 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 insect of onion

Nashik

Black mold, bacterial soft rot and other storage diseases

The survey was conducted in onion storage for the occurrence of insect pests and diseases in five villages, namely Bhabde, Gunjal Nagar, Saraswati wadi, Lohnere, and Vasulpada of taluka-Deola on 28.05.2019. The onion bulbs stored in chawal/godowns were produced by farmers during *rabi* season 2018-19. Thus, a total of twenty-five (25 nos.) onion storage sites were visited for



diseases of onion and the data were recorded. Onion bulbs stored in 25 different chawal in different villages were studied and the black mold incidence was found to range from 0 to 3.0% after one month of storage. The highest black mold incidence (3.0%) in onion bulbs was recorded in storage at village Gunjal Nagar and Saraswati wadi after one month of storage.

Similarly, a total of 25 onion storage sites were visited for diseases of onion and data recorded on 25.06.2019 in five villages namely Niwane (onion storage -5 nos.), Juni Bhendi (onion storage -5 nos.), Navi Bhendi (onion storage -5 nos.), Padebudruk (onion storage -5 nos.), and Manur (onion storage-5 nos.) of taluka Kalwan. Onion bulbs stored in 25 chawal in five villages were studied and the black mold incidence was found to vary from 2.0 to 5.0% after two months of storage. The highest black mold incidence (5.0%) was recorded in storage at villages Juni Bhendi, Navi Bhendi and Padebudruk.

Again, a total of 25 onion storages were visited on 10.07.2019 in the five villages in taluka Yeola. Onion bulbs stored in the 25 storages in the villages showed the black mold incidence ranging from 7.0 to 16.0% after three months of storage. The highest black mold incidence (16.0%) in onion bulbs was recorded in the village Andershol.

Again, 25 onion storages were visited on 26.08.2019 in five villages namely Niwane, Juni Bhendi, Navi Bhendi, Sakora and Manur in taluka Kalwan, Nashik. Onion bulbs stored in there were studied and the black mold incidence was recorded to range from 9.0 to 19.0% in onion bulbs after four months of storage. The highest black mold incidence (19.0%) were 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.

Stemphylium blight (*Stemphylium vesicarium*)

Diseases of onion crop at twenty-five farmers fields were studied recorded on 28.09.2019 at villages Dhandhari, Lakhamapur, Bramhangaon, Aarai and Shemdi of taluka Satana. The farmers had transplanted onion seedlings on different dates in August (15 to 30.08.2019) in the different villages. Onion fields were visited and found that the crop was at vegetative growth stage because transplanting was done during August. The farmers had selected Agrifound Dark Red and local onion variety for *kharif* season. Stemphylium blight was found only in five onion fields with disease intensity of 0.40 to 2.0% and incidence of 10-20%, in crop transplanted during the month of August. The highest stemphylium blight incidence (20.0%) with intensity (2.0%) was recorded in the onion field transplanted on 15/08/2019 of farmer in Shemdi village.

Further, diseases of onion crop at 25 farmers fields were studied on 23.10.2019 during the survey at villages Deshmane, Purangaon, Aandershool, Erandgaon and Gavandgaon of taluka Yeola. The farmers had transplanted onion seedlings in August (22.08.2019), September (12 to 28.09.2019) and on different dates in October (01 to 10.10.2019). Onion fields were found at vegetative, bulb initiation as well as bulb development stages as transplanting was done mostly during September and October 2019. The farmers had selected L-883 and local onion variety for *kharif* season. Stemphylium blight was found in 7 onion fields with disease intensity of 0.40 to 3.60% and incidence of 10-40% in crops transplanted during the month of August, September and October. The highest stemphylium blight incidence (40.0%) with intensity (3.60%) was recorded in onion field transplanted on 22/08/2019 of farmer Sh. Bhasker Govind Mali in Aandershool village, whereas the lowest stemphylium blight intensity (0.40 %) was recorded in onion field of Sh. Balkrishna Yashwant Thomre (village Purangaon) and Sh. Kondaji Ramji Pagare (village Erandgaon).

A total of 25 farmers fields were visited for study of diseases in onion crop at different villages Sograush, Shirsane, Bhatgaon, Bhoeyagaon and Khadak Malegaon of taluka Chandwad on 28.11.2019. The seedlings were transplanted by the farmers on different dates in September (15 to



20.09.2019), October (04 to 28.10.2019) and few plots in November (01 to 03.11.2019) in different villages in *kharif/late kharif* season. At the time of visit, the crop was at vegetative stage as well as bulb development stage. Stemphylium blight disease intensity ranged from 0.40 to 15.60% and incidence from 10-70%. The highest stemphylium blight incidence (70.0%) with intensity of 15.60% was recorded in onion field of farmer Sh. Dhyaneshwar More in Bhatgaon village that was transplanted on 15/09/2019.

Purple blotch (*Alternaria porri*)

Purple blotch was absent in all the 25 onion fields of five villages namely Dhandhari, Lakhamapur, Bramhangaon, Aarai and Shemdi of taluka Satana as on 28.09.2019.

The same onion fields were again visited for purple blotch disease on 23.10.2019 and data were recorded during the survey at the villages of taluka Yeola. The disease intensity ranged from 0.40 to 1.60% and incidence from 10 to 20% in the crops transplanted during the month of August, September and October. The highest purple blotch incidence (20.0%) with intensity of 1.60% was recorded in onion field of farmer Sh. Bhasker Govind Mali in village Aandershool that was transplanted on 22.08.2019.

Purple blotch intensity varied from 0.40 to 8.40% and incidence from 10 to 65% during the survey on 28.11.2019 in the 25 fields in the villages of taluka Chandwad. The highest purple blotch intensity (8.40%) was recorded in onion field of farmer Sh. Dhyaneshwar More in village Bhatgaon that was transplanted on 15/09/2019.

The other diseases like onion smut (*Urocystis cepulae*), bacterial rot (*Pseudomonas aeruginosa*) and nematode (*D. dipsaci/Pratylenchus spp.*) incidence were not found in onion.

Thrips (*Thrips tabaci*)

Thrips in onion crop at 25 farmers fields were studied on 28.09.2019 during the survey at villages Dhandhari, Lakhamapur, Bramhangaon, Aarai and Shemdi of taluka Satana. The farmers had transplanted onion seedlings in August (15 to 30.08.2019). The thrips incidence ranged from 8 to 10% with 2 to 5 nymphs/plant in the month of September 2019 in crop transplanted during August (*kharif* 2019). Fifteen onion fields were found free from thrips.

The survey for thrips infestation in onion crop was conducted in all the 25 fields in the same villages Deshmane, Purangaon, Aandershool, Erandgaon and Gavandgaon of taluka Yeola on 23.10.2019. The thrips incidence ranged from 5 to 12% with population from 2 to 8 nymphs/plant in crop transplanted during the period August to October. The highest thrips incidence (12.0%) with population of 8 nymphs/plant was recorded in onion field of farmer Sh. Bhasker Govind Mali in village Aandershool.

The survey for thrips infestation in onion crop was done in all the 25 fields in villages Sograush, Shirane, Bhatgaon, Bhoiegaon and Khadak Malegaon of taluka Chandwad on 28.11.2019. The incidence ranged from 5 to 25% with population from 2 to 30 nymphs/plant in crop transplanted during the months of September to November. The highest thrips incidence (25.0%) and population (30 nymphs/plant) were recorded in same onion field of farmer Sh. Dhyaneshwar More in village Bhatgaon.

Karnal

A total of 25 onion storages and one 1 field were visited in the month of July (29.07.2019), August (31.08.2019), September (30.09.2019) and November (06.11.2019) for diseases and thrips of onion crop and data were recorded during the survey at two villages namely Rambha and Kutail in Karnal district, Haryana.



Black mold, bacterial soft rot and other storage diseases

The onion bulbs stored in chawal/godowns were produced by farmers during *rabi* season 2018-19. The black mold incidence ranged from 10 to 22.0% in July, from 14 to 20.0% in August and from 18 to 24.0% in September. The highest black mold incidence (24.0%) in onion bulbs was recorded in storage of farmer Sh. Saranjit in village Rambha, Karnal in September 2019.

Stemphylium blight (*Stemphylium vesicarium*)

Stemphylium blight showed 2.90% intensity with 60% incidence in one field during survey in the month of November (06.11.2019) in village Rambha.

Purple blotch (*Alternaria porri*)

Purple blotch did not appear in onion field in the village Rambha during *kharif* 2019.

Thrips (*Thrips tabaci*)

Thrips did not appear in onion field in the village Rambha during *kharif* 2019.

Evaluation of different lines of red onion for disease resistance- AVT-II (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 and purple blotch diseases including Agrifound Dark Red. However, line OCV19-55 proved to be superior with lowest intensity of stemphylium blight (9.20%) and line OCV19-64 with lowest intensity of purple blotch (5.20%). The check variety Agrifound Dark Red recorded 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 studies on the evaluation of different white onion lines during *kharif* 2019 conducted at Nashik revealed that none of the lines was free from stemphylium blight disease, including check variety Agrifound White, however, line OAV19-23 proved to be overall superior with lowest intensity of stemphylium blight (7.60%) and purple blotch (4.20%), while the check variety Agrifound White recorded high intensity of stemphylium blight and purple blotch (18.60% and 7.80%) respectively.

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

The studies on the evaluation of different red onion hybrid lines during *kharif* 2019 conducted at Nashik showed that none of the lines was free from stemphylium blight and purple blotch diseases, however, line OAH19-33 proved superior with lowest intensities 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 residue in bulbs after harvest

The pooled 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 superior for management of foliar diseases with percent disease control (PDC) of stemphylium blight (61.15%) and purple blotch (43.50%) to 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 benefit cost ratio (9.21:1) in the 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 more effective for management of foliar diseases with 49.24% percent disease control (PDC) of stemphylium blight than 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 after harvesting.

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* @ 5.0 g/L at 45 DAT + spray of Trifloxistrobin + Tebuconazole @ 0.2% at 60 DAT + spray of *T. viride* @ @ 5.0 g/L at 75 DAT performed better for management of purple blotch disease with lowest intensity (6.10%) in comparison to the intensity (9.30%) in untreated control.

At Karnal, purple blotch did not appear on onion crop during the entire cropping season in any treatment including untreated control. The onion bulbs were found free from pesticide residue after harvest.

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

The thrips foliage damage ranged from 11.0 to 18.76 % in different red onion lines, including the check variety Agrifound Dark Red. The highest gross yield (177.44 q/ha) was recorded in line OBV19-47 and it was found at par with all lines except line OBV19-53. The highest marketable yield was recorded in line OBV19-47 (152.55 q/ha) and it was at par with line OBV19-44, OBV19-49 and OBV19-51. The lowest gross and marketable yields (128.59 and 102.04 q/ha, respectively) were recorded in line OBV19-53.

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

The thrips foliage damage ranged from 20.50 to 24.60 % in different red onion hybrid lines. The highest gross yield (192.70 q/ha) was recorded in line OAH19-35 and it was found at par with all lines except line OAH19-42. The highest marketable yield was recorded in line OAH19-35 (149.61 q/ha) and it was at par with line OAH19-38 and OAH19-40. The lowest gross and marketable yields (131.57 and 103.87 q/ha, respectively) were recorded in line OAH19-42.

Post Harvest Management

***Rabi*, 2019-20**

Storage performance of red onion lines- IET (AINRPOG)

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed the lowest total loss (16.95%) four months after storage in the line ORVA-19-16 and it was at par with the ORVA-19-



01, ORVA-19-07 ORVA-19-14 and the check variety NHRDF Red-4. At Karnal, the no sprouting, decay loss (11.75%), and total loss (26.43%) were recorded in the line ORVA-19-01, which was at par with the lines ORVA-19-05, ORVA-19-07, ORVA-19-11, check varieties ALR, NHRDF Red-3 and NHRDF Red-4 in respect of total loss after four months of storage.

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

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed the lowest total loss (10.54%) during four months after storage in the line ORVB19-29 and it was at par with the lines ORVB-19-20, ORVB-19-22, ORVB-19-24 and check variety NHRDF Fursungi. At Karnal, the lowest zero sprouting was recorded in line ORVB-19-29 and lowest decay loss (25.97%), PLW (34.61%) and total loss (37.87%) were recorded in the NHRDF Red-3, that was at par with the check varieties ALR and NHRDF Red-4 during four months of storage.

Storage performance of red onion lines for early maturity- IET (AINRPOG)

The trial conducted at RRS, Nashik during *rabi* 2019-20 revealed that the lowest total loss (13.46%) after four months of storage was in the check variety NHRDF Fursungi, at par with the lines OREA-19-45, OREA-19-52, NHRDF Red-3 and NHRDF Red-4. At Karnal, the lowest zero sprout loss, decay loss (3.89%) and total loss (13.97%) were recorded in the line OREA-19-52 and it was at par with line OREA-19-48 in respect of decay loss and total loss after four months of storage.

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

The trial conducted at RRS, Nashik during *rabi* 2019-20 revealed that after four months of storage, the lowest decay loss (12.55%) and total loss (28.35%) were in the check variety Agrifound White, however, the lowest sprout loss (2.47%) was recorded in the line OWVB-19-82 and it was found at par with the check variety Agrifound white. At Karnal, the lowest sprout loss (0.77%) after four month of storage was recorded in line OWVB-19-75 and the lowest decay loss (5.33%) and total loss (22.10%) were recorded in the line OWVB-19-82 and the Agrifound White, respectively, at par with the Agrifound White and lines OWVB-19-82 in respect of decay and total loss, respectively.

Storage performance of white onion lines for high TSS - IET (AINRPOG)

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed that after five months of storage, the lowest PLW (24.82%) and total loss (33.20%) were in the check variety Agrifound White, at par with the lines OWTA-19-87, OWTA19-91, OWTA-19-96, OWTA-19-98 in respect of total loss. At Karnal, the lowest decay (12.02%) and total loss (31.62%) was found in the line OWTA-19-89 and it was at par with the line OWTA -19-98 and check variety Agrifound White in respect of total loss.

Storage performance of white onion germplasm – (AINRPOG)

The trial conducted at RRS Karnal during *rabi* 2019-20 revealed that after five months of storage, the lowest total loss (28.29%) was recorded in the line W-182 and it was at par with the lines L-355, W-045, W-143, W-177, W-203, W-226, W-232, W-390 and check variety Bhima Shweta.

Late Kharif, 2019-20

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

The trial conducted at Nashik during late *kharif* 2019-20 revealed that the lowest total loss (21.00%) was in check variety NHRDF Red-4, at par with line OBV-15 (21.13%) after 3 months of storage.



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

The trial at Nashik during late *kharif* 2019-20 revealed the lowest total loss (23.11%) in check variety NHRDF Red-4, at par with lines OCV-38, OCV-45 and OCV-47 after 3 months of storage.

Varietal performance of onion (AINRPOG)

The trial conducted at Nashik during late *kharif* 2019-20 revealed that after 3 months storage, the lowest total loss (20.00%) was in line OBV-58, which was at par with check variety NHRDF Red-4.

Storage performance of red onion hybrid lines IET (AINRPOG)

The trial conducted at Nashik during late *kharif* 2019-20 revealed that after 3 months of storage, the lowest total loss (16.28%) was in line OAH-13 and it was at par with line OAH-02.

Kharif, 2019

Storage performance of red onion lines- IET (AINRPOG)

The trial conducted at RRS, Nashik during *kharif* 2019 revealed the lowest total loss (28.58%) after 2 months of storage in the line OAV-19-14, at par with lines OAV-19-10, OAV-19-16, OAV-19-18 and OAV-19-20.

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

The trial conducted at Nashik during *kharif* 2019 revealed that the lowest total loss (32.85%) was in the line OBV-19-47 and it was at par with after 2 months of storage with OBV-19-44, the check varieties Bhima Dark Red and Agrifound Dark Red.

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

The trial conducted at Nashik during *kharif* 2019 revealed that after 2 months of storage the lowest total loss (22.45%) was in the line OCV-19-62 and it was at par with line OCV-19-60, check varieties Bhima Dark Red and Agrifound Dark Red.

Storage performance of white onion lines- IET (AINRPOG)

The trial conducted at Nashik during *kharif* 2019 revealed that after 2 months of storage the lowest total loss (21.85%) was in line OAV-19-21 and it was at par with the lines OAV-19-23, OAV-19-25 as well as OAV-19-28.

Storage performance of red onion hybrid lines- IET (AINRPOG)

The trial conducted at Nashik during *kharif* 2019 revealed that the lowest decay loss (0.73%) and total loss (18.12%) after 2 months of storage was in the line OAH-19-38 and it was at par with the line OAH-19-35 in respect of decay loss and with the lines OAH-19-35 and OAH-19-42.

Garlic

Plant Genetic Resources and Crop Improvement

Rabi, 2019-20

Collection, evaluation and conservation of garlic germplasm

The trial conducted at RRS, Karnal during 2019-20 revealed that the highest gross yield (244.00 q/ha), marketable yield (244.00 q/ha) and lowest unmarketable bulbs (0.00%) were recorded in the garlic line G-450.



Collection, evaluation of garlic germplasm- (AINRPOG)

The trial conducted Karnal during *rabi* 2019-20 revealed that the gross yield (183.30 q/ha) and marketable yield (181.35 q/ha) were recorded in the line G-404.

Performance evaluation of garlic lines- IET (AINRPOG)

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed that the highest gross yield (117.42 q/ha) and marketable yield (112.95 q/ha) were recorded in the line GN-19-12 and it was at par with the check variety Yamuna Safed-9 in respect of gross and marketable yield. At Karnal, the highest gross yield (170.74 q/ha) and marketable yield (170.19 q/ha) were recorded in the check variety Yamuna Purple-10.

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

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed that the highest gross yield (116.79 q/ha), marketable yield (112.09 q/ha), average bulb weight (26.35 g) and average weight of 10 cloves (14.49 g) were recorded in the check variety Yamuna Safed-9. At Karnal the highest gross yield (138.74 q/ha), marketable yield (137.52 q/ha), average bulb weight (25.31 g), average weight of 10 cloves (14.76 g) were recorded in the Yamuna Purple-10, and was at par with the Yamuna Safed -8 in respect of gross yield and marketable yield and with the lines GN-19-36 in respect of gross yield.

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* 2019-20 revealed that the highest gross yield (136.47 q/ha) and marketable yield (135.39 q/ha) as well as minimum number of cloves per bulb (9.80) were recorded in the line G-433 and it was at par with the line G-66 in respect of gross and marketable yields. The line G-433 was found as bold size cloves of garlic.

Study the performance evaluation of garlic advance lines

The trial conducted at RRS Karnal during *rabi* 2019-20 revealed that the gross yield (210.22 q/ha) and marketable yield (209.96 q/ha) were recorded in the line G-397.

Post Harvest Management

Rabi, 2019-20

Collection, evaluation and selection of garlic germplasm (AINRPOG)

The trial conducted at Karnal during *rabi* 2019-20 revealed that the lowest total loss (3.75 %) at 135 days after storage was in line G-39.

Collection, evaluation and selection of garlic germplasm- (AINRPOG)

The trial conducted at Karnal, during *rabi* 2019-20 revealed that after 135 days of storage, the lowest total loss (4.10 %) was found in the line G-35, at par with the lines G-23, G-192, G-229, G-366, G-376, G-384, G-409, and the check varieties Yamuna Safed-3 and Yamuna Safed-5.

Storage performance of garlic lines- IET (AINRPOG)

The trial conducted at RRS Nashik during *rabi* 2019-20 showed that after 135 days of storage, the lowest total loss (6.23%) was in the line GN-19-09 and it was at par with the line GN-19-07. At Karnal, 180 days after storage the lowest total loss (8.87%) was in the line GN-19-01 and it was at par with the line GN-19-07.



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

The trial conducted at RRS Nashik during *rabi* 2019-20 revealed that after 135 days of storage, the lowest total loss (3.33 %) was in the line GN-19-42 and found at par with the line GN-19-36. At Karnal the lowest total loss (7.27 %) was recorded in the line GN-19-40 and was found at par with the lines GN-19-38, GN-19-44 and GN-19-46.

Crop Production System Management

Rabi, 2019-20

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

The study was conducted on garlic variety Yamuna Safed-3 (G-282) during *rabi*, 2017-18, 2018-19 and 2019-20 at RRS, Karnal. The three years pooled results revealed that; The fertigation treatment 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha proved to be superior in terms of highest yield and benefit : cost ratio (1.84:1), and it was found at par with treatment 100% RDF (NPKS in 8 splits) *i.e.* 100:50:50:30 kg/ha.

The growth regulators treatment foliar application of gibberalic acid (GA₃) @ 50 ppm at 45 & 60 DAP performed better than other treatments in respect of yield and it was found at par with treatment foliar application of NAA @ 50 ppm at 45 & 60 DAP. The highest benefit : cost ratio (1.89:1) was recorded in both the treatments.

The combination of fertigation and growth regulators *i.e.* fertigation treatment 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha and foliar application of gibberalic acid (GA₃) @ 50 ppm at 45 & 60 DAP proved to be superior to other treatments in terms of highest yield. However, the highest benefit: cost ratio (1.86:1) was recorded in fertigation treatment 80% RDF (NPKS in 8 splits) *i.e.* 80:40:40:24 kg/ha and foliar application of NAA @ 50 ppm at 45 & 60 DAP.

Fertilizer scheduling through drip irrigation system in garlic (AINRPOG)

The experiments were conducted at RRS, Karnal on garlic variety Yamuna Safed-4 (G-323) during *rabi* 2017-18, 2018-19 and 2019-20. The three years pooled results revealed that the treatment drip irrigation at 100% PE through drip system - Irrigation at alternate day 100% RDF (100:50:50:50 kg NPKS/ha) – fertigation at 6 days intervals + 5 tons organic manure; Full dose of organic manure applied as a basal before planting proved, superior as compared to the other treatments in terms of uptake of potassium and sulphur. The same treatment also recorded the highest marketable bulb yield, bulb dry matter and highest benefit : cost ratio (1.83:1).

Plant Health Management

Rabi, 2019-20

Evaluation of garlic lines for disease resistance- IET (AINRPOG)

The studies on evaluation of garlic lines revealed that the line GN19-12 proved to be superior with lowest intensity of stemphylium blight (3.73%) and purple blotch (0.93%), whereas check variety Agrifound White showed stemphylium blight (387%) and purple blotch (1.47%) at Nashik. At Karnal, the line GN19-04 proved to be superior with the lowest intensity of stemphylium blight (2.30%), whereas check variety Yamuna Safed-3 had an intensity of 3.30%.



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

The studies on evaluation of garlic lines revealed that the line GN19-36 proved superior with the lowest intensity of stemphylium blight (3.87%) and purple blotch (0.67%), whereas check variety Agrifound White showed the stemphylium blight intensity of 4.0% and purple blotch 1.60% at Nashik. At Karnal also, line GN19-36 proved to be superior with lowest intensity of stemphylium blight (2.80%), whereas check variety Yamuna Safed-3 recorded an intensity of 3.23%.

Screening of different garlic lines for thrips resistance- IET (AINRPOG)

At Nashik, the lowest thrips damage scale 1 was recorded in lines GN19-09, GN19-12, GN19-21, GN19-23 and check variety Agrifound White, while the highest thrips damage scale 2 was recorded in all the other lines at 75 DAP. The highest gross and marketable yields (91.47 q/ha and 87.69 q/ha) were recorded in Agrifound White, while gross yield was found at par with lines GN19-01, GN19-04, GN19-09 and GN19-12. The lowest gross and marketable yields (25.53 q/ha and 15.0 q/ha) respectively were recorded in the line GN19-21. At Karnal, the thrips scale 1 was recorded in all the lines including Yamuna Safed-3 at 75 DAP. The highest gross and marketable yields (198.14 q/ha and 187.65 q/ha, respectively) were recorded in Yamuna Safed-3. The lowest gross and marketable yields (76.54 q/ha and 63.58 q/ha) were recorded in the line GN19-21.

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

The data revealed that at Nashik the lowest thrips damage scale 1 was recorded in the line GN19-36 and check variety Agrifound White, while the highest thrips damage scale 2 was recorded in all the other lines at 75 DAP. The highest gross and marketable yields (101.74 q/ha and 97.20 q/ha, respectively) were recorded in Agrifound White. The lowest gross yield (35.59 q/ha) was recorded in line GN19-44 while lowest marketable yield (22.85 q/ha) was recorded in the line GN19-42. At Karnal, the thrips scale 1 was recorded in all the lines, including Yamuna Safed-3 at 75 DAP. The highest gross and marketable yields (191.97 q/ha and 183.94 q/ha) respectively) was recorded in Yamuna Safed-3, while gross yield was found at par with line GN19-48. The lowest gross and marketable yields (101.85 q/ha and 93.82 q/ha, respectively) were recorded in line GN19-44.

Okra

Plant Health Management

Kharif, 2020

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

The trial conducted during *kharif* 2020 at Nashik showed highest population of white fly (3.30 nymphs/3 leaves / plant), jassid (6.0 nymphs/3 leaves/plant), shoot borer infestation (38.33%) and fruit borer infestation (34.24%) in okra during 29th and 34th standard week, respectively. In tomato, the highest population of white fly (10.50 nymphs / 3 leaves / plant) was recorded during 31st standard week, while the highest jassid population (1.40 nymphs/3 leaves/plant) was recorded during 33rd standard week and fruit borer infestation (55.55%) during 44th standard week. At Karnal, the highest population of jassid (63.70 nymph /3 leaves / plant) and fruit borer infestation (14.58 %) were recorded in okra during 42nd and 43rd standard week, respectively. In tomato, the highest whitefly population (3.30 nymphs/3 leaves / plant) was recorded during 37th standard week, while no flowering and fruiting were observed during entire cropping period due to infection of leaf curl virus.



(B) Laboratory Studies/Services

Bio-control Laboratory

Nashik

NHRDF Tricho-Vir (*Trichoderma viride*)

(i) Talcum base

Mass production of NHRDF Tricho-Vir was carried out and a total of 249.76 q of Tricho-Vir was prepared, packed and distributed to the farmers under plant protection service for the management of soil borne fungal diseases in different horticultural crops.



(NHRDF TRICO-VIR, Powder)



(NHRDF TRICO-VIR, Liquid)

(ii) Liquid base

Mass production of liquid base Tricho-Vir was also carried out and a total of 1064.0 litre of liquid base formulation was prepared, packed and distributed to the farmers under plant protection services for the management of soil borne fungal diseases in different horticultural crops, especially grape and pomegranate.

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

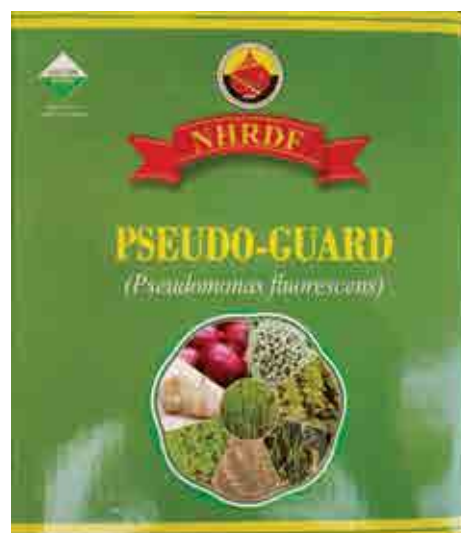
Mass production of NHRDF Pseudo-Guard was carried out and a total of 10.80 q of Pseudo-Guard was prepared, packed and distributed to the farmers under different schemes for the management of soil borne diseases in different horticultural crops.



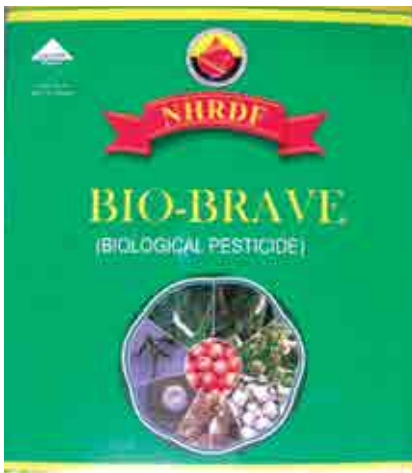
(NHRDF S-Guard)

NHRDF S-Guard (SNPV)

Mass production of the Spodoptera Nuclear Polyhedrosis Virus (SNPV) was carried out and a total of 280100 LE, were prepared, packed and distributed to the farmers for management of *Spodoptera litura* in vegetable and horticultural crops.



(NHRDF PSEUDO- GUARD)



(BIO-BRAVE)

Karnal

Bio-Brave (*Beauveria bassiana*)

Mass production of Bio-Brave was carried out and a total of 35.20 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 169 kg of honey was produced from honey bee unit and the entire quantity was distributed on cost basis for the maintenance of bee unit.



(Bee Unit)

Mushroom Spawn Production Laboratory

New Delhi

Good quality spawn of different edible species of mushroom, namely button mushroom (*Agaricus bisporus*), Oyster mushroom (*Pleurotus species*), milky mushroom (*Calocybe indica*), fresh mushroom and pasteurized compost were produced in the laboratory. A total of 2483.1 kg of spawn of different species of mushroom were produced and distributed to the mushroom growers in Delhi, Uttar Pradesh, Haryana, Punjab and Uttarakhand. Good quality 15390 kg of pasteurized compost was also produced and distributed to the mushroom growers.



Oyster mushroom (*Pleurotus florida*)



Button mushroom (*Agaricus bisporus*)

Pesticide Residue Analysis Laboratory

Nashik

A total of 2755 samples of different matrix viz., grapes, wine, chemicals, onion and other fruits and vegetables were analyzed for agrochemicals residue as well as chemicals for quality standards in Pesticide Residue Analysis Laboratory. A total of 150 vegetable samples were analysed for residue analysis in each month under MPRNL project of DA & FW, MOAFW, Govt. of India.



(Pesticide Residue Analysis Lab, Nashik)

Plant Pathology Laboratory

Nashik

Identification of diseases and plant pathogens

A total of 446 samples (Soil- 40, Grape- 1, Onion bulbs- 372, Potato- 27, Rose- 1, Maize- 1, Ginger- 1, Cocopit- 1 & organic manure- 2) 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.



(Plant Pathology Lab, Nashik)

Laboratory Experiments

In vitro quality test of talcum based and liquid formulation of NHRDF Tricho-Vir and NHRDF 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-based 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 2.0×10^6 to 3.0×10^6 per gram in the talcum-based, while in liquid formulation of *T. viride*, the colony ranged from 2.66×10^6 to 3.66×10^6 /ml in the product. The colony count after mixing of *Ps. fluorescens* culture and talcum powder was 1.33×10^8 to 2.0×10^8 per gram.



Fruit bud differentiation in grape

A total of 16 samples of grape canes received from the farmers in Nashik area of Maharashtra were studied under stereoscopic binocular microscope for fruit bud differentiation and the reports were issued accordingly.

Plant Physiology Laboratory

Nashik

A total of 4048 samples of onion and garlic received from different field trials were analyzed 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 508 samples of onion and garlic received from different field trials were analyzed for total soluble solids, dry matter and pyruvic acid content.



(Plant Physiology Lab)

Seed Testing Laboratory

New Delhi

A total of 976 seed samples of vegetables, cereals, pulses, oil seeds and flowers seed, Onion, Pea, Cowpea, Cluster bean, Tomato, Bhindi, Mustard, Carrot, Methi, Groundnut, Soybean, Brinjal, Paddy, Palak, Radish, Bottle guard, Chilli, Coriander, Capsicum, Pumpkin, Cucumber, French bean, Bean, Sponge gourd, Muskmelon, Drumstick, Marry gold, Cauliflower, Cabbage, and Raya)



(Seed Test Lab)



(Soil Testing Lab)

received from different center of NHRDF and also outside of organization and tested for the germination, moisture and physical purity (GMP).

Soil Testing and Biochemistry Laboratory

Nashik

A total of 1635 samples received from farmers & other organization of soil, irrigation water, plant petiole, grape wine, table grapes, organic manure, FYM, and vermicompost were tested and report was issued.

Cost of Production of Onion, Garlic & Potato

Onion, garlic and potato are important vegetable crops grown in India on a large scale. These crops are cultivated in almost all the states 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 require 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* seasons. Seed is sown in field and seedlings are raised which are transplanted in main field manually. Depending upon the aims, the crop requires 5-7 irrigations in *kharif* season, 10-15 in late *kharif* and 15-18 during *rabi* session. Besides, the crop is affected by diseases and insect-pests and thus, the application of herbicides and pesticides is must to address the problems, which enhances the cost of production. When the crop attains maturity, harvesting is done manually which further increases the cost of production.

Garlic is grown in *rabi* session only by planting of cloves in the main field. Like onion, 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.

Potato is cultivated mainly in *rabi* season, however, in the states of Madhya Pradesh, Maharashtra and Karnataka, *kharif* crop is also grown. Like onion and garlic crops, potato is also planted and harvested manually and require frequent irrigations, high manure and chemical fertilizer doses, along with 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 up to 40% water, which can be used 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 of each crop with area is given below:



The cost of production of common *kharif* onion varied from Rs. 478 to Rs. 921/- per quintal and *rabi* onion from Rs. 463 to Rs. 963/- q depending upon the labour wages, cost of seed / planting material, other inputs and yield of onion (Tables 3 & 4).

- ◆ The cost of production of common onion seed varied from Rs. 463 to 1263/kg in different varieties, depending upon the inputs, labour and seed yield. The cost of production of Agrifound Rose onion seed was Rs. 605/kg (Table 4).
- ◆ The cost of production of *kharif* 'onion produced by locally grown sets (bulblets) in Coimbatore district (Tamil Nadu) was Rs. 1654/q, while it was Rs. 1119/q for crop raised by transplanting seedlings (Table 3).
- ◆ The cost of production of garlic ranged from Rs. 1695 to 4497/q depending upon the varieties, labour wages, input cost, and yield at different places. The details of cost of production of garlic are given in Table 5.

Area and Production of Onion, Garlic and Potato

The production of onion, and garlic crop increased during the period under report. Onion production accounted more by around 2.10%, 14.53% potato and 8.02% garlic as compared to 2019-20. The state-wise area, production and productivity of onion, garlic and potato during 2020-21 is given in Tables 7, 8, 9.


Export of Onion, Garlic and Potato

During 2020-21, 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, indicate that export of onion was 15.78 lakh tonnes, 31.46% more than the previous year (2019-20). Onion was exported mainly to Malaysia, Singapore, Bangladesh, Nepal, Sri Lanka, Mauritius and Gulf countries (Table 10).

The export of Garlic was 4.49 lakh tonnes, 42.43% less than previous year. Garlic was exported mainly to Canada, Mexico, Australia, Thailand, Sri Lanka, Nepal, Taiwan, Bangladesh and Poland (Table 13).

Potato was exported mainly to Nepal, Brazil, Germany, Maldives, United Arab Emirates, the USA, Oman and UK. A total export of potato was 323,687.98 MT, about 24.20% less than previous year. The details of export of potato are given in Table 15.





Projects Implemented

9

The NHRDF continued to implement various projects related to research and development of vegetables 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 Farmers Welfare, Government of India

Department of Agriculture and Farmers Welfare

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

Department of Agriculture Research and Education – Indian Council of Agricultural Research (ICAR)

- ◆ Krishi Vigyan Kendra, Ujwa, New Delhi, ICAR-ATARI, Zone II, Jodhpur, Rajasthan
- ◆ 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 under RKVY

Government of Odisha

- ◆ Regional Research Station, NHRDF, Boudh

Government of Madhya Pradesh

- ◆ Onion Storage Structure through NAFED under RKVY

Transfer of Technology

10

(A) Extension

The NHRDF is involved in extension education of farmers and trainers since its inception. The object behind that is to quicken the process of transfer of technology so that farmers are able to adopt the same and thereby improve the yield and quality of their crops at a faster rate. The farmers were guided on improved package of practices for growing onion, garlic and other horticultural vegetable crops under this programme. The NHRDF implemented extension education programmes through demonstrations, trainings, field days, meetings, providing literature and arranging exhibitions, seminars and group visits through different centres located almost all over the. The extension centres implementing the transfer of technology programmes are given below:

| S. No. | Centre Name | State Covered |
|--------|----------------------------|---|
| 1. | Bhatinda | Punjab |
| 2. | Boudh | Odisha |
| 3. | Chitegaon | Maharashtra |
| 4. | Coimbatore | Tamil Nadu |
| 5. | Delhi | Delhi and Uttarakhand |
| 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. | Kombai | Tamil Nadu |
| 12. | Kota | Rajasthan |
| 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, Ujwa | NCT Delhi |



(B) Electronic Media Coverage 2020-21

| S. No. | Topic | Programme | Date & time of telecast/broadcast |
|---|---|-----------------|-----------------------------------|
| Dr. P. K. Gupta, Director (Acting) | | | |
| 1. | <i>Rabi pyaj evam lehsun ki katai va bhandaran</i> | DD Kissan | 24 th May, 2020 |
| 2. | Solar project under <i>Mukhayamantri Aaya Badhotari Yojna</i> GNCT, Delhi | Krishi Darsan | 20 th October, 2020 |
| 3. | MIDH Schemes of GOI | DD Kisaan | 9 th July, 2020 |
| 4. | <i>Kharif onion ki utpadan taknik</i> | Hello Kisaan | 16 th Aug, 2020 |
| 5. | <i>Pyaj lahsun ki dekhbhal</i> | DD Kisaan | 11 th Jan, 2021 |
| Dr. (Mrs) Ritu Singh, SMS (Home Science) | | | |
| 1. | Food Processing | Hello Kisaan | 5 th June, 2020 |
| 2. | <i>Mausam ke anusar sabjiyon ka prasanskan</i> | DD Kisaan | 3 rd Feb, 2021 |
| 3. | <i>Antarrashtriya mahila diwas mahilao ko krishi main bhagidari</i> | DD Kisaan | 5 th March, 2021 |
| Dr. Rakesh Kumar, SMS (Horticulture) | | | |
| 1. | Package & practices of summer season crops during COVID-19 | DD Kisan | 8 th May, 2020 |
| 2. | Central Govt. Schemes | DD Kisaan | 28 th July, 2020 |
| 3. | <i>Kharif mausam main sabjiyon ki samsamayik karya</i> | Hello Kisaan | 24 th Aug, 2020 |
| 4. | <i>Grisamkalin sabjiyon ki kheti</i> | DD Kisaan | 1 st March, 2021 |
| Dr. D.K. Rana, SMS (Plant Protection) | | | |
| 1. | <i>Gehu ki katai ke smay Corona se savdhan</i> | All India Radio | 21 st April, 2020 |
| 2. | <i>Madhumakhi palan aur shahad utpadan</i> | DD Kisaan | 11 th Feb, 2021 |
| Dr. Samarpal Singh, SMS (Agronomy) | | | |
| 1. | Agriculture practices with prevention measurement of COVID-19 | DD Kisan | 7 th May, 2020 |
| 2. | Kisan gosthi on direct seeded rice | DD Kisan | 22 nd May, 2020 |
| Dr. Kailash, SMS (Agriculture Extension) | | | |
| 1. | Krishak Utpadak Sangthan | DD Kisan | 14 th May, 2020 |
| Dr. S. K. Tiwari, STO (Seed) | | | |
| 1. | <i>Carona Virus se bachuo hetu chat per Sabzi Bagwani</i> | All India Radio | 2 nd June, 2020 |
| 2. | <i>Shitkalin Sabji utpadan</i> | Gaon Kisan | 1 st , October, 2020 |

| S. No. | Topic | Programme | Date & time of telecast/broadcast |
|---|-----------------------------------|-----------------|-----------------------------------|
| 4. | Cold storage and Micro Irrigation | Chopal Charcha | 31 st November, 2020 |
| Sh. S.C. Tiwari, STO (Plant Pathology) | | | |
| 1. | Mushroom Production Technologies | All India Radio | 28 th December, 2020 |
| Sh. A.K. Mishra, STO (Horticulture) | | | |
| 1. | Post Harvest Management on Garlic | Radio talk | 5 th May, 2020 |
| KVK, Ujwa Delhi | | | |
| 1. | Central Govt. Schemes | DD Kisan | 28 th July, 2020 |

(C) Visitors

| S. No. | Name | Designation & Organization | Date |
|----------------------|---------------------------|---|------------|
| NHRDF, Delhi | | | |
| 1. | Dr. Naveen Kumar Patle | Additional Commissioner (Hort.) Ministry of Agriculture & Farmers' Welfare, Govt of India | 26.10.2020 |
| NHRDF, Karnal | | | |
| 1. | Sh. Ramesh Chander | Magistrate, Indri, Karnal | 05.10.2020 |
| NHRDF, Boudh | | | |
| 1. | Sri N C Jyoti Ranjan Naik | Asst. District Magistrate | 28.11.2020 |
| 2. | Miss Jharana Pradhan | Deputy Collector, Boudh | 28.11.2020 |
| 3. | Dr. Sumit Mishra | Joint Director, Directorate of Rice Development, Govt. of India | 21.12.2020 |
| 4. | Dr. Sumantra Mishra | Secretary, Juggernaut Association of Entrepreneurs | 21.12.2020 |
| 5. | Sri Janardhan Sahoo | President, Odisha Cold Storage Association | 21.12.2020 |
| NHRDF, Indore | | | |
| 1. | Dr. Rajender Singh | ADO, Agri. Department, Indore | 06.06.2020 |
| 2. | Sh. Jai Prakash | Area Manager, NSC, Indore | 02.07.2020 |
| 3. | Sh. M.K. Rawat | Branch Manager, NAFED, Indore | 25.11.2020 |
| Patna | | | |
| 1. | Smt. Madhupriya | Assistant Director, Horticulture, Bhojpur | 29.07.2020 |
| 2. | Dr B.K. Mandal | Senior Scientist & Head – KVK, Shiekhpora | 30.09.2020 |
| 3. | Sh. Rupesh Kumar Agarwal | Assistant Director, Horticulture, Jamui | 25.11.2020 |



(D) Visits

A total of 9 farmers from Jhabua district of Madhya Pradesh, visited NHRDF, Nashik, Maharashtra on 24.12.2020 know the research and developmental activities of horticultural crops, especially the onion and garlic. The details are given below:

| Date | No. of farmers/Officers | From place |
|---------------------------------|-------------------------|-----------------------------------|
| Odisha | | |
| 19 th February, 2021 | 40 | Phulbani District |
| 24 th February, 2021 | 40 | Baliguda Block, Kandhmal District |
| 25 th March, 2021 | 40 | Sonepur District |
| Madhya Pradesh | | |
| 24 th December, 2020 | 09 | Jhabua |

(E) Trainings

Training imparted by NHRDF, Nashik & New Delhi to Agricultural/Horticultural Officers/ Farmers of national and international participants during 2020-21

| Date | Days | No. of farmers/ students* | District & state/Country | Topic | Sponsored by |
|-----------------------|------|---------------------------|--------------------------|--|--------------|
| 28-30 September, 2020 | 3 | 10 | National | Mushroom Production training and post-harvest management | NHRDF |
| 14-16 October, 2020 | 3 | 12 | | | |
| 26-28 October, 2020 | 3 | 11 | | | |
| 22-24 December, 2020 | 3 | 13 | | | |
| 28-30 December, 2020 | 3 | 24 | | | |
| 4-9 March, 2021 | 5 | 18 | | | |
| 23-27 March, 2021 | 5 | 25 | Rajasthan | | ATMA |

(F) Awards

6th NHRDF Award 2020

Dr. Rampal Gupta was born in a farmer's family in District Sultanpur of Uttar Pradesh on 1st January, 1950. He post-graduated from UP Institute of Agricultural Sciences and Technology, Kanpur, Uttar Pradesh (presently known as Chandra Shekhar Azad University of Agriculture and Technology) in the year 1974. Subsequently, he achieved doctorate in 1978 from CSIR-National Botanical Research Institute, Lucknow. Immediately after obtaining of his Ph.D. degree, Dr. Gupta joined NHRDF, Delhi on 1st December, 1978 as Assistant Plant Pathologist and continued to work in NHRDF till June, 2016 as a Director.



During his entire career at NHRDF, Dr. Gupta achieved high order of respect because of his dedication, commitment and utmost devotion to duty. He reached the top post of Director, NHRDF, who is the Chief Executive Officer, in July, 2005 and he remained in this position till he finally demitted and left the organization in June, 2016. Considering his vast experience in the Research and Development work in horticultural crops, particularly onion and garlic, the Ministry of Agriculture & Farmers' Welfare, Government of India, New Delhi decided to utilize his experience and acumen in the development of horticultural crops in the country by appointing him as the Chief Consultant, under MIDH scheme in October, 2016, where he worked till July, 2021. Presently, Dr. Gupta is working as the Advisor in a National Level Cooperative Organization in Delhi.

During his long professional association with NHRDF, Dr. Gupta was largely instrumental in the development of 3 onion and 7 garlic varieties. He also developed different packages of practices and post-harvest technologies for onion and garlic which have been widely adopted by farmers in the country.

Dr. Gupta also authored 254 research papers, contributed popular articles in books/bulletins, national and international scientific journals, magazines and newsletters. He also wrote chapters especially on onion and garlic in books published by reputed publishers in the country, including ICAR.

His contribution, particularly in the field of onion and garlic is well recognized by the scientific societies by honoring Dr. Gupta with Life-time Achievement Award, Honorary Fellow Award and even the prestigious award instituted in the name of Dr. M.S. Swaminathan, the distinguished agricultural scientist and the man responsible for the green revolution in the country.

National Horticultural Research and Development Foundation (NHRDF), New Delhi to conferred the "6th NHRDF Award-2020" to recognize the contribution of Dr. Gupta in the research and development work in horticultural crops particularly in onion and garlic.



Plate No. 3

Training Imparted to Agriculture /Horticulture Officials and Farmers



Dr. Naveen Kumar Patle, Additional Commissioner (Hort), Ministry of Agriculture & Farmers' Welfare, Govt. of India, New Delhi inaugurated the training programme on Mushroom Production at Bagwani Bhawan on 26th October, 2020



25 women farmers visited our farm during the training programme under Mission Shakti, held at Boudh on 11th December, 2020



KVK, Delhi organizing “Training cum awareness programme on energy efficient pump set” programme under Bureau of Energy Efficiency Ministry of Power, GOI, New Delhi on 26th March, 2021 and inaugurated by Dr. S.K. Singh, Director, ICAR-ATARI, Jodhpur



5 Days Mushroom Production Technology and Post-Harvest Training organized at NHRDF, New Delhi from 4th to 9th March, 2021

Plate No. 4

Exposure Visit of Farmers at NHRDF Centres



Dr. Rajnish Mishra, Dy. Director, NHRDF, Boudh delivered scientific lecture to Sonepur district had visited the farms on 25.03.21 under MIDH Programme



Dealers on Certificate Course on Insecticides management organised by NHRDF, Boudh on 5.04.2021



25 farmers from DHO, Lucknow, (UP) under Pradhan Mantri Krishi Sinchai Yojana) visiting the garlic cultivation & post-harvest management field on 04.03.2020 at RRS, Karnal



Group visit of farmers Jhabua district of Madhya Pradesh visiting from NHRDF, RRS Chitegaon, on 24.12.2020

Plate No. 5

Exhibitions/Farmers Fair



Delhi



Boudh



Hubli



Karnal



Kurnool



Kota



Plate No. 6

Higher official's visit to NHRDF Offices



A view of Sh. Hemant Godse, Member of Parliament, Govt. of India, New Delhi visited RRS, Chitegaon, Nashik on 25th August, 2020



A view of NABL Auditor Team visiting RRS, Chitegaon, Nashik on 30th November, 2020



A view of Delegates of Telangana, Govt. of Telangana, visiting RRS, Nashik on 8th November, 2020



Dr. Ashok Dalwai, IAS of Inter-Ministerial Committee on Doubling Farmers' Income (DFI) & CEO, NRAA Dept. of Agriculture, MOA, Govt. of India, New Delhi visiting a farmer's field at organized by NHRDF, Hubli on 20th March, 2021.



A view of AGMARK Team visiting RRS, Nashik on 19th January, 2021



A view of Breeder Seed monitoring Team visiting RRS, Nashik on 18th March, 2021

Major Activities - Krishi Vigyan Kendra

11

1. Front Line Demonstrations

A total of 198 frontline demonstrations in *kharif* 2020 and *rabi* 2020-21 season were conducted, covering an area of 79.2 ha on oilseeds, pulses, cereals and vegetable crops under different schemes.



Field day organized on 25/02/2021 at Kheda Dabar



Field Day organized on 08/03/2021 at Kajipur

2. Vocational Training

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

| S. No. | Title | No. of Trainees |
|--------------|---|-----------------|
| 1. | Bee keeping (1) | 17 |
| 2. | Mushroom production technology (1) | 27 |
| 3. | Organic farming (1) | 30 |
| 4. | Value addition of fruits & vegetables (1) | 14 |
| 5. | Nursery workers (ASCI) (1) | 20 |
| Total | | 108 |



Bee Keeping



Mushroom Production



Value Addition of fruits & Vegetables

Plate No. 7

Other Activities



Kisan Mela



Exhibition



Women day Celebration at KVK, Delhi



Prime Minister Speech



Awareness Campaign on Organic Farming



Pickle making training

Plate No. 8

Awareness Programme for Farmers during Lockdown Period

कोविड-19 के कारण लॉकडाउन (बन्दी) अवधि के दौरान किसानों और कृषि क्षेत्र के लिए दिशानिर्देश

गृह मंत्रालय, भारत सरकार के दिशा-निर्देशों के अनुसार नंबर (2440-3/2020-डीएन-आई (ए) दिनांक 24, 25 और 27 मार्च, 2020), गिनिलिखित कृषि और संबद्ध गतिविधियों को लॉकडाउन (बन्दी) की अवधि के दौरान घुट दी गयी है:

- पशु चिकित्सा अस्पताल।
- न्यूनतम सामान्य मूल्य (MSP) परिपालनो सहित कृषि उत्पादों की खरीद हेतु उपरदायी समस्त अभिकरण।
- पिन मॉडियो के संचालन कृषि उपज मंडी समिती द्वारा किया जाता है या राज्य सरकार द्वारा अधिपुष्टि किया जाता है।
- किसानों और खेत श्रमिकों द्वारा खेती का कार्य।
- फार्म मशीनरी से संबंधित करटन हायरिंग सेटर (CHC)
- उर्वरक, कीटनाशक और बीज के विकास और पैकेजिंग में कार्यरत टर्काईयों।
- कम्पाइन हार्बेस्टर और कृषि/बागवानी उपकरणों की कटाई और दुवाई संबंधित मशीनों की अंतर-राज्य आवाजाही।

इन घुटों से कृषि और खेती से संबंधित गतिविधियों को बिना किसी अनुश्रुति के सुनिश्चित किया जा सकेगा ताकि आवश्यक आपूर्ति सुनिश्चित की जा सके और किसानों को लॉकडाउन (बन्दी) के दौरान किसी भी कठिनाई का सामना न करना पड़े। लॉकडाउन (बन्दी) के दौरान कार्यान्वयन के लिए संबंधित मंत्रालयों/राज्यों और केंद्र शासित प्रदेशों को आवश्यक दिशा-निर्देश जारी किए गए हैं।

किसानों के लिये मुफ्त सहायता हेतु 24x7 किसानों की मदद हेतु

लॉकडाउन के दौरान किसानों की समस्याओं का तुरंत समाधान हेतु कॉल सेंटर का संचालन किया जा रहा है

कृषि-किसानों के तुरंत समाधान हेतु सहायता के लिए: **1800-180-1551**

सुदृढ़ कृषि बाजार (ई-नगर) के उपयोग को तेज कर लेने वाली किसानों को प्रचार की परियोजना के माध्यम से लिए: **1800-270-0224**

कृषि उत्पादों के अंतर-राज्य परिवहन में आ रही समस्याओं के हल के लिए: **1800-180-4200** और **14488**

सर्वे थिस टाइम

॥ दैनिक जाम्बरण

नई दिल्ली, 21 मई 2020

प्राथमिक दूरी रख वैज्ञानिकों ने किसानों से किया संवाद

किसानों को COVID-19 के संकेतों से सावधान रहने के लिए जागरूक करने के लिए NHRDF और KVK के वैज्ञानिकों ने किसानों से संवाद किया।

NHRDF and KVK continued to awaken farmers during COVID-19. The Scientists went to the village and kept cautious with the problem related to farming and COVID kept on advancing.

किसानों की आय बढ़ाएगी सौर ऊर्जा, लगाया सोलर प्लांट



नई दिल्ली, (पत्राभ केसरी)। दिल्ली के किसानों की आय बढ़ाने के लिए खेती में सौर ऊर्जा प्लांट लगाए जा रहे हैं। इन प्लांट के लिए दिल्ली सरकार पंच उद्योग बना रहा है। सौर ऊर्जा को प्रोत्साहित करने के लिए किसानों को 110 बिजलीघरों के प्लांट का सिलान्वयन दिल्ली सरकार के अंतर्गत मंत्रालय के तहत किया जा रहा है। इस संकेत पर सौर ऊर्जा प्लांट, डीएम जे.न.के. अग्रवाल, एनडीएस मंत्रालय के अंतर्गत है। सौर ऊर्जा प्लांट के तहत किसानों को सौर ऊर्जा के उपयोग के बारे में जागरूक करने के लिए किसानों की आय बढ़ाने के लिए सौर ऊर्जा प्लांट लगाए जा रहे हैं।



Foundation stone of Solar Project under Delhi Government by Smt. Manisha Saxena, IAS, Secretary, Delhi Government & MD, NAFED at KVK Delhi.

3. Rural Agricultural Work Experience (RAWE)

| Name of Student | University / Institute |
|------------------------------|---|
| Shalini Sundram, B.Sc. (Ag.) | Rimt University, Punjab |
| Dheeraj Kashyap, B.Sc. (Ag.) | Dr Rajendra Prasad Central Agricultural University, Bihar |
| Amit Kumar, B.Sc. (Ag.) | Dr Rajendra Prasad Central Agricultural University, Bihar |

4. Sponsored Programmes conducted by KVK

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

Crop residue burning in the states of north-west India is a major concern for all stake holders of agriculture and environmentalists. The phenomenal atmospheric pollution, nutritional losses and soil health deterioration have made policy makers vigilant. Therefore, an appropriate strategy for *In-situ* Crop Residue Management (CRM) was planned for effective implementation to facilitate zero burning farming. The Central Sector Scheme on "Promotion of Agricultural Mechanization for *In-situ* Management of Crop Residues in the states of Punjab, Haryana, Uttar Pradesh and NCT of Delhi" was implemented for effective utilization and management of crop residues by respective governments in these states.

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. | IEC activities | Type of activity/ level | Allotted Activities | Number of activity/ areas | No. of participated |
|--------|---------------------------------|-----------------------------|---------------------|---------------------------|---------------------|
| 1. | Awareness Programme | Village | 05 | 06 | 140 |
| | | Block | 02 | 2 | 100 |
| | | District | 01 | 1 | 80 |
| 2. | Demonstrations | Happy Seeder | 120 ha. | 2240 ha | 22 |
| | | Zero Tillage | | 3600 ha | 35 |
| | | Mulcher | | 3120 ha | 30 |
| 3. | Training Programme (No.) | | 03 | 5 | 125 |
| 4. | Kisan Mela | | 01 | 1 | 400 |
| 5. | Field Day | | 02 | 1 | 60 |
| 6. | Awareness by publicity material | Wall Writing | NA | 60 | Public place |
| | | Hoarding, Poster and Banner | NA | 30 | |
| | | Literature | NA | 1000 No. | |



During the programme, farmers were well trained through video films and Method demonstration about the importance of *In-situ* Crop Residue Management for sustaining soil health and properties, and the harmful effect of paddy burning on soil health, microorganisms, environment and human health. In this programme, focus was also on the use of paddy straw as animal fodder, use for preparation of vermicompost and mushroom production and improving soil fertility and productivity by conservation mechanization.



Kisan Mela under CRM on 12.3.2021



Publicity Material such as Pamphlets and Folder Jingle Message

5. Farm Products

KVK Ujwa, Delhi : A total of 168.94 q of certified seed of wheat, mustard, okra and palak seed was produced under the seed chain by certification agencies and provided to farmers of Delhi, Haryana and Uttar Pradesh. The 152.68 q of vermicompost, kitchen garden kits (156 nos.), processed products, honey and 50,000 vegetable seedlings were distributed.



(Pickle)



(Nursery)



(Honey)



(Vermi compost)



(Kitchen Garden kit)



(Kinnow)



Farm Produce



(Potato)



(Palak leaf)



(Chilli)

Seed and Planting Material

12

Seed is the foundation for any agriculture production system. The expected results of most advanced technology will not be achieved without using quality seed/planting material. Timely availability of recommended varieties is of utmost importance in maximizing per unit returns and productivity. In past decade, NHRDF has significantly contributed in multiplication and distribution of quality seed/planting material. The NHRDF is engaged in quality seed production and distribution of improved varieties of onion, garlic, potato and others vegetables. Onion and garlic nucleus, breeder, foundation and certified as well as truthful labeled seeds are regularly produced and distributed by NHRDF. During the period 2020-21 NHRDF produced and distributed 10.04 q of nucleus/breeder seed, 53.79 q of foundation, 4.33 q of certified and 1325.69 q of truthful seeds of different onion varieties. In case of garlic, 137.81 q of breeder seed, 184.08 q of foundation, 458.94 q of certified and 3861.65 q of truthful labeled garlic seeds/cloves were also produced and distributed.

Seed & Planting material produced during 2020-21 (q)

| Crop | Breeder | Foundation | Certified | Truthful |
|--------|---------|------------|-----------|----------|
| Onion | 10.04 | 53.79 | 4.33 | 1325.69 |
| Garlic | 137.81 | 184.08 | 458.94 | 3861.65 |

Quantity of seed of different crops produced and distributed during 2020-21

| S. No. | Crop | Varieties | Seed produced (kg) | Seed distributed (kg) |
|--------|--------------|---|--------------------|-----------------------|
| 1 | Onion | ADR/L-883 ALR/NHRDF Red/ NHRDF Red-3/NHRDF Red-4/A. Rose/A. White/CO ON-5 | 138381 | 110031.8 |
| 2 | Garlic | G-50/G-282/G-323/G-384/G-313/G-404/G-408 | 450467.3 | 514269 |
| 3 | Potato | K. Jyoti/K. Pukhraj/K. Khyati/K. Mohan/K. Himalini/K. Lavkar, K. Gavrav/K. Surya/K. Bahar/K. Chipsona-1 & 3 | 1319517 | 488045 |
| 4 | Fenugreek | RMT-305/G-2 | 4659 | 983.5 |
| 5 | Bottle Gourd | Pusa Naveen | 762 | 129 |
| 6 | Bitter Gourd | PH-2 | 35.8 | 33.05 |

| S. No. | Crop | Varieties | Seed produced (kg) | Seed distributed (kg) |
|--------------|--------------|-------------------------|--------------------|-----------------------|
| 7 | Sponge Gourd | Kashi Divya | 222.5 | 14 |
| 8 | Brinjal | Pusa Uttam | 848 | 2.5 |
| 9 | Cauliflower | Sabour Agrim | 207 | 4.89 |
| 10 | Chilli | K-2 | 1020 | 103.2 |
| 11 | Pea | Pusa Pragti, Azad Pea-3 | 3364.5 | 3044.5 |
| 12 | Radish | Pusa Chetki | 2579 | 15 |
| 13 | Carrot | Pusa Rudhira | 2067 | 5 |
| 14 | Coriander | GDLC-1 | 4072 | 1767 |
| 15 | Spinch | All Green | 2437 | 2 |
| 16 | Mustard | Pusa Vijai/Giriraj | 3130 | 544 |
| 17 | Tomato | PKM-1, Arka Rakshak | 194.55 | 31.8 |
| 18 | Pumpkin | Pusa Vishwash | 7.0 | 2 |
| 19 | Cow Pea | CP-4&6/Dharini | 23354 | 1133 |
| 20 | Drumstick | PKM-1 | 806 | 3737.6 |
| 21 | Cluster bean | Pusa Navbahar | 2891 | 100 |
| 22 | Musk Melon | Pusa Madhurash | 64 | 50.2 |
| 23 | Paddy | Pusa-44, PB-1509 | 0 | 2193.00 |
| 24 | Cucumber | Swarna Sheetal | 0 | 3.5 |
| 25 | Okra | A-4/Arka Anamika | 4164 | 288.5 |
| 24 | Soybean | MAUS-71 | 12570 | 17828 |
| Total | | | 1977819.65 | 1142064.345 |

Research Papers

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- ◆ Gupta PK and Bhasker P. the technical bulletin No. 23. Medicinal values: Onion and Garlic. Pages 54 published by NHRDF in 2020.
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- ◆ Gupta RC, Pandey MK, Pathak MK, Singh S and Gupta PK. 2021. Effect of different fungicide groups with insecticides for control of foliar diseases of onion and their residue in bulbs after harvest. *International Journal of Current Microbiology and Applied Sciences*. **10**(06). 802-810.
- ◆ Gupta PK and Bhasker P. 2021. Pharmaceutical properties of onion and garlic, published by Brillion Publishing, New Delhi. In the book Current Horticulture: Improvement, Production, Plant Health Management and Value-addition. Volume 2: pp. 229-236, 2021. ISBN: 978-93-90757-42-8. e-ISBN: 978-93-90757-43-5. The Editors are Balraj Singh, A. K. Singh, B. S. Tomar, J. K. Ranjan and Som Dutt.
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- ◆ Bhasker P, Gupta PK and Sharma HP. 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): 39-49.
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- ◆ Pandey Sujay, Pathak MK, Dubey BK and Gupta PK 2020. Chemical control of onion thrips with insecticides through sequential sprays. *Journal of Entomology and Zoology studies*, **8** (1): 517-521.

- ◆ Gupta RC, Pandey MK, Pathak MK, Sharma HP and Gupta PK. 2020. Integrated disease management of garlic. *India Journal of Areca nut, Spices & Medicinal Plants*. **22** (2): 42-47.

Books

Technical Bulletins

- a. English
- b. Hindi

Regular Publications

English

- ◆ NHRDF Annual Report (every year)
- ◆ Annual Progress Report of MIDH-NHM (every year)
- ◆ NHRDF News Letter (Quarterly)
- ◆ NHRDF at a glance
- ◆ Training brochure of NHRDF

Hindi

- ◆ NHRDF, Beej

Video CDs

English

- ◆ NHRDF Kal Aaj Aur Kal/NHRDF forever
- ◆ Improved Practices of Onion Cultivation
- ◆ Improved Practices of Garlic Cultivation

Hindi

- ◆ NHRDF Kal Aaj Aur Kal/NHRDF forever
- ◆ Improved Practices of Onion Cultivation
- ◆ Improved Practices of Garlic Cultivation
- ◆ Bharat me Mushroom Utpadan

Extention Leaflets

English

- ◆ Onion cultivation
- ◆ Garlic cultivation
- ◆ Onion seed cultivation
- ◆ Pesticides Residue Analysis Laboratory

Hindi

- ◆ Baby corn
- ◆ Bhindi Cultivation
- ◆ Bitter gourd Cultivation
- ◆ Bottle gourd Cultivation
- ◆ Carrot
- ◆ Chilli cultivation
- ◆ Cumin
- ◆ Coriander Cultivation
- ◆ Drumstick Cultivation
- ◆ French bean Cultivation



- ◆ Garlic Cultivation
- ◆ Kisano Ke Liye Pradatta Suvidhayen
- ◆ Kharbuja
- ◆ Lobiya ki Kheti
- ◆ Makka Ki Kheti
- ◆ Methi Cultivation
- ◆ Mrida Aum Seenchai Ka Jal Parikshan
- ◆ Mrida Swasthya Aum Kheti ke Liye Vermicompost Labhdayak
- ◆ Ek Parichay
- ◆ Sankar Mirch (F1 Hybrid) CH-1
- ◆ Sankar Mirch (F1 Hybrid) Arka Khayati
- ◆ Sankar Tomato (F1 Hybrid) Arka Rakshak
- ◆ Bio Brave
- ◆ S-Guard (SNPV)

- ◆ Onion and Garlic - Medicine value
- ◆ Onion Cultivation by Bulblets
- ◆ Onion-Sulphur
- ◆ Organic production of vegetables
- ◆ Paddy Cultivation
- ◆ Pea
- ◆ Potato Cultivation
- ◆ Pyaj me Rog Evam Keet Niyantaran
- ◆ Radish Cultivation
- ◆ Soybean ki Unnat Kheti
- ◆ Tomato
- ◆ Trichoderma
- ◆ Wheat Cultivation
- ◆ Gende ki Kheti

Marathi

- ◆ Bhindi cultivation
- ◆ Garlic cultivation
- ◆ Onion cultivation
- ◆ Onion seed cultivation

- ◆ Onion Insect and Disease Control
- ◆ Onion yellow hybrid cultivation
- ◆ Pesticides residue analysis

Odisha

- ◆ Bhindi Cultivation
- ◆ Garlic Cultivation
- ◆ Onion Cultivation
- ◆ Onion Seed Cultivation

- ◆ Onion Insect and Disease Control
- ◆ Onion Yellow Hybrid Cultivation
- ◆ Pesticides Residue Analysis

Tamil

- ◆ Bhindi Cultivation
- ◆ Garlic Cultivation
- ◆ Onion Cultivation
- ◆ Onion Seed Cultivation
- ◆ Onion Insect and Disease Control
- ◆ Onion Yellow Hybrid Cultivation
- ◆ Pesticides Residue Analysis

Telgu

- ◆ Bhindi Cultivation
- ◆ Garlic Cultivation
- ◆ Onion Cultivation
- ◆ Onion Seed Cultivation
- ◆ Onion Insect and Disease Control
- ◆ Onion Yellow Hybrid Cultivation
- ◆ Pesticides Residue Analysis



Appointments

1. Shri Sudhir Shokeen joined as Administrative Assistant at Janakpuri, New Delhi on 29/12/2020.
2. Shri Himashu Kumar Rajora joined as Administrative Assistant at Janakpuri, New Delhi on 29/12/2020.
3. Shri Aayush Chhillar joined as General Clerk at Janakpuri, New Delhi on 05/02/2021.
4. Shri Sanjeev Kumar Sharawat joined as Junior Engineer at Janakpuri, New Delhi on 03/03/2021.
5. Shri Rakesh Kumar joined as Driver at Karnal on 12/03/2021.
6. Shri Virender Kumar joined as Driver at Indore on 12/03/2021.

Transfers

1. Dr. S. K. Singh, Jt. Director (Seed) transferred from Rajkot to Karnal and joined duty on 12/11/2020 at Karnal.
2. Shri S. N. Choudhary, Dy. Director (Pl. Br.) transferred from Coimbatore to Janakpuri, New Delhi and joined duty on 02/12/2020 at Janakpuri, New Delhi.
3. Shri B. K. Dubey, Dy. Director (Pl. Br.) transferred from Karnal to Rajkot and joined duty on 26/11/2020 at Rajkot.

Retirements

1. Shri Fauzdar Prasad, Attendant, Deoria retired on 30/04/2020.
2. Ms. U. D. Yardi, St. Typist, Chitegaon, Nashik retired on 31/05/2020.
3. Shri M. V. Kale, Driver, Chitegaon, Nashik retired on 31/05/2020.
4. Shri Prem Swarup, STO(H), Deoria retired on 30/06/2020.
5. Shri H. K. Sharma, Dy. Director (Hort.), Janakpuri, New Delhi retired on 31/07/2020.
6. Mrs. Radha Joshi, Sr. Administrative Assistant, Janakpuri, New Delhi retired on 31/10/2020.



7. Shri Jagdev Yadav, Driver, Indore retired on 31/01/2021.
8. Shri U. S. Negi, Attendant, Karnal retired on 28/02/2021.
9. Shri V. K. Dixit, Accountant, Janakpuri, New Delhi retired on 31/03/2021.

Human Resource Development

15

(A) Trainings

| S. No. | Name of officer / staff | Title of training | Duration | Organized by |
|--------|---|--|----------|---|
| 1. | Sh. B. K. Dubey , DD & Sh. Shashi Kumar , Technical Officer | Quality seed production and seed certification | 1 day | Haryana State Seed Certification Agency |
| 2. | Dr. Sujay Pandey AD (Ent.) | Documenting Success Stories | 5 days | ICAR, NDRI, Karnal |
| 3. | Sh.S.Purushothaman TO (P.P.) | Environment Friendly Indigenous Crop Protection | 5 days | ICAR, IARI, New Delhi |
| 4. | Sh. M. K. Pandey Technical Officer | "Environment friendly indigenous crop protection | 5 days | ICAR-IARI, Pusa New Delhi |
| 5. | Sh. A. K. Mishra Technical Officer | Documentation | 5 days | MANAGE, Hyderabad |
| 6. | Dr. H. M. Singh STO (H) | COVID-19 Pandemic: Innovative Agri - Solutions in Vegetable Sector | 3 days | ICAR-IIVR Varanasi |
| 7 | Dr. H. M. Singh STO (H) | National Training Course on "Seed Production Techniques in Agronomical & Horticultural Crops | 5 days | R.B. (PG) Collage, Agriculture Campus, Mudi, Agra |

(B) Meetings, Seminars and Workshops Attended by NHRDF Officers

| Date | Particulars |
|---|--|
| Dr. P. K. Gupta , Director (Acting), New Delhi | |
| 20-05-2020 | Attended meeting with Director, Horticulture, Govt. of NCT Delhi regarding Project proposed on supply chain management of horticulture crops under Central Sector Scheme, Ministry of Agriculture & Farmers Welfare, Government of India. |
| 29-05-2020 | Participated 2 nd Area estimation of Horticulture crop of 2019-20 at Krishi Bhawan, Organized by Horticultural Division, Department of Agriculture Cooperation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Government of India. |



| Date | Particulars |
|--|---|
| 04-08-2020 | Meeting with Hon'ble Minister Sh. Gopal Rai, Govt. of Delhi on project proposal on supply chain management of NCT Delhi at KVK. |
| 31-08-2020 | Meeting with Secretary Cum Development Commissioner, Govt. of Delhi reg. Meeting with Secretary Cum Development Commissioner, Govt. of Delhi about Bio-Decomposer (KVK). |
| 03-09-2020 | Meeting with NCOF about Bio-decomposer along with Secretary Cum Development Commissioner, & JP, Ag. Govt. of Delhi (KVK) on NCOF, Ghaziabad. |
| 07-09-2020 | Review Committee Meeting to finalize 3rd Adv Est 2019-20 to be held at Krishi Bhawan, New Delhi. |
| 11-09-2020 | Meeting at Bagwani Bhawan with Dr. Diwakr Bahukhandi, reg. Mushroom Production |
| 14-09-2020 | Meeting with JS (MIDH) reg. MIDH at Krishi Bhawan. |
| 24-09-2020 | Meeting with Chief Minister of NCT of Delhi at ICAR-IARI, reference KVK regarding Crop Residue Management |
| 03-11-2020 | Lead Lecture on Growth of Micro Food Enterprises through Webinar. |
| 06-11-2020 | Foundation Day Lecture- 2020, Indian Academy of Horticultural Sciences. |
| Dr. S. K. Singh , Joint Director(S) | |
| 23-12-2020 | Delivered lecture on Crop residue management in Kisan Mela and Farmers Day (Kisan Diwas) arranged by Krishi Vigyan Kendra, NDRI, Karnal. |
| 24-12-2020 | Attended the research trial meeting of <i>kharif, late kharif & rabi</i> , 2020-21 on 24.12.2020 with Dr. Sujay Pandey, AD (Ent.), Sh. Purushothman, STO (PP) & Sh. Ashok Kumar, TA |
| Dr. Rajneesh Mishra , Dy. Director(H) | |
| 14-12-2020 | Attended the Annual Review meeting at Permanent Forest Nursery, Purunakatak, Boudh organized by DFO, Boudh and discussed several activities of NHRDF, Boudh with Sri. Abhilash Mahakur. |
| 28-02-2020 | Attended the National Science Day programme at Panchayat College, Boudh, organized by Science Dept., Panchayat College, Boudh. |
| Shri. B.K. Dubey , Dy. Director (Br.) | |
| 25 to 27-09-2020 | Participated in 38 th Annual Group meeting of AICRP (VC) with Dr. Sujay Pandey, AD (Ento.) and Sh. S. Purushothaman, STO held at IIVR, Varanasi (UP). |
| 21-10-2020 | Participated in 80 th Scientific Advisory Committee web Meeting held at NHRDF, Delhi with Dr. Sujay Pandey, AD (Ento.) and Sh. S. Purushothaman, STO. |
| Dr. Sujay Pandey , Asst. Director (E) | |
| 01-03-2020 | Attended the 52 nd Foundation Day held at ICAR-CSSRI, Karnal. |
| 06-11-2020 | Delivered lecture on "Insect pest & disease of onion & their management" through online Webinar on Advanced Techniques in onion cultivation arranged by Deptt. of Horticulture, Uchani, Karanl. |
| Shri R. B. Singh , Asst. Director (H) | |
| 06-11-2020 | Attended the "Kisan Mela" with exhibition arranged by Krishi Vigyan Kendra, Ambala. |



| Date | Particulars |
|-----------------------------------|---|
| Dr. H. M. Singh, STO (H) | |
| 14-06-2020 | Attended the “ Indian Horticulture Summit 2020 ” held at MGCGV Chitrakoot, Satna (M.P.), Organized by Society for Horticulture Research and Development, Ghaziabad (U.P.). |
| 16 to 20-06-2020 | Attended National Webinar on “ Organic Farming ” Organized by Dean, Collage of Agriculture, JNKVV, Balaghat. |
| 10 to 11-07-2020 | International Web – Conference on “ Climate Smart Agriculture for Sustainable Food and Nutritional Security (CSASFNS-20) ” Organized by Beni Singh Collage, Chenari, Rohtas and Society for Upliftment of Rural Economy (SURE), Varanasi (U.P.). |
| 13-18-07-2020 | Participated in 06 days National Training Course on “ Seed Production Techniques in Agronomical & Horticultural Crops ” Organized by R.B. (PG) Collage, Agriculture Compus, Mudi, Agra (U.P.). |
| 28-07-2020 | Participated in Webinar on “ Changing Scenario of Vegetable Production & Marketing in Pandemic Period ” Organized by College of Horticulture, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut- 250110, (U.P.). |
| 26-08-2020 | International webinar on “ Women in Science and their Role in Sculpting Modern Agriculture ” organized by Bihar Agricultural University, Sabour, Bhagalpur. |
| 15-09-2020 | International Webinar on “ Plant Physiological Paradigms towards Agricultural Sustainability under Climate Change ” organized by Bihar Agricultural University, Sabour, Bhagalpur. |
| 13-10-2020 | Lecture delivered on Onion cultivation technology with Schemes of NHRDF in Farmers training at KVK, Piprakothi, East Champaran. |
| Shri A. K. Mishra, STO (H) | |
| 05-05-2020 | Delivered radio talk on PHM of Garlic |
| 07-05-2020 | Guided farmers about garlic storage through audio clips and news paper. |
| 14-05-2020 | Guided farmers about onion storage through audio clips and news paper. |
| 31-05-2020 | Guided farmers about <i>kharif</i> onion nursery through audio clips and news paper. |
| 19-06-2020 | Attended National Webinar on “Entrepreneurship Opportunities in Agriculture for Migrant workers in COVID-19” arranged by KVK, Anta. |
| 11-08-2020 | Guided farmers about storage of onion and garlic during workshops on Formation of FPO at KVK, Anta |
| 22-08-2020 | Delivered lecture under DAESI Programme at SIAM Kota. |
| 16-12-2020 | Attended SAC meeting at KVK Anta. |
| 17-12-2020 | Attended SAC meeting at KVK Kota. |
| Shri Mukhedkar, TA | |
| 08-10-02020 | Farmers’ meeting for extension of NHRDF activities in new area and field visit of Cauliflower Seed Production programme 2020-21 on 8/10/2020. |



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 Rs. 5,0431,460/-by interest from fixed deposits, Rs. 25,56,671/- from the distribution of planting material and farm produce, Rs. 1,80,04,591/- from the laboratory service charges, Rs. 20,96,92,129/- from seed procurement proceeds and Rs. 6,900/- as annual subscription. The total expenditure during 2020-21 was Rs. 27,77,08,090/- which was less by Rs. 1,18,12,888/- over the income 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 2021

| Previous Year 31.03.2020 | | CURRENT YEAR 31.03.2021 | | Previous Year 31.03.2020 | | CURRENT YEAR 31.03.2021 | |
|-----------------------------|------------------------------------|----------------------------|--|-----------------------------|------------------------------------|----------------------------|--|
| EXPENDITURE PARTICULARS | | EXPENDITURE PARTICULARS | | INCOME PARTICULARS | | INCOME PARTICULARS | |
| 84,558.00 | Audit fees & Expenses | 80,000.00 | | 31,01,793.80 | Farm Produce Revenue | 25,56,671.00 | |
| 15,840.00 | Benevolent Fund | 15,160.00 | | 5,21,79,335.52 | Interest Received / Accrued | 5,07,14,943.43 | |
| 66,648.00 | Books and Periodicals | 32,879.00 | | 2,22,19,262.00 | Laboratory Charges | 2,45,25,611.50 | |
| 8,05,607.00 | Extension Services | 5,24,373.00 | | 28,800.00 | Subscription Fees | 6,900.00 | |
| 63,37,855.00 | Farm Expenses | 67,12,313.44 | | - | Sale of Scrap Items | 22,343.00 | |
| 9,96,498.00 | Insurance Charges | 8,87,582.00 | | 1,65,384.65 | Closing Stock of NHRDF Publication | 1,53,842.65 | |
| 88,40,504.00 | Lab Expenses | 81,49,337.72 | | 2,54,27,003.61 | Deficit for the Year | 1,89,90,002.91 | |
| 43,46,199.00 | Legal & Professional Fees | 27,79,031.00 | | | | | |
| 7,79,157.00 | Medical Expenses | 6,89,875.00 | | | | | |
| 10,53,972.00 | Meeting Expenses | 9,56,521.00 | | | | | |
| 6,90,498.00 | Municipal & Non-Agril. Taxes | 6,50,644.00 | | | | | |
| 6,32,81,732.00 | Salary and Allowances | 6,29,26,166.00 | | | | | |
| 2,28,000.00 | Staff Welfare | 1,66,305.00 | | | | | |
| 3,20,201.77 | Telephone Expenses | 4,36,353.68 | | | | | |
| 54,511.16 | Training & Seminar | 1,31,850.00 | | | | | |
| 9,96,123.00 | Conveyance Expenses | 9,28,172.00 | | | | | |
| 45,97,374.00 | Gratuity Expenses | 22,27,271.00 | | | | | |
| 94,39,742.00 | Depreciation | 85,11,096.00 | | | | | |
| 1,84,559.65 | Opening Stock of NHRDF Publication | 1,65,384.65 | | | | | |
| 10,31,21,579.58 | Total ₹ | 9,69,70,314.49 | | 10,31,21,579.58 | Total ₹ | 9,69,70,314.49 | |

As per our report of even date
For Kale & Associates
Chartered Accountants
FRN: 114144 W

(A.V.Kale)
Proprietor
[M.No.32039]
Date:-16.09.2021



(Vijaya)
AAO

(Rahul Dabas)
FACAO

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



NATIONAL HORTICULTURAL RESEARCH AND DEVELOPMENT FOUNDATION

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

INCOME & EXPENDITURE ACCOUNT (SEED DIVISION) FOR THE YEAR ENDED 31ST MARCH 2021

ANNEXURE - II

| Previous Year 31.03.2020 | EXPENDITURE PARTICULARS | CURRENT YEAR 31.03.2021 | Previous Year 31.03.2020 | INCOME PARTICULARS | CURRENT YEAR 31.03.2021 |
|-----------------------------|------------------------------|----------------------------|-----------------------------|--------------------------|----------------------------|
| 1,45,458.35 | Bank Charges | 1,38,082.49 | 1,21,25,738.00 | Closing Stock of seed | 69,16,852.00 |
| 12,54,951.00 | Medical Expenses | 11,93,511.00 | 18,49,60,927.70 | Seed & Bulb Distribution | 20,96,92,129.00 |
| 63,94,897.04 | Office Rent & Maintenance | 82,51,300.00 | 26,48,722.00 | PHRC Receipts | 20,02,380.00 |
| 1,43,27,302.00 | Opening Stock of Seeds | 1,21,25,738.00 | | | |
| 7,68,67,792.06 | Procurement of Seeds & Bulbs | 10,80,19,320.98 | | | |
| 3,51,257.00 | Postage and Telegram | 3,80,427.74 | | | |
| 2,46,664.00 | Printing and Stationery | 6,48,350.00 | | | |
| 5,13,80,348.00 | Salary and Allowances | 5,02,82,121.00 | | | |
| 7,46,687.00 | Staff Welfare | 5,65,128.00 | | | |
| 17,91,736.50 | Travelling and Conveyance | 13,68,585.00 | | | |
| 24,41,051.50 | Vehicle Maintenance | 25,23,620.00 | | | |
| 58,35,943.00 | Water & Electricity | 50,75,484.00 | | | |
| 1,59,66,310.00 | Gratuity Expenses | 24,39,580.00 | | | |
| - | TDS / GST Expenses | 17,650.00 | | | |
| 93,725.00 | Compensation & Discount | - | | | |
| 6,111.00 | Interest on TDS | - | | | |
| 2,18,85,154.25 | Surplus for the year | 2,55,82,462.79 | | | |
| 19,97,35,387.70 | Total ₹ | 21,86,11,361.00 | 19,97,35,387.70 | Total ₹ | 21,86,11,361.00 |

As per our report of even date

For Kale & Associates

Chartered Accountants

FRN: 114144 W/KA/2006

(A.V.Kale)

Proprietor

[M.No.32039]

Date:-16.09.2021



Rahul Dabas
(Rahul Dabas)
FACAO

P.K. Gupta
(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 2021

ANNEXURE - III

| Previous Year 31.03.2020 | Current Year 31.03.2021 | Previous Year 31.03.2020 | Current Year 31.03.2021 | Sche- dule | Particulars | Sche- dule | Current Year 31.03.2021 |
|-----------------------------|----------------------------|-----------------------------|----------------------------|---------------|----------------------------------|------------------------------------|----------------------------|
| 26,26,57,215.64 | 28,91,15,366.28 | 9,74,58,350.15 | 9,13,64,595.15 | F | CORPUS/DEVELOPMENT FUND | FIXED ASSETS | |
| | | | | | Opening Balance | | |
| -2,54,27,003.61 | -1,89,90,002.91 | 9,74,58,350.15 | 9,13,64,595.15 | | Less deficit R&D | Total (₹) | |
| 2,18,85,154.25 | 2,55,82,462.79 | 75,91,00,000.00 | 90,06,57,000.00 | G | Add Surplus Seed Division | INVESTMENTS | |
| | | | | | | Fixed Deposits | |
| 26,91,15,366.28 | 29,57,07,826.16 | 75,91,00,000.00 | 90,06,57,000.00 | | | Total (₹) | |
| 25,30,76,675.59 | 28,23,00,011.59 | 59,579.00 | 79,902.00 | A | RESERVES & SURPLUS | CURRENT ASSETS | |
| 40,92,09,706.90 | 54,74,20,046.90 | 3,59,76,128.14 | 11,75,76,485.03 | H | Reserve (R&D) | Cash in Hand | |
| 66,22,86,382.49 | 82,97,20,058.49 | 5,86,64,477.33 | 5,42,49,720.17 | I | Revolving Fund (Seed) | Cash at Bank | |
| | | | | | Total (₹) | Sundry Debtors | |
| 19,71,948.84 | 27,71,827.34 | 1,38,59,596.00 | 1,27,40,226.00 | B | CURRENT LIABILITIES | Interest Receivable | |
| 19,71,948.84 | 27,71,827.34 | 1,21,25,738.00 | 69,16,852.00 | | Sundry Creditors | Closing Stock of NHRDF Publication | |
| 22,82,812.00 | 15,98,901.00 | 4,19,412.00 | 1,53,842.65 | C | OTHER LIABILITIES | Prepaid Expenses | |
| 52,23,980.00 | 66,70,288.00 | 5,00,000.00 | 10,00,000.00 | D | Earnest Money | LIC (GP and Superannuation Scheme) | |
| 7,65,109.00 | 1,36,827.00 | - | 2,82,580.37 | | Security Payable | Input Tax Credit | |
| 20,52,794.00 | 22,56,959.00 | - | 1,32,28,977.00 | E | TDS Payable | Grant Project Account | |
| | | | | | PF Trust dues payable | Total (₹) | |
| 1,03,24,695.00 | 1,06,62,975.00 | 12,17,70,315.12 | 20,65,68,107.22 | | Total (₹) | LOANS AND ADVANCES | |
| 2,37,73,575.00 | 4,33,21,123.00 | 8,55,022.30 | 8,55,022.30 | J | Project Expenses Payable | Security Deposits Receivable | |
| 4,97,536.75 | 6,41,236.75 | 1,20,08,487.00 | 1,07,85,816.00 | | Salary Payable | TDS Receivable | |
| 8,15,144.00 | 7,75,607.00 | 80,000.00 | | | Bonus payable | Total (₹) | |
| 84,900.00 | 80,000.00 | | | | Audit Fees Payable | | |
| 1,03,279.00 | | | | | Provision for GST | | |
| 3,97,762.21 | 3,25,551.93 | | | E | Provision for Imprest Expenses | | |
| 12,10,881.00 | 2,50,13,578.00 | | | K | Grant Project Account | | |
| 5,96,204.00 | 11,98,337.00 | | | | Staff Advance / Expenses Payable | | |
| 34,500.00 | 12,420.00 | | | | Benevolent Fund Trust | | |
| 2,74,93,781.96 | 7,13,67,853.68 | 1,28,63,509.30 | 1,16,40,838.30 | | Total (₹) | | |
| 99,11,92,174.57 | 1,21,02,30,540.67 | 99,11,92,174.57 | 1,21,02,30,540.67 | | Total (₹) | | |



As per our report of even date
 For Kale & Associates
 Chartered Accountants
 FRN: 114144 W

(Signature)
 (A.V.Kalle)
 Proprietor
 [M.No.32039]

(Signature)
 (Vijeta)
 AAO

(Signature)
 (Rahul Dabas)
 FACAO

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

Date:-16.09.2021

Seed Production and Distribution

Table 1 : Quantity of seed produced and distributed (2020-21)

| S. No. | Crop | Variety | 2020-21 (quintals) | |
|--------------|--------------|--|--------------------|-----------------|
| | | | Sale | Produce |
| 1. | Bitter gourd | PH-2 | 0.33 | 0.36 |
| 2. | Bottle gourd | Pusa Naveen | 1.29 | 7.62 |
| 3. | Brinjal | Pusa Uttam/Pusa purple long | 0.03 | 8.48 |
| 4. | Carrot | Pusa Rudhira | 0.05 | 20.67 |
| 5. | Cauliflower | Sabour Agrim | 0.05 | 2.07 |
| 6. | Chilli | K-2 | 1.03 | 10.20 |
| 7. | Cluster bean | P Navbahar | 1.00 | 28.91 |
| 8. | Coriander | RKD-18/GDLC-1 | 17.67 | 40.72 |
| 9. | Cowpea | Kashi Nidhi/Kashi Kanchan/Dharini | 11.33 | 233.54 |
| 10. | Cucumber | Swarna Sheetal | 0.04 | 0.00 |
| 11. | Drumstick | PKM-1 | 37.38 | 8.06 |
| 12. | Garlic | G-50/G-282/G-323/G-384/G-386/G-313/G-404 | 5142.69 | 4110.73 |
| 13. | Groundnut | Girnar-3/R-578/K-9/Dharani/K-1319 | 136.60 | 138.60 |
| 14. | Fenugreek | Pusa Early Banching, Gujarat-2/RMT-305 | 9.84 | 46.59 |
| 15. | Muskmelon | Pusa Madhuras | 0.50 | 0.64 |
| 16. | Okra | Arka Anamika/Pusa Bhindi-5 | 2.89 | 41.64 |
| 17. | Onion | ADR/L-883/NHRDF Red/NHRDF Red-2/NHRDF Red-3/ NHRDF Red-4/CoOn-5/A. Rose/A. White | 1099.32 | 1383.81 |
| 18. | Paddy | Pusa-44, PB-1509 | 21.93 | 0.00 |
| 19. | Spinch | All green | 0.02 | 24.37 |
| 20. | Pea | Pusa Pragati, PB-89/AP-3 | 30.45 | 33.64 |
| 21. | Potato | K. Jyoti/K. Pukhraj/K. Khyati/K. Chipsona-1 & 3/K. Bahar/K. Mohan/K. Surya/K. Gavrav/K. Lavkar | 4880.45 | 13195.17 |
| 22. | Pumpkin | Pusa Vishvash, Chakaiya | 0.02 | 0.07 |
| 23. | Radish | Pusa Chetaki/Punjab White-2 | 0.15 | 25.79 |
| 24. | Soybean | MAUS-71, KDS-753 | 178.28 | 145.80 |
| 25. | Sponge gourd | Kashi Divya | 0.14 | 2.22 |
| 26. | Tomato | Arka Rakshak/PKM-1 | 0.32 | 1.94 |
| 27. | Mustard | Giriraj/Pusa Vijay | 0.00 | 31.30 |
| 28. | Pigeon Pea | BRG-4, PA-291 | 0.00 | 17.04 |
| 29. | Moong | MH-421 | 0.00 | 31.44 |
| 30. | Seasame | Til-5, Rajasthan til-351 | 0.00 | 1.46 |
| Total | | | 11573.77 | 19592.88 |

Table 2 : Cost of production of onion seed crop during 2020-21

(Rs./ha)

| S. No. | Particulars | Gujarat | | | Maharashtra | | | |
|--------|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | ALR | NHRDF Red-3 | NHRDF Red-4 | ADR | NHRDF Red-3 | NHRDF Red-4 | ALR |
| 1. | Land rent for six month | 15000 | 15000 | 15000 | 12000 | 12000 | 12000 | 12000 |
| 2. | Bulb cost (qt.) | 100000 | 100000 | 100000 | 75000 | 100000 | 100000 | 100000 |
| 3. | Land Preparation | 13000 | 13000 | 13000 | 13640 | 13640 | 13640 | 13640 |
| 4. | Manures & Fertilizers | 26459 | 26459 | 26459 | 47303 | 47303 | 47303 | 47303 |
| 5. | Planting/sowing | 6480 | 6480 | 6480 | 12000 | 12000 | 12000 | 12000 |
| 6. | Weeding & Hoeing | 12350 | 12350 | 12350 | 16000 | 16000 | 16000 | 16000 |
| 7. | Plant Protection | 7700 | 7700 | 7700 | 19088 | 19088 | 19088 | 19088 |
| 8. | Irrigation | 37500 | 37500 | 37500 | 8780 | 9480 | 9480 | 9480 |
| 9. | Harvesting, culling, sorting, grading & packing | 12400 | 12400 | 12400 | 25500 | 25910 | 25910 | 25910 |
| 10. | Transportation | 2500 | 2500 | 2500 | 2500 | 3000 | 3000 | 3000 |
| 11. | Overhead charges | 2000 | 2000 | 2000 | - | - | - | - |
| 12. | Supervisory charges | 4200 | 4200 | 4200 | 12500 | 15000 | 15000 | 15000 |
| 13. | Total (Rs.) | 239589 | 239589 | 239589 | 244311 | 273421 | 273421 | 273421 |
| 14. | Bank interest (Rs.) | 8386 | 8386 | 8386 | 8551 | 9570 | 9570 | 9570 |
| 15. | Grand total cost (Rs) | 247974 | 247974 | 247974 | 252862 | 282990 | 282990 | 282990 |
| 16. | Average Yield (kg) | 550 | 550 | 550 | 500 | 600 | 600 | 600 |
| | Final cost per kg (Rs.) | 451 | 451 | 451 | 506 | 472 | 472 | 472 |

| S. No. | Particulars | Madhya Pradesh | | | | Karnataka | | Rajasthan | | | | | |
|--------|---|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | ADR | ALR | NHRDF Red-3 | NHRDF Red | CO-ON-5 | A. Rose | ADR | L-883 | NHRDF Red | NHRDF Red-3 | ALR | NHRDF Red-4 |
| 1. | Land rent for six months | 20000 | 20000 | 20000 | 20000 | 15000 | 15000 | 15000 | 15000 | 15000 | 15000 | 15000 | 15000 |
| 2. | Bulb cost (qt.) | 100000 | 125000 | 125000 | 125000 | 52500 | 30000 | 75000 | 75000 | 100000 | 100000 | 100000 | 100000 |
| 3. | Land Preparation | 8000 | 10000 | 10000 | 10000 | 17500 | 16500 | 12000 | 12000 | 12000 | 12000 | 12000 | 12000 |
| 4. | Manures & Fertilizers | 17515 | 17515 | 17515 | 17515 | 18002 | 8002 | 27757 | 27757 | 27645 | 27645 | 27645 | 27645 |
| 5. | Planting/sowing | 10000 | 10000 | 10000 | 10000 | 11000 | 11000 | 7280 | 7280 | 5880 | 5880 | 5880 | 5880 |
| 6. | Weeding & Hoeing | 19250 | 20500 | 20500 | 20500 | 18000 | 18000 | 10600 | 10600 | 10600 | 10600 | 10600 | 10600 |
| 7. | Plant Protection | 6263 | 6263 | 6263 | 6263 | 15500 | 12500 | 5090 | 5090 | 4790 | 4790 | 4790 | 4790 |
| 8. | Irrigation | 10000 | 11000 | 11000 | 11000 | 9600 | 9600 | 24000 | 24000 | 27300 | 27300 | 27300 | 27300 |
| 9. | Harvesting, culling, sorting, grading & packing | 27500 | 30000 | 30000 | 30000 | 12000 | 12000 | 11300 | 11300 | 11300 | 11300 | 11300 | 11300 |
| 10. | Transportation | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| 11. | Overhead charges | 4000 | 4000 | 4000 | 4000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| 12. | Supervisory charges | 5000 | 5000 | 5000 | 5000 | 3000 | 3000 | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 |
| 13. | Total (Rs) | 233528 | 265278 | 265278 | 265278 | 180102 | 143602 | 196127 | 196127 | 222615 | 222615 | 222615 | 222615 |
| 14. | Bank interest | 8173 | 9285 | 9285 | 9285 | 6304 | 5026 | 6864 | 6864 | 7792 | 7792 | 7792 | 7792 |
| 15. | Grand total cost (Rs) | 241701 | 274562 | 274562 | 274562 | 186406 | 148628 | 202991 | 202991 | 230406 | 230406 | 230406 | 230406 |
| 16. | Average Yield (kg) | 250 | 400 | 400 | 400 | 450 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| | Final cost per kg (Rs) | 967 | 686 | 686 | 686 | 414 | 297 | 406 | 406 | 461 | 461 | 461 | 461 |

Table 3 : Cost of production of onion bulb during *khariif* 2020

| S. No. | Particulars | Maharashtra | | Gujarat | | Madhya Pradesh | | Tamil Nadu (Multiplier) | |
|--------|---|---------------|---------------|---------------|---------------|----------------|---------------|-------------------------|--|
| | | ADR | L-883 | ADR | Bulblets | | Bulb | Seedling | |
| 1. | Land rent for six months | 12000 | 12000 | 20000 | 20000 | 20000 | 36000 | 36000 | |
| 2. | Seed cost (kg.) | 16000 | 16000 | 20000 | 93750 | 20000 | 45000 | 2500 | |
| 3. | Land Preparation | 16440 | 16440 | 13950 | 12350 | 8000 | 20000 | 20000 | |
| 4. | Nursery raising cost | 6540 | 6540 | 3620 | 0 | 6000 | 0 | 3000 | |
| 5. | Manures & Fertilizers | 30179 | 30179 | 25345 | 19495 | 17100 | 22242 | 21992 | |
| 6. | Transplanting | 21350 | 21350 | 13850 | 14750 | 20000 | 12600 | 12600 | |
| 7. | Weeding & Hoeing | 16550 | 16550 | 10650 | 15630 | 11750 | 19250 | 14400 | |
| 8. | Plant Protection | 18030 | 18030 | 10635 | 8110 | 8915 | 9060 | 8310 | |
| 9. | Irrigation | 9990 | 9990 | 14250 | 15600 | 8000 | 5400 | 5400 | |
| 10. | Harvesting, culling, sorting, grading & packing | 31750 | 31750 | 16250 | 17500 | 36250 | 19080 | 24816 | |
| 11. | Transportation | 12000 | 12000 | 8750 | 15000 | 10000 | 4680 | 5640 | |
| 12. | Overhead charges | - | - | 2000 | 2000 | 2000 | 2340 | 2820 | |
| 13. | Supervisory charges | 4000 | 4000 | 2500 | 4250 | 5000 | 7500 | 7500 | |
| 14. | Total (Rs.) | 194829 | 194829 | 161799 | 238435 | 173015 | 203152 | 164978 | |
| 15. | Bank interest | 9741 | 9741 | 5663 | 8345 | 6056 | 3555 | 2887 | |
| 16. | Grand total cost (Rs.) | 204570 | 204570 | 167462 | 246780 | 179071 | 206707 | 167865 | |
| 17. | Average Yield (q) | 225 | 225 | 350 | 300 | 260 | 125 | 150 | |
| | Final cost per quintal (Rs.) | 909 | 909 | 478 | 823 | 689 | 1654 | 1119 | |

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| S. No. | Particulars | Punjab | Karnataka | Uttar Pradesh | Rajasthan | | Bihar | Andhra Pradesh |
|--------|---|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| | | | | | Seedlings | Bulleets | | |
| 1. | Land rent for six months | 37500 | 10000 | 15000 | 20000 | 20000 | 20000 | 30000 |
| 2. | Seed cost (kg.) | 20000 | 10000 | 20000 | 20000 | 100000 | 20000 | 20000 |
| 3. | Land Preparation | 26000 | 17500 | 10200 | 10800 | 9300 | 8500 | 15000 |
| 4. | Nursery raising cost | 1500 | 1000 | 7250 | 6000 | 0 | 5000 | 6000 |
| 5. | Manures & Fertilizers | 20458 | 18030 | 12370 | 10280 | 15257 | 17450 | 14220 |
| 6. | Transplanting | 9000 | 0 | 12000 | 13000 | 10000 | 36000 | 20000 |
| 7. | Weeding & Hoeing | 6250 | 15000 | 14350 | 9300 | 9000 | 9000 | 13750 |
| 8. | Plant Protection | 12700 | 13600 | 13620 | 4850 | 4850 | 6638 | 17125 |
| 9. | Irrigation | 6600 | 0 | 9960 | 5200 | 6500 | 5000 | 4500 |
| 10. | Harvesting, curring, sorting, grading & packing | 8750 | 6000 | 20000 | 15900 | 24250 | 18000 | 24800 |
| 11. | Transportation | 6000 | 5000 | 14000 | 10000 | 10000 | 8100 | 7500 |
| 12. | Overhead charges | 5000 | 2000 | - | 3500 | 3500 | 2500 | 6000 |
| 13. | Supervisory charges | 3000 | 1500 | - | 4000 | 4000 | 3000 | 5000 |
| 14. | Total (Rs.) | 162758 | 99630 | 148750 | 132830 | 216657 | 159188 | 183895 |
| 15. | Bank interest (Rs.) | 8138 | 4982 | 5206 | 5313 | 8666 | 6368 | 6436 |
| 16. | Grand total cost (Rs.) | 170896 | 104612 | 153956 | 138143 | 225323 | 165555 | 190331 |
| 17. | Average Yield (q) | 225 | 150 | 200 | 150 | 160 | 225 | 150 |
| | Final cost (Rs./q) | 760 | 697 | 770 | 921 | 1408 | 736 | 1269 |

Table 4 : Cost of production of *rabi* onion bulb during 2020-21.

| S. No. | Particulars | Gujarat | Maharashtra | | | Madhya Pradesh | Tamil Nadu | Punjab |
|--------|---|---------------|---------------|---------------|---------------|----------------|---------------|--------|
| | | | ALR | NHRDF Red-3 | NHRDF Red-4 | | | |
| 1. | Land Rent for six months | 15000 | 12000 | 12000 | 20000 | 36000 | 37500 | |
| 2. | Seed Cost (kg) | 23000 | 9600 | 9600 | 23000 | 20000 | 20000 | |
| 3. | Land Preparation | 10300 | 16440 | 16440 | 8000 | 20000 | 17600 | |
| 4. | Nursery raising | 7330 | 6340 | 6340 | 4000 | 3000 | 1700 | |
| 5. | Manures & Fertilizers | 24653 | 30225 | 30225 | 17100 | 27686 | 20458 | |
| 6. | Transplanting | 13850 | 19800 | 19800 | 20000 | 14700 | 9000 | |
| 7. | Weeding & Hoeing | 27350 | 16550 | 16550 | 11750 | 26750 | 6250 | |
| 8. | Plant Protection | 3100 | 14335 | 14335 | 11190 | 14000 | 14300 | |
| 9. | Irrigation | 20000 | 14000 | 14000 | 8000 | 8400 | 13200 | |
| 10. | Harvesting, curring, sorting, grading & packing | 13750 | 29700 | 29700 | 35000 | 27195 | 10000 | |
| 11. | Transportation | 16575 | 15000 | 15000 | 10000 | 8760 | 6000 | |
| 12. | Overhead charges | 2000 | - | - | 2000 | 3285 | 2000 | |
| 13. | Supervisory charges | 2800 | 4000 | 4000 | 5000 | 7500 | 5000 | |
| 14. | Total (Rs.) | 179708 | 187990 | 187990 | 175040 | 217276 | 163008 | |
| 15. | Bank interest @ 3.5% (6 months) | 3145 | 4700 | 4700 | 3063 | 3802 | 8150 | |
| 16. | Grand Total of production cost | 182852 | 192690 | 192690 | 178103 | 221078 | 171158 | |
| 17. | Average Yield (q/ha) | 325 | 200 | 200 | 350 | 175 | 250 | |
| | Final production (Rs./q) | 563 | 963 | 963 | 509 | 1263 | 685 | |

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| S. No. | Particulars | Karnataka | | Haryana | Uttar Pradesh | Bihar | Rajasthan | Andhra Pradesh | Odisha |
|--------|---|---------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|
| | | A. Rose | CO-ON-5 | | | | | | |
| 1 | Land Rent for six months | 15000 | 15000 | 55000 | 15000 | 20000 | 25000 | 30000 | 10000 |
| 2 | Seed Cost (kg) | 18400 | 18400 | 23000 | 20000 | 18000 | 10000 | 23000 | 9000 |
| 3 | Land Preparation | 17500 | 17500 | 12000 | 10700 | 8700 | 10800 | 15000 | 5300 |
| 4 | Nursery raising | 1000 | 1000 | 3290 | 6200 | 10500 | 6000 | 6000 | 22400 |
| 5 | Manures & Fertilizers | 18030 | 18030 | 13806 | 12020 | 26700 | 15217 | 17230 | 17664 |
| 6 | Transplanting | 10000 | 10000 | 22400 | 14000 | 18000 | 12600 | 20000 | 0 |
| 7 | Weeding & Hoeing | 18000 | 18000 | 20600 | 14000 | 20750 | 9000 | 11750 | 19600 |
| 8 | Plant Protection | 13500 | 13500 | 3000 | 14350 | 13575 | 5155 | 15000 | 1800 |
| 9 | Irrigation | 9600 | 9600 | 3000 | 13140 | 18000 | 8500 | 9000 | 6000 |
| 10 | Harvesting, culling, sorting, grading & packing | 12000 | 12000 | 14000 | 21100 | 26250 | 31100 | 25000 | 40600 |
| 11 | Transportation | 6000 | 6000 | 5000 | 15000 | 7500 | 10000 | 14000 | 0 |
| 12 | Overhead charges | 2000 | 2000 | 2000 | - | 3000 | 4000 | 5000 | - |
| 13 | Supervisory charges | 3000 | 3000 | 2000 | - | 3000 | 5000 | 11200 | - |
| 14 | Total (Rs.) | 144030 | 144030 | 179096 | 155510 | 193975 | 152372 | 202180 | 132364 |
| 15 | Bank interest @ 3.5% (6 months) | 7202 | 7202 | 3134 | 3110 | 9699 | 7619 | 7076 | 6618 |
| 16 | Grand Total of production cost | 151232 | 151232 | 182230 | 158620 | 203674 | 159990 | 209256 | 138982 |
| 17 | Average Yield (q/ha) | 250 | 250 | 240 | 250 | 300 | 250 | 280 | 300 |
| | Final production cost (Rs./q) | 605 | 605 | 759 | 634 | 679 | 640 | 747 | 463 |

Table 5 : Cost of production of garlic during 2020-21

| S. No. | Particulars | Gujarat | Rajasthan | Punjab | Bihar | Haryana | Tamil Nadu | Uttar Pradesh | Odisha |
|--------|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 1. | Land Rent for six months | 15000 | 25000 | 50000 | 20000 | 55000 | 37500 | 15000 | 10000 |
| 2. | Seed Cost (ql.) | 72000 | 65000 | 65000 | 75000 | 75000 | 75000 | 75000 | 75000 |
| 4. | Land Preparation | 12700 | 5200 | 17600 | 8700 | 11000 | 13750 | 12000 | 12100 |
| 7. | Manures & Fertilizers | 26559 | 19033 | 14458 | 28416 | 12266 | 36200 | 13070 | 24277 |
| 5. | Planting | 10000 | 12000 | 14000 | 34500 | 15225 | 12000 | 15000 | 14000 |
| 8. | Weeding & Hoeing | 18100 | 22875 | 8750 | 18000 | 35600 | 22500 | 19350 | 16800 |
| 9. | Plant Protection | 6765 | 8710 | 14100 | 10238 | 7000 | 16500 | 15400 | 1800 |
| 6. | Irrigation | 37500 | 24000 | 13200 | 30000 | 6000 | 4200 | 18000 | 8400 |
| 10. | Harvesting, curing, sorting, grading & packing | 13100 | 29250 | 13500 | 24000 | 24400 | 26256 | 24000 | 33600 |
| 11. | Transportation | 8000 | 7200 | 7000 | 2500 | 4000 | 18750 | 7500 | 8750 |
| 13. | Overhead charges | 2000 | 4500 | 5000 | 3000 | 2000 | 4695 | - | 0 |
| 12. | Supervisory charges | 4200 | 5000 | 3000 | 3000 | 2000 | 7500 | - | 0 |
| 14. | Total (Rs.) | 225924 | 227768 | 225608 | 257354 | 249491 | 274851 | 214320 | 204727 |
| 15. | Bank interest | 7907 | 7972 | 7896 | 9007 | 8732 | 9620 | 11788 | 7165 |
| 16. | Total Cost (Rs.) | 233831 | 235740 | 233504 | 266361 | 258223 | 284471 | 226108 | 211892 |
| 17. | Average yield (q) | 52 | 60 | 100 | 125 | 75 | 150 | 90 | 125 |
| | Final cost (Rs./q) | 4497 | 3929 | 2335 | 2131 | 3443 | 1896 | 2512 | 1695 |

Table 6 : Cost of production of potato during 2020-21

| S. No. | Particulars | Punjab | Haryana | Uttar Pradesh | Bihar | Odisha |
|--------|---|---------------|---------------|---------------|---------------|---------------|
| 1. | Land Rent for six months | 42500 | 55000 | 12000 | 10000 | 10000 |
| 2. | Seed Cost (qt) | 96000 | 96000 | 72000 | 90000 | 57000 |
| 3. | Land Preparation | 17600 | 5000 | 8000 | 8700 | 6800 |
| 4. | Sowing and planting cost | 3000 | 8900 | 22500 | 24000 | 22760 |
| 5. | Manures & Fertilizers | 27207 | 17680 | 14000 | 27500 | 18142 |
| 6. | Weeding & Hoeing | 16650 | 1200 | 22500 | 15750 | 16800 |
| 7. | Plant Protection | 15600 | 3500 | 7500 | 13062 | 1800 |
| 8. | Irrigation | 9000 | 4900 | 12000 | 15000 | 3500 |
| 9. | Haulm cutting, Harvesting, curing, sorting, grading & packing | 13500 | 19600 | 24000 | 22500 | 28000 |
| 10. | Transportation | 12000 | 6000 | 8000 | 6000 | 0 |
| 11. | Overhead charges | 5000 | 2000 | - | - | 0 |
| 12. | Supervisory charges | 3000 | 3000 | 6000 | 3000 | 0 |
| 13. | Total (Rs.) | 261057 | 222780 | 208500 | 235512 | 164802 |
| 14. | Bank interest | 9137 | 7797 | 7298 | 9420 | 5768 |
| 15. | Total Cost (Rs.) | 270194 | 230577 | 215798 | 244932 | 170570 |
| 16. | Average Yield (q) | 325 | 340 | 240 | 250 | 250 |
| 17. | Final cost per quintal (Rs.) | 831 | 678 | 899 | 980 | 682 |



Table 7 : Area, production and productivity of onion in different states during 2020-21

| S. No. | States/Ut | Onion | | | | |
|--------|------------------|----------------|---------------|-----------------|---------------|--------------|
| | | Area | | Production | | Productivity |
| | | ('000 ha) | Share (%) | ('000 MT) | Share (%) | (tonnes/ha) |
| 1. | Maharashtra | 703.80 | 43.33 | 10476.46 | 39.32 | 14.89 |
| 2. | Madhya Pradesh | 186.92 | 11.51 | 4548.56 | 17.07 | 24.33 |
| 3. | Karnataka | 230.40 | 14.18 | 2660.68 | 9.99 | 11.55 |
| 4. | Gujarat | 67.74 | 4.17 | 1657.96 | 6.22 | 24.48 |
| 5. | Rajasthan | 82.30 | 5.07 | 1386.67 | 5.21 | 16.85 |
| 6. | Bihar | 58.34 | 3.59 | 1328.30 | 4.99 | 22.77 |
| 7. | West Bengal | 40.61 | 2.50 | 747.60 | 2.81 | 18.41 |
| 8. | Andhra Pradesh | 40.88 | 2.52 | 636.49 | 2.39 | 15.57 |
| 9. | Haryana | 21.15 | 1.30 | 602.35 | 2.26 | 28.48 |
| 10. | Uttar Pradesh | 28.55 | 1.76 | 470.84 | 1.77 | 16.49 |
| 11. | Tamil Nadu | 51.39 | 3.16 | 390.16 | 1.46 | 7.59 |
| 12. | Chhattisgarh | 23.43 | 1.44 | 380.72 | 1.43 | 16.25 |
| 13. | Odisha | 29.98 | 1.85 | 350.17 | 1.31 | 11.68 |
| 14. | Jharkhand | 17.59 | 1.08 | 295.57 | 1.11 | 16.80 |
| 15. | Punjab | 10.35 | 0.64 | 246.52 | 0.93 | 23.82 |
| 16. | Telangana | 7.09 | 0.44 | 134.48 | 0.50 | 18.97 |
| 17. | Assam | 8.29 | 0.51 | 91.93 | 0.35 | 11.09 |
| 18. | Jammu & Kashmir | 4.32 | 0.27 | 77.84 | 0.29 | 18.02 |
| 19. | Himachal Pradesh | 3.41 | 0.21 | 74.83 | 0.28 | 21.94 |
| 20. | Uttarakhand | 4.49 | 0.28 | 45.74 | 0.17 | 10.19 |
| 21. | Others | 0.88 | 0.05 | 16.62 | 0.06 | 18.89 |
| 22. | Nagaland | 0.60 | 0.04 | 5.61 | 0.02 | 9.35 |
| 23. | Manipur | 0.54 | 0.03 | 5.19 | 0.02 | 9.61 |
| 24. | Meghalaya | 0.57 | 0.04 | 5.09 | 0.02 | 8.93 |
| 25. | Mizoram | 0.27 | 0.02 | 1.80 | 0.01 | 6.67 |
| 26. | Sikkim | 0.27 | 0.02 | 1.67 | 0.01 | 6.19 |
| 27. | Tripura | 0.17 | 0.01 | 1.11 | 0.00 | 6.53 |
| 28. | Kerala | 0.01 | 0.00 | 0.07 | 0.00 | 7.00 |
| | Total | 1624.34 | 100.00 | 26641.03 | 100.00 | 16.40 |

Table 8 : Area, production and productivity of garlic in different states during 2020-21

| S. No. | States/Ut | Garlic | | | | |
|--------|------------------|---------------|---------------|----------------|---------------|--------------|
| | | Area | | Production | | Productivity |
| | | ('000 ha) | Share (%) | ('000 MT) | Share (%) | (Tonnes/ha) |
| 1. | Madhya Pradesh | 193.07 | 49.23 | 1982.6 | 62.15 | 10.27 |
| 2. | Rajasthan | 87.66 | 22.35 | 517.09 | 16.21 | 5.90 |
| 3. | Uttar Pradesh | 34.9 | 8.90 | 207.14 | 6.49 | 5.94 |
| 4. | Gujarat | 15.06 | 3.84 | 118.22 | 3.71 | 7.85 |
| 5. | Punjab | 8.87 | 2.26 | 96.77 | 3.03 | 10.91 |
| 6. | Assam | 10.77 | 2.75 | 68.92 | 2.16 | 6.40 |
| 7. | Odisha | 12.44 | 3.17 | 45.48 | 1.43 | 3.66 |
| 8. | West Bengal | 3.98 | 1.01 | 37.98 | 1.19 | 9.54 |
| 9. | Haryana | 3.2 | 0.82 | 31.7 | 0.99 | 9.91 |
| 10. | Maharashtra | 3.78 | 0.96 | 22.44 | 0.70 | 5.94 |
| 11. | Karnataka | 4.01 | 1.02 | 21.22 | 0.67 | 5.29 |
| 12. | Himachal Pradesh | 6.51 | 1.66 | 12.7 | 0.40 | 1.95 |
| 13. | Uttarakhand | 2.12 | 0.54 | 11.52 | 0.36 | 5.43 |
| 14. | Tamil Nadu | 1.27 | 0.32 | 7.36 | 0.23 | 5.80 |
| 15. | Bihar | 1.58 | 0.40 | 2.62 | 0.08 | 1.66 |
| 16. | Nagaland | 0.29 | 0.07 | 2.38 | 0.07 | 8.21 |
| 17. | Chhattisgarh | 1.57 | 0.40 | 1.68 | 0.05 | 1.07 |
| 18. | Kerala | 0.2 | 0.05 | 1.07 | 0.03 | 5.35 |
| 19. | Jammu & Kashmir | 0.71 | 0.18 | 0.57 | 0.02 | 0.80 |
| 20. | Meghalaya | 0.12 | 0.03 | 0.2 | 0.01 | 1.67 |
| 21. | Telangana | 0.02 | 0.01 | 0.11 | 0.00 | 5.50 |
| 22. | Mizoram | 0.02 | 0.01 | 0.01 | 0.00 | 0.50 |
| | Total | 392.15 | 100.00 | 3189.78 | 100.00 | 8.13 |



Table 9 : Area, production and productivity of potato in different states during 2020-21

| S. No. | States/Ut | Potato | | | | |
|--------|-------------------|----------------|---------------|-----------------|---------------|--------------|
| | | Area | | Production | | Productivity |
| | | ('000 ha) | Share (%) | ('000 MT) | Share (%) | (tonnes/ha) |
| 1 | Uttar Pradesh | 620.44 | 28.16 | 15811.31 | 28.15 | 25.48 |
| 2 | West Bengal | 455.21 | 20.66 | 15099.07 | 26.88 | 33.17 |
| 3 | Bihar | 327.58 | 14.87 | 9041.91 | 16.10 | 27.60 |
| 4 | Gujarat | 125.47 | 5.70 | 3890 | 6.93 | 31.00 |
| 5 | Madhya Pradesh | 156.39 | 7.10 | 3566.94 | 6.35 | 22.81 |
| 6 | Punjab | 107.09 | 4.86 | 2948.55 | 5.25 | 27.53 |
| 7 | Haryana | 30.75 | 1.40 | 807.37 | 1.44 | 26.26 |
| 8 | Jharkhand | 49.13 | 2.23 | 767.1 | 1.37 | 15.61 |
| 9 | Assam | 103.04 | 4.68 | 757.63 | 1.35 | 7.35 |
| 10 | Chhattisgarh | 41.4 | 1.88 | 591.25 | 1.05 | 14.28 |
| 11 | Maharashtra | 22.03 | 1.00 | 491.94 | 0.88 | 22.33 |
| 12 | Karnataka | 28.33 | 1.29 | 450.47 | 0.80 | 15.90 |
| 13 | Uttarakhand | 26.87 | 1.22 | 367.31 | 0.65 | 13.67 |
| 14 | Odisha | 24.91 | 1.13 | 296.85 | 0.53 | 11.92 |
| 15 | Rajasthan | 13.59 | 0.62 | 256 | 0.46 | 18.84 |
| 16 | Jammu & Kashmir | 8.03 | 0.36 | 197.87 | 0.35 | 24.64 |
| 17 | Himachal Pradesh | 15 | 0.68 | 196.3 | 0.35 | 13.09 |
| 18 | Meghalaya | 18.94 | 0.86 | 187.3 | 0.33 | 9.89 |
| 19 | Tripura | 8.13 | 0.37 | 147.31 | 0.26 | 18.12 |
| 20 | Tamil Nadu | 3.79 | 0.17 | 73.01 | 0.13 | 19.26 |
| 21 | Nagaland | 4.35 | 0.20 | 55.59 | 0.10 | 12.78 |
| 22 | Telangana | 1.99 | 0.09 | 47.17 | 0.08 | 23.70 |
| 23 | Sikkim | 6.16 | 0.28 | 44.6 | 0.08 | 7.24 |
| 24 | Andhra Pradesh | 2.29 | 0.10 | 41.27 | 0.07 | 18.02 |
| 25 | Others | 0.69 | 0.03 | 17.14 | 0.03 | 24.84 |
| 26 | Manipur | 0.89 | 0.04 | 13.78 | 0.02 | 15.48 |
| 27 | Kerala | 0.45 | 0.02 | 6.04 | 0.01 | 13.42 |
| 28 | Mizoram | 0.1 | 0.00 | 0.95 | 0.00 | 9.50 |
| 29 | Arunachal Pradesh | 0.02 | 0.00 | 0.44 | 0.00 | 22.00 |
| | Total | 2203.06 | 100.00 | 56172.47 | 100.00 | 25.49 |

Table 10 : Month-wise export of onion during 2016-17 to 2020-21

| Onion Export (Quantity in lakh MT) | | | | | |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|
| | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020- 21 |
| April | 1.95 | 1.6 | 1.73 | 1.89 | 2.35 |
| May | 2.3 | 2.09 | 2.2 | 1.63 | 2.05 |
| June | 1.9 | 1.24 | 1.05 | 1.91 | 2.4 |
| July | 1.54 | 1.42 | 1.53 | 1.60 | 2.72 |
| August | 1.95 | 1.58 | 1.81 | 1.26 | 2.24 |
| September | 1.97 | 1.44 | 2.02 | 1.04 | 1.29 |
| October | 2.04 | 0.87 | 1.78 | 0.17 | 0.019 |
| November | 1.9 | 1.14 | 1.36 | 0.06 | 0.028 |
| December | 2.57 | 1 | 1.75 | 0.23 | 0.043 |
| January | 1.9 | 0.58 | 1.94 | 0.09 | 0.571 |
| February | 1.99 | 1.01 | 2.33 | 0.04 | 0.315 |
| March | 2.15 | 1.9 | 2.34 | 1.54 | 1.74 |
| Total | 24.16 | 15.89 | 21.84 | 11.45 | 15.78 |

Table 11 : India Onion Import during 2020-21

| 2020-21 | | |
|----------------------|-------------|------------------|
| Country | Qty in (MT) | Value (Lakh Rs.) |
| Afghanistan Tis | 34620.42 | 9995.48 |
| United Arab Emirates | 6827.06 | 2388.25 |
| Egypt | 16598.96 | 6194.03 |
| Iran | 3549.09 | 997.26 |
| Turkey | 3351.44 | 1055.51 |
| Korea Rp | 0 | 0 |
| Malaysia | 0 | 0 |
| Morocco | 582.3 | 208.25 |
| Netherland | 371.4 | 137.02 |
| Russia | 99.75 | 32.79 |

| 2020-21 | | |
|-----------------|------------------|------------------|
| Country | Qty in (MT) | Value (Lakh Rs.) |
| Singapore | 0 | 0 |
| Sri Lanka | 0 | 0 |
| Tanzania Rep | 116 | 17.76 |
| Thailand | 84 | 60.01 |
| Unspecified | 29 | 9.91 |
| Vietnam Soc Rep | 35 | 6.46 |
| Australia | 0 | 0 |
| China P Rp | 0 | 0 |
| Total | 66,264.42 | 21,102.73 |



Table 12 : Country-wise onion export from India during 2020–21

| Country | Qty (MT) | Value (Lakh Rupees) |
|-----------------|-----------|---------------------|
| Bangladesh PR | 552363.07 | 75548.08 |
| Malaysia | 198109.11 | 46146.99 |
| U Arab Emts | 170641.24 | 33050.16 |
| Sri Lanka DSR | 144713.35 | 31322.23 |
| Nepal | 113564.86 | 16477 |
| Indonesia | 70741.11 | 11269.31 |
| Saudi Arab | 57363.62 | 10025.78 |
| Qatar | 45354.15 | 9335.93 |
| Kuwait | 39529.51 | 8369.06 |
| Oman | 42545.37 | 8123.81 |
| Singapore | 18937.7 | 4217.11 |
| Vietnam Soc Rep | 25010.94 | 4194.59 |
| Maldives | 11473.06 | 3912.5 |
| Baharain IS | 17153.26 | 3410.22 |
| Hong Kong | 10627.95 | 2172.7 |
| Philippines | 7103.31 | 2058.64 |
| Mauritius | 7308 | 1962.24 |
| Reunion | 6277.88 | 1576.27 |
| U.K. | 5454.15 | 1454.18 |
| Brunei | 2741 | 1060.12 |
| Thailand | 5564 | 1034.93 |
| Italy | 3687.47 | 946.89 |
| Greece | 2417 | 628.49 |
| Iraq | 4186 | 581.41 |
| Bhutan | 1270.6 | 543.75 |
| Somalia | 3053 | 485.04 |
| Russia | 1307.9 | 464.17 |
| Spain | 1405.95 | 434.42 |
| Seychelles | 1105.2 | 242.22 |
| Kenya | 837 | 161.57 |
| Netherland | 429.01 | 118.45 |

| Country | Qty (MT) | Value (Lakh Rupees) |
|-----------------|---------------------|---------------------|
| China P RP | 580 | 105.01 |
| Slovenia | 290 | 96.49 |
| Tanzania Rep | 343 | 85.06 |
| Djibouti | 638 | 84.56 |
| France | 191.63 | 73.15 |
| Comoros | 319.49 | 63.47 |
| Canada | 100.09 | 55.16 |
| Timor-Leste | 259 | 50.5 |
| Australia | 71.55 | 48.59 |
| U.S.A. | 122.93 | 33.19 |
| South Sudan | 184 | 30.58 |
| Gabon | 145 | 28.78 |
| Germany | 43.19 | 26.74 |
| Sierra Leone | 87 | 15.64 |
| Senegal | 49.5 | 13.91 |
| Taiwan | 54 | 12.16 |
| Norway | 18.24 | 11.87 |
| Sudan | 54 | 9.89 |
| Congo P Rep | 29 | 8.21 |
| Switzerland | 5.06 | 5.38 |
| Ghana | 28.98 | 5.25 |
| Cote D Ivoire | 28 | 4.48 |
| Ireland | 2.61 | 2.63 |
| New Zealand | 0.6 | 1.23 |
| Sweden | 0.8 | 0.91 |
| Japan | 0.66 | 0.54 |
| Belgium | 0.46 | 0.42 |
| Egypt A Rp | 0.01 | 0.01 |
| Panama Republic | 0.02 | 0.01 |
| Total | 1,578,922.59 | 282,202.08 |



Table 13 : Country-wise garlic export from India during 2020–21

| 2020-21 | | | 2020-21 | | |
|-----------------|----------|---------------------|-----------------|-----------------|---------------------|
| Country | Qty (MT) | Value (Lakh Rupees) | Country | Qty (MT) | Value (Lakh Rupees) |
| U.S.A. | 464.22 | 1117.24 | Maldives | 7.95 | 10.63 |
| Nepal | 1375.33 | 688.48 | Senegal | 8.5 | 3.07 |
| U Arab Emts | 827.89 | 601.01 | Australia | 0.44 | 1.52 |
| Taiwan | 173.38 | 254.28 | Japan | 0.5 | 0.93 |
| Thailand | 567 | 230.71 | Reunion | 3 | 0.55 |
| Malaysia | 603.38 | 229.83 | U K | 0.06 | 0.52 |
| Bhutan | 120.92 | 107.17 | Sri Lanka DSR | 0.2 | 0.14 |
| Vietnam Soc Rep | 134.31 | 104.21 | France | 0.03 | 0.07 |
| Mauritius | 53.6 | 73.39 | Cameroon | 0.03 | 0.05 |
| Oman | 36.02 | 39.28 | Canada | 0.01 | 0.04 |
| Kuwait | 33.48 | 32.33 | Malawi | 0.04 | 0.03 |
| Qatar | 28.24 | 26.7 | Brunei | 0.02 | 0.03 |
| Saudi Arab | 15.56 | 20.66 | Panama Republic | 0.01 | 0 |
| Singapore | 27.82 | 18.25 | Hong Kong | 0.01 | 0 |
| Baharain IS | 16 | 13.28 | Total | 4,497.95 | 3,574.40 |

Table 14 : India-Import garlic during 2020–21

| Country | 2020-21 | |
|-----------------|-----------------|-----------------|
| | Qty | Lakh Rs. |
| Afghanistan Tis | 1467.36 | 1629.35 |
| U Arab Emts | 3731.7 | 1025.58 |
| China P Rp | 1160 | 303.95 |
| Iran | 983.89 | 231.76 |
| U.S.A. | 55.45 | 121.93 |
| Taiwan | 75 | 69.36 |
| Turkey | 0 | 0.03 |
| Total | 7,473.40 | 3,381.96 |

Table 15 : Country-wise potato export from India during 2020–21

| Country | Qty | Lakh Rs. |
|-----------------|-----------|----------|
| Nepal | 218675.76 | 30620.87 |
| Oman | 22070.4 | 4559.68 |
| Saudi Arab | 15710 | 3306.31 |
| Malaysia | 13898.5 | 3188.4 |
| Indonesia | 11789 | 2844.29 |
| Sri Lanka DSR | 8459.03 | 1975.37 |
| Kuwait | 7850 | 1746.97 |
| Maldives | 4435 | 1623.08 |
| U Arab Emts | 6600.58 | 1492 |
| Mauritius | 3892 | 1230.5 |
| Vietnam Soc Rep | 2837 | 626.08 |
| Bhutan | 2631.47 | 521.66 |
| Seychelles | 1242.5 | 376.78 |
| Hong Kong | 1053 | 268.8 |
| Baharain IS | 1289.87 | 257.69 |
| Qatar | 998.1 | 227.36 |
| Turkey | 175 | 40.86 |

| Country | Qty | Lakh Rs. |
|--------------|-------------------|------------------|
| Brunei | 29 | 8.43 |
| Singapore | 11.21 | 6.51 |
| Senegal | 28 | 5.89 |
| U S A | 2.74 | 4.13 |
| Australia | 2.82 | 3.8 |
| U K | 2 | 3.46 |
| Ireland | 1.59 | 2.66 |
| Germany | 1 | 1.15 |
| New Zealand | 0.56 | 1.01 |
| Belgium | 0.4 | 0.72 |
| Canada | 0.32 | 0.6 |
| Switzerland | 0.14 | 0.33 |
| Malta | 0.65 | 0.23 |
| Liberia | 0.33 | 0.21 |
| Benin | 0.01 | 0.01 |
| Total | 323,687.98 | 54,945.84 |



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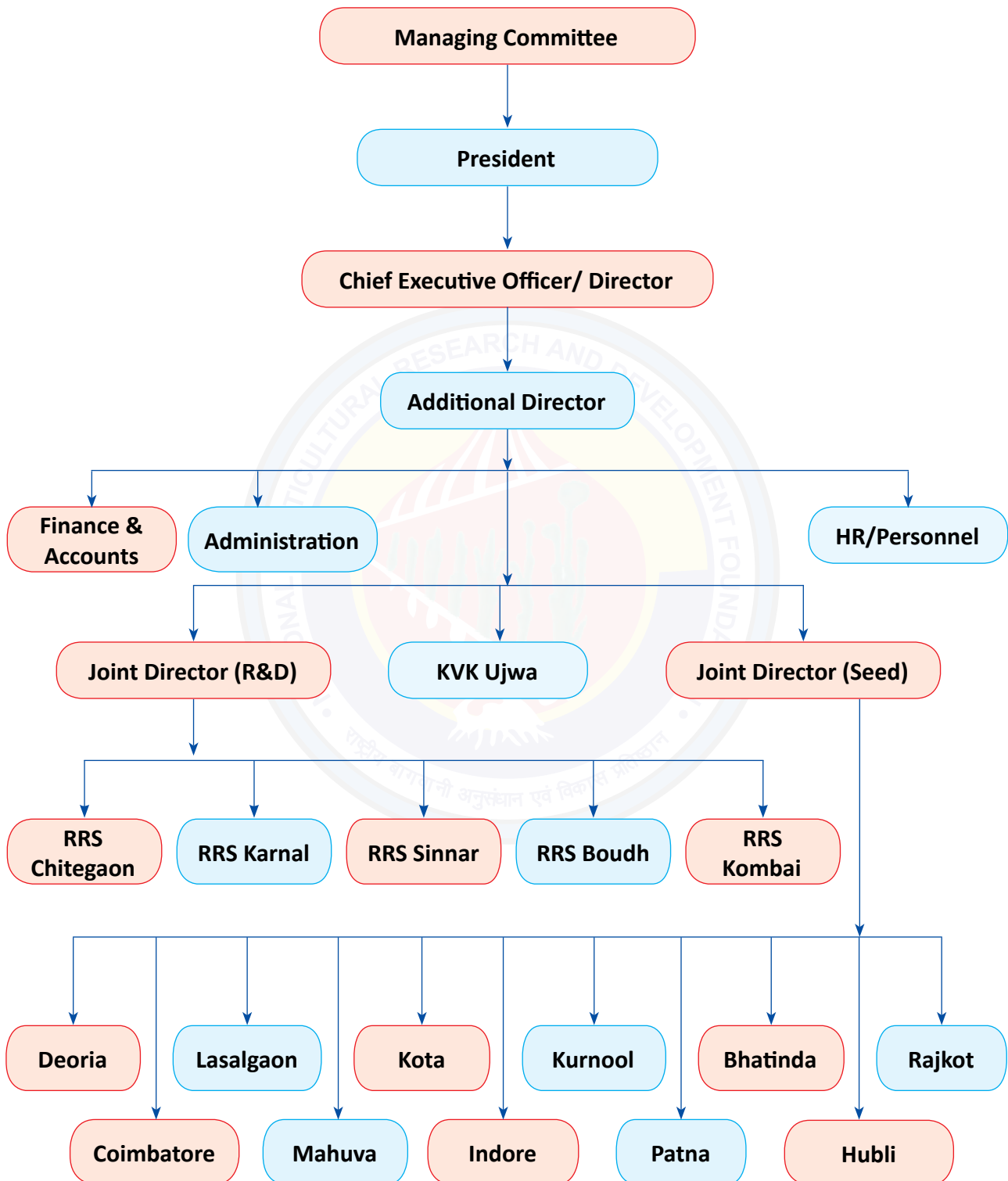
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Meteorological Data

RRS, Nashik (Maharashtra)

| Month & Year | Temperature (°C) | | Relative humidity (%) | | Rainfall (mm) |
|-----------------|------------------|-------|-----------------------|-------|---------------|
| | Max. | Min. | Max. | Min. | |
| July- 2020 | 29.02 | 21.28 | 76.38 | 61.42 | - |
| August- 2020 | 26.45 | 23.97 | 83.55 | 72.00 | - |
| September- 2020 | 28.67 | 24.18 | 80.00 | 64.96 | - |
| October- 2020 | 29.30 | 21.63 | 72.75 | 52.50 | - |
| November- 2020 | 26.45 | 15.32 | 58.23 | 40.41 | - |
| December- 2020 | 23.80 | 11.43 | 69.72 | 41.32 | 23.80 |
| January- 2021 | 24.37 | 12.77 | 71.88 | 46.63 | 24.37 |
| February- 2021 | 24.00 | 13.07 | 64.35 | 38.13 | - |

RRS, Karnal (Haryana)

| Month & Year | Temperature (°C) | | Relative humidity (%) | | Rainfall (mm) |
|-----------------|------------------|-------|-----------------------|-------|---------------|
| | Max. | Min. | Max. | Min. | |
| July- 2020 | 33.80 | 23.99 | 85.10 | 71.26 | - |
| August- 2020 | 26.45 | 23.07 | 87.13 | 77.65 | - |
| September- 2020 | 34.35 | 22.86 | 81.47 | 64.10 | - |
| October- 2020 | 32.91 | 14.20 | 69.52 | 41.74 | - |
| November- 2020 | 26.45 | 7.79 | 71.30 | 48.77 | - |
| December- 2020 | 19.99 | 6.01 | 84.87 | 58.84 | - |
| January- 2021 | 16.60 | 7.10 | 91.90 | 74.10 | 36.40 |
| February- 2021 | 23.96 | 9.08 | 85.75 | 61.75 | 11.50 |

Onion and Garlic Varieties



Agrifound Light Red



Agrifound Dark Red



NHRDF Red



NHRDF Red-2 (L-355)



NHRDF Red-3



NHRDF Red-4





Coll-863



Coll-883



Agrifound Rose



Agrifound White



Agrifound Red



NHRDF Fursungi (L-819)



Yamuna Safed



Yamuna Safed-2



Yamuna Safed-3



Yamuna Safed-4



Yamuna Safed-5



Agrifound White





Agrifound Parvati



Agrifound Parvati-2



Yamuna Safed-6



Yamuna Safed-7



Yamuna Safed-8



Yamuna Safed-9

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CENTRES

Batinda, Coimbatore, Deoria, Hubli, Indore, Karnal, Kombai, Kota, Kurnool, KVK-Ujwa, Lasalgaon,
Mahuva, Nashik, Paljhar, Patna, Rajkot and Sinnar



NHRDF Quality Seeds



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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CENTERS

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