



# ICAR-NRCSS E-NEWS LETTER



Vol 15 (1)

Seed Spices E-News Letter

January - February, 2022

## From Director's Desk



It is a matter of immense pleasure to share this first issue of Seed Spice E-Newsletter, 2022. To overcome the low yield & quality and incidence disease and pest, different genetic stocks were developed in coriander, fennel and celery. To promote organic fennel cultivation, fennel varieties were identified for cultivation under

organic production system. Under new development initiative (waste to wealth) at ICAR-NRCSS, compost and vermicompost unit was established. Quality seed were produced in farmers participatory approach and monitoring of seed production sites were carried out. Institute conducted various HRD activities such as organized winter schools for capacity building in seed spice sector. For transfer of technologies training, field day and input distribution programme organized under DBT Kisan biotech Hub, MIDH, SCSP&TSP schemes. In Azdi ka Amrit Mahotsav three programmes including National Girl Child Day was organized during the period. Other programmes such as Institute foundation day and republic day was also celebrated. In addition to this 6 research paper, two book chapter and one book was published during the period.

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## Research Highlights

### Genetic stock developed in seed spice crops

To identify best genotypes in coriander for yield and quality attributes, an experimental trial for two year (2019-2020) was carried out at ICAR-NRCSS, farm. A total of 100 germplasm were evaluated and observations were recorded for yield and yield attributing characters. Out of 100 germplasm, 15 germplasm were tested in station trial. The analysis of variance revealed significant differences among the entries for all the traits including seed yield. Entry ACr-160 recorded for highest seed yield (18.72 q/ha), whereas, entry SDM-19-03 recorded for maximum essential oil (0.34 %) which were found higher as compared to check variety ACr-2 (1117 & 0.31 %).

*R.S. Meena, S. S. Meena, A.K. Verma, Y.K. Sharma, S. N. Sexana and N.K. Meena*

To develop dwarf high yielding genotypes and *Ramularia* blight resistant-tolerant in fennel, an experimental trial for three year (2016-2021) was carried out at NRCSS, farm. A total of 120 germplasm were evaluated and observations were recorded for yield and yield attributing characters. Out of 120 germplasm, 12 germplasm were tested in station trial. The analysis of variance revealed significant differences among the entries for all the traits including seed yield. Fennel entry AF- 87 recorded highest seed yield (39.40 q/ha) and AF-27 recorded for maximum essential oil (1.51 %) in station trial

over the check variety AF-3 (32.12 q/ha & 1.36%). In addition, genotypes AF-87 (PDI-9.17), AF 48 (12.5) and AF-3 (PDI-12.5) were reported lower disease incidence, considered initially as resistant against *Ramularia* blight and entry AF-87 was recorded free from aphid infestation while AF-27 received lower aphid infestation (39 aphids/umbel).

*R.S. Meena, S. N. Sexana R.D. Meena, Sharda Choudhary and N.K. Meena*

In breeding of celery for yield and quality attributes a field trial was conducted during the period 2016-21 for three consecutive years to develop new improved varieties through selection method. A total 34 germplasm and 25 segregant lines were evaluated and data were recorded for yield and yield attributing characters. Out of 49 lines, 15 lines were tested in station trial. The analysis of variance revealed significant differences among the entries for all the traits including seed yield. Entry A-Cel-25 recorded for highest seed yield (4.93 q/ha) and entry karnoli-13 was recorded for maximum essential oil (1.9%) as compared to the check variety A-Cel-1 (4.68q/ha & 1.7 %). Entry A-Cel-25 received minimum aphid infestation (13.86 aphid/umbel) over other evaluated entries.

*R.S. Meena, Sharda Choudhary, N.K. Meena, A.K. Verma and R.D. Meena*

## Fennel varieties identified for cultivation under organic production system

Fennel (*Foeniculum vulgare* Mill) is an imperative seed spice crop and belongs to the family Apiaceae. The demands of organic products are very high in national and international market because these products are free from pesticides, insecticides and other harmful chemical compound residues. The organic production system is also considered as human and environment friendly. So far there is no any variety recommended in seed spices for cultivation under organic production system. Hence,



Best performing varieties of fennel (GF-12 and AF-1)

Selection of fennel varieties under organic production system is very much needed. Therefore, to find out the variety best response under organic management system, an experiment was conducted to evaluate the different fennel varieties under organic management production system at ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan under All India Network Programme on Organic Farming during the Rabi season 2015-16 to 2020-21. Eight varieties viz., AF-1, RF-101, Co-01, GF-12, Rajendra Saurabh, RF-281, RF-125 and GF-02 were tested under the organic system. The results revealed that varieties GF-12 and AF-1 performed better in organic production system than other tested varieties. The maximum plant height (cm) at harvest (179.87), number of primary branches per plant (11.19), number of secondary branches per plant (21.39), number of umbels per plant (38.83) with highest seed yield (2735.0 kg/ha) recorded in variety GF-12 followed by AF-1 (2704.31 kg/ha) and the lowest seed yield (2374.35 kg/ha) was obtained in the variety RF-101. The seed yield percent higher in variety GF-12 (15.19 %) & (13.90) in variety AF-1 over low yielding variety RF-101. Highest net return (Rs. 156124) with B: C Ratio 1: 3.49 were obtained in the variety GF-12 followed by AF-1 (Rs. 153668) with B: C ratio 1: 3.45. Hence, these two varieties (GF-12 and AF-1) can be recommended to cultivate under organic production system in fennel crop.

S. Lal, G. Lal, S.N. Saxena, N.K. Meena, R.D. Meena, N. Chaudhary and M. K. Chaudhary

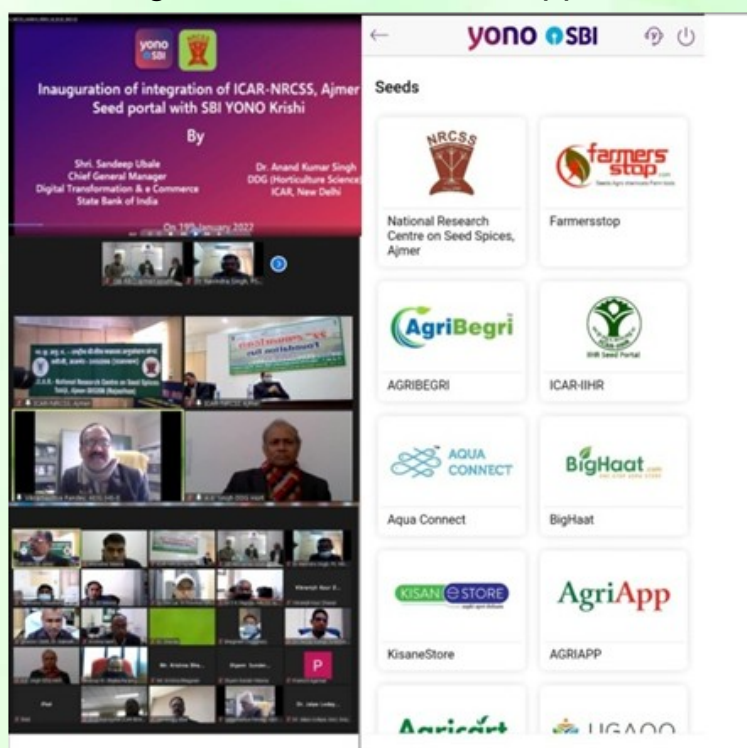
## New Development Under Digital India initiative

### Integration of ICAR-NRCSS Seed Portal with YONO SBI app

Innovative initiative by ICAR-NRCSS in the field of online seed sales has been taken with integration of ICAR-NRCSS Seed Portal with YONO SBI krishi app. Now seed growing farmers across the country will be able to buy seeds of seed crops through YONO SBI App. ICAR-NRCSS is after the ICAR-IIHR Bengaluru whose seed portal has been integrated with YONO SBI Krishi App of State Bank of India. It should be known that State Bank YONO App is a reputed and widely used mobile banking app in India, which has access to more than five crore users of the country, which is available in 10 other Indian languages besides Hindi and English. With the integration of both the apps, lakhs of

seed spice farmers of the country will get digital assistance in buying seeds. Farmers living in different regions of the country, who want to cultivate seed spice crops, will be able to get seeds of improved varieties of seed spices sitting comfortably at their homes. With this, the target of increasing the area and production of seed spice crops in the country will be achieved.

The integration has been made available to the seed spice stakeholders on the occasion of the 22<sup>nd</sup> Foundation Day of ICAR-NRCSS Ajmer by Dr. Anand Kumar Singh, Deputy Director General, Horticulture Science, ICAR New Delhi on 19<sup>th</sup> Jan., 2022. On this occasion, Mr. Sandeep Ubale, Chief General Manager (Digital Transformation and E-commerce) State Bank of India, Mr. Rajesh Kumar Mishra, Chief General Manager, State Bank of India, Jaipur Region also joined the program virtually. Dr. S.N. Saxena, Director ICAR-NRCSS thanked the SBI YONO team and said that through YONO App, there will be a meaningful cooperation in achieving the goal of seed distribution of improved varieties of seed spices. This linkage has been developed under guidance of Dr. S.N. Saxena, Director ICAR-NRCSS. Dr. Murlidhar Meena, Scientist & I/C ARIS Cell and Mr. Sunil Agrawal, AF&AO, played the key role in articulating the facility with technical support from YONO SBI Team. Dr. Sanjay Kumar, Scientist, Sh. S. R. Meena ACTO helped in the development of this integration.



## New Website of ICAR-NRCSS <https://nrcss.icar.gov.in/> developed and hosted at ICAR-Data Centre

The website of ICAR-NRCSS has been redesigned and developed as per guidelines of Indian Council of Agricultural Research, New Delhi. The website is now hosted at ICAR data centre with more security measures. It is developed as mobile friendly with many added features including online payment gateway and ICAR-NRCSS Seed Portal facilities to promote digital India programme. The entire information about the institute, resources, research and necessary acquaintances has been provided under different heads. Farmer's corner head provides information on good agricultural practices to be followed in different seed spices and weather information for decision making. Important links for easy access to related websites has been provided for ease of the users. New website has been provided with online seed purchase facilities, following self understood step by step procedures. The user can track the status of order using link

provided here. Once the order accepted by concerned authorities payment can also be made online using payment gateway link provide on website. After successful payment seeds of required crops and quantities will be delivered to door step of the clients. The event gallery provides for all photos, videos and media coverage. Social media accounts namely twitter, face book and YouTube channels of ICAR-NRCSS have been created and provide with links at this new website. The website also provides the information on available facilities on payment basis under the head SAIF. This new website has been developed by Dr. Murlidhar Meena, Scientist & In-Charge ARIS Cell with technical support from Tag11 Softech Pvt Ltd Software Co., Ajmer and under guidance of Dr. S.N. Saxena, Director ICAR-NRCSS. The new website <https://nrcss.icar.gov.in/> has been hosted in ICAR Data Centre. Website is regularly maintained and updated by ARIS Cell under Agricultural Knowledge Management Unit (AKMU).



## Waste to Wealth Initiative at ICAR-NRCSS

ICAR- NRCSS Ajmer has initiated one vermicompost and compost unit at the corner of NRCSS farm. This area is approximately 2



Vermicompost



Compost unit



Processing waste



Vermicompost bed



Vermiwash



Cleaning of waste

biga which was cleaned by uprooting shrubs under Swachh Bharat Mission with direction of Dr. S.N. Saxena Director, ICAR NRCSS Ajmer. To fill the vermin-compost and compost unit, we use waste of the farm (weeds of farm,



Composting of weed and tree leaves



Neem leaves



Decomposing neem leaves

leave trees, after cutting waste grass of lawn), waste of processing unit and waste of the household and guest house of the institute. These well prepared manure utilized in farm section and experimental fields for

good soil health. Sustainable seed spices can be cultivated by this approach without losing farm fertility. At farm section off season coriander was also sown and sold coriander leaves among the NRCSS Ajmer staff. This unit was visited many boy and girls of schools and colleges and farmers (women and men) of different part of country, they also appreciated and take some idea regarding off season coriander other vegetables which are being grown here. This initiative was started by Dr. R.S. Meena. S.R.Balai, P.K. Agarwal and Suresh Kumar bagra under the overall guidance of Dr. S.N. Saxena.

### Quality Seed production

#### Production of quality planting materials of seed spices through farmer’s participatory mode

During 2021-22 ICAR-NRCSS, Ajmer has undertaken quality seed production of different seed spices crops at farmer’s fields through participatory mode in Ajmer, Nagaur and Bikaner districts of Rajasthan. Total 14 farmers were selected based on their interest and resource availability for TFL seed production of 10 different varieties of six seed spices crops. The flowering stage monitoring of the seed production program has been taken during January and February 2022.



Monitoring of cumin & nigella seed production field at Nokha, Bikaner



Monitoring of fennel seed production field at Gagwana, Ajmer

The monitoring team (Dr. Sanjay Kumar, S.R. Meena & P.K. Agarwal) observed that there are significant effects of sowing time on seed spices growth and development in seed production fields. The team has also instructed the seed growers for the timely operation of various activities viz., rouging, weeding, and thinning in cumin, coriander, and ajwain seed production.

## Transfer of technologies

### DBT Kisan-biotech Hub

#### Monitoring and Input distribution to FLDs beneficiaries

Monitoring of FLD's on cumin at village Katyasani, Medtacity Dist. Nagaure was carried out by Dr. S.S. Meena, Dr. Shiv Lal and Dr. Murlidhar Meena on 20<sup>th</sup> January, 2022. The status of the crop was seen at farm conditiona and farmers were advised for appropriate control measures in case of any problem in crop. The ten cumin FLD beneficiaries were also distributed with Tarpaulins made from High Density Polyethylene ( HDPE ) Woven Fabrics (10 mtrs x 10 mtrs) and HDPE Woven Bed Vermiculture (12' X 4' X 2' feet) for sun drying of farm produce and preparing FYM respectively.

Monitoring of FLD's on Nagauri Pan Methi



Tirpal and vermibed distribution to cumin farmers at Katyasani, Medtacity, Nagaure distributed at Mundawa under DBT project was also carried out on 20<sup>th</sup> January, 2022. We conducted monitoring of all the Nagauri Pan Methi FLD's and also distributed Tarpaulins made from High Density



Monitoring and input distribution to Nagauri Pan Methi and cumin farmers

Field day cum training programme at Mundwa

Polyethylene ( HDPE ) Woven Fabrics (10 mtrs x 10 mtrs) and HDPE Woven Bed Vermiculture (12' X 4' X 2' feet) to all the beneficiary farmers.

and delivered the lecture. Dr. S.S. Meena delivered lecture on GAP in Nagauri Pan Methi. Dr. Shivalal gave lecture on Nutritive aspects and value addition in Nagauri Pan Methi. Dr. Murlidhar Meena gave lecture on Economic benefits of Nagauri Pan Methi cultivation. Sh. Prashant Ranga from Ambhuja Foundation instructed participants about procedures to FPO formation and its benefits. After training a field day was conducted and all the participants were visited the demonstration farm of FLD distributed by ICAR-NRCSS Ajmer. The visitor took the first hand knowledge on variety and GAP in crop.

### **Field day cum training programme on “Promoting GAP & IPM in Nagauri Pan Methi”**

A field day cum farmer training on “Promoting GAP & IPM in Nagauri Pan Methi” was organized at Mundwa, Nagour (Raj) under DBT project (GAP) on 21/01/2022. In this programme more than fifty Nagauri Pan Methi farmers participated. Experts from SABC Dr. Bhagirath Choudary attended the training

## MIDH

### Farmers' training

One day farmers training programme on “Organic cultivation of cumin and coriander” was organized under Mission for Integrated Development of Horticulture (MIDH) at ICAR-NRCSS, Ajmer (Rajasthan) on 26<sup>th</sup> February, 2022 for the SC community farmers.



Dr. S. N. Saxena, Director, NRCSS, Ajmer  
interacting with participants



## SCSP programme of ICAR- NRCSS

### Field day and monitoring of FLDs

To promote and popularize ICAR-NRCSS organic products such as bioagents (*Trichoderma harzanium*, *T. viridae*) botanical insecticide and other organic products like NPK consortia, bio-decomposer, one day field day, monitoring and agri input distribution programme was organized at village Hadmatia, Serohi district under SCSP on 02/02/2022. To impart technical know how about use of NPK consortia, bio-decomposer,

theme based deliberations were also made during the programme. Monitoring of AF-2 FLDs were also carried out at farmers field and at one of the farmer FLD site, field day was also organized to make them aware about importance of quality seeds, appropriate harvesting stages for chewing type's fennel and optimum drying techniques for clean and quality green fennel production. To carry out various post harvest activities especially drying of green fennel, green shed net was also distributed to 5 FLDs farmers. This programme was coordinated and organized by Dr. Shiv Lal, Dr. Murlidhar Meena, Dr. N. Chaudhary, Dr. C.K. Jangid and local coordinator Dr. Mulayam Singh Yadav, AAO, Revdar, Serohi.

## Field day

To demonstrate the performance of FLD of ICAR-NRCSS, Ajmer fenugreek and Nigella varieties and production technologies, field day was arranged at beneficiary farmer's field SCSP on 24/02/2022. In this programme milk can, training kit (notepad and pen), bioagents (*Trichoderma harzanium*, *T. viridae*), bio decomposer, Sagarika K+ organic fertilizer, botanical insecticide, face mask, ber and Khejri plants were distributed to each SC beneficiaries. Technical knowhow was also imparted about use of sagarika fertilizer (IFFCO), botanical insecticide and bio-agents by scientist of ICAR-NRCSS, Ajmer. Monitoring of Fenugreek varieties AFG-2, AFG-4, AFG-5 and Nigella AN-1 FLDs were



also carried out at farmer's field and suggested to keep FLDs weed free and pest free. A total of 50 SC female farmers were participated in this event and got benefitted. This programme was coordinated and organized by Dr. Shiv Lal, Dr. M.D. Meena, Dr. C.K. Jangid.

## TSP

### Farmers training

A farmer training under TSP was organized at Kolyari, Udaipur on 25 January, 2022. In this programme fifty farmers belonged to Scheduled Tribe (ST) community were benefited. During the programme certain lectures were provided to the farmers. Various issues raised and healthy discussion was made among farmers, state government staff & ICAR-NRCSS scientists. The farmers were also briefed on the subject regarding package of practices of seed spices cultivation and use of vermin pit. The participants were distributed knapsack sprayer and registration kit etc. This training was conducted by Dr. R.D. Meena, and Dr. Narendra Choudhary with help of local authorities.



## HRD activities

**Winter School on “Crop diversification with low volume high value seed spices and horticultural crops for doubling farmer’s income” organized at ICAR-NRC on Seed Spices, Tabiji, Ajmer (Rajasthan) from 11-31 January, 2022**

A 21 days winter school on “Crop diversification with low volume high value seed spices and horticultural crops for doubling farmer’s income” organized at ICAR-NRCSS, Ajmer from 11 to 31 January 2022. The proposal was submitted in March 2021 and approved by the Agricultural Education Division, ICAR, HRD, New Delhi in November 2021. Total 72 applicants approached through Capacity Building Programme portal to participate in the training and 25 were selected for the winter school programme. Out of 25 participants seven were female and eighteen were male. These participants were from different states of India viz; Rajasthan, Punjab, Bihar, MadhyaPradesh, Jammu & Kashmir, Gujarat, Karnataka, belonging to different disciplines (Agronomy, Plant Breeding, Horticulture, Soil Science, Pathology, Biotechnology, entomology etc). looking to the present pandemic situation of COVID-19 the winter school was organized in HYBRID



MODE after approval from the ADG, ICAR-HRD, New Delhi, where sixteen participants attended the winter school in offline mode and attended the classes physically and nine were present online from their respective places. Inauguration programme was organized on 11 January 2022 and total 51 lectures and



practicals were organized during 21 days programme.

Lectures and practicals were containing course on Horticulture crops scope, importance and challenges, crop diversification with horticultural and other crops, farming system, Multitier crops and cropping system quality planting material production. Molecular approaches, good agricultural practices. off-season cultivation, organic production, nano-formulations and micro-emulsions for enhancing potential of biopesticides, Importance of post harvest management and value addition, role of honeybee, nursery raising, precision farming, protected cultivation and mechanization, codex alimentarius on export and import, plant growth promoting rhizobacteria, Integrated pest and disease management etc. Three field cum exposure visits were organized to NRCSS farm, Saradhna and nearby field, Pushkar and nearby villages & field, rose and gooseberries processing units at Pushkar.

## Events/Days/Programmes etc.

### Azadi Ka Amrit Mahostav

Under the main theme “Azadi ka Amrit Mahotsav’ 3 webinars/event have been organized during the Jan-Feb. month by ICAR -NRCSS under these events first lecture was delivered by Dr. C.K. Jangid, Scientist – Soil science, ICAR-NRCSS, Ajmer on ‘organic farming with reference of natural farming for horticultural crops’ and second lecture was delivered by Dr Vasundhara Sharma, Scientist, Plant Physiology, ICAR-NRCSS, Ajmer on “Role of plant growth regulators for enhancing abiotic stress tolerance and essential oil content in seed spices”. National Girl child day (राष्ट्रीय बालिका दिवस) programme was also organized in AKAM and all staff members attended the same.

### 22<sup>nd</sup> Institute Foundation day

ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan has completed 21 years since its foundation 2000. A celebratory event was organized via virtual mode to mark the foundation of the institute, which started by playing ICAR song. Chief Guest, Dr.Anand Kumar Singh, DDG (Horti. Sci.), ICAR- New Delhi, Special guests Dr.Vikramaditya Pandey, ADG (Horti. Sci.-I), ICAR, New Delhi, Sh. Sandeep P. Ubale, (CGM, Digital transformation & e-commerce, SBI) and Sh. Rajesh Kumar Mishra (CGM, SBI

Jaipur circle) shared the podium by way of virtual mode. The special guests also included Dr. S.N Saxena, Director, ICAR-NRCSS, Ajmer. Dr. S.N Saxena welcomed the chief guest and special guests and all the distinguished guests from different ICAR and SBI fraternities along with the ICAR NRCSS staff members who joined the programme. The welcome address was followed by launching of integration of the ICAR-NRCSS seed portal with of SBI YONO application which was completed by Dr. Anand Kumar Singh. Later Sh. Sandeep P. Ubale conveyed congratulations for the integration of the ICAR-NRCSS seed portal with of SBI YONO application and opined that integration of NRCSS seed portal will help farmers to reach the technology to the field level. Sh. Rajesh Kumar Mishra highlighted major schemes which support agriculture and the farmer's viz., YONO Krishi available for the farmer's empowerment and which covers all the farming activities.

Later Dr. Vikramaditya Pandey started off by wishing ICAR-NRCSS, a very happy 22<sup>nd</sup> birthday. He emphasised that ICAR-NRCSS, Ajmer is the second institute in the ICAR domain to launch a seed portal followed by ICAR-IIHR Bengaluru. Further, he elucidates the importance of seed spices coupled with improved technologies in the Horticulture sector to double the farmer's income.

Further Dr. Anand Kumar Singh delivered the chief guest speech by greeting New Year, 2022 wishes to all the participants and he acknowledged the senior colleagues who thought of the inception of ICAR NRCSS. He laid emphasis on the importance and export contribution of seed spice crops in the country's economic growth and the contribution of Horticulture to the GDP of the nation. He then talked about the importance of Agriculture and how it helps to gain more income through technological interventions. He also suggested that the emphasis should be given to the identification and commercialization of new compounds in seed spices with respect to quality. The focus should be given to the year-round production of seed spices alongside the expansion of cultivation of seed spices under greenhouse conditions and vertical farming practices. Further, he addressed that scientists need to focus on science-based technologies and the incorporation of ICT tools to perceive seamless transformation in agriculture.

His speech was supplemented by Dr. S.N Saxena. He opened his speech with the remarkable contribution made by ICAR-NRCSS in the field of varieties and modern technologies developed and transferred to the field in the seed spices sector. Further, he released the following books and technological bulletins written at NRCSS.



2. Innovative technologies in seed spices for commercialization published under ITMU of ICAR NRCSS Ajmer.
3. FSSAI licence granted for 14 seed spices and spice based value-added products as a general manufacturer for 2021 to 2026 On the occasion of foundation day appreciation certificates were awarded to the different officials of ICAR-NRCSS members who significantly contribute in their respective fields to the progress of the institution in the preceding year.

On the occasion of foundation day appreciation certificates were awarded to the following group of ICAR-NRCSS members who significantly contribute in their respective fields to the progress of the institution in the preceding year.

1. Success stories: Impact of technological interventions through integrated farming system approach in tribal districts of Rajasthan authored by N.K.Meena, R.S. Meena, S.N. Saxena, G Lal, S. Lal, M.D. Meena, Narendra Choudhray and R.D.Meena.

1. Dr. R.S. Meena, Principal Scientist, Plant breeding
2. Dr. Shiv Lal, Senior Scientist, Postharvest technology
3. Dr. R.D. Meena, Scientist, Plant pathology
4. Dr. M.D. Meena, Scientist, Agricultural Economics
5. Mr. S.R. Meena, ACTO
6. Mr. S.R. Balai, technical Assistant
7. Mr. Sanjeev Sharma, Assistant
8. Mr. Pradeep Kulhari, Assistant

## 73rd Republic day was celebrated

ICAR-NRCSS, Ajmer celebrated its 73<sup>rd</sup> Republic Day on 26 January to mark the day India became a sovereign republic. The national flag was unfurled by Padma Bhushan Dr R.S. Paroda, Chairman, Trust for Advancement of Agricultural Sciences (TAAS), Former Secretary, DARE and Director General, ICAR. On his republic day address Dr. Paroda reminded the staff about the upholding spirit and values of the constitution of India. He urged the scientists and other staff to work seriously on developing technological solutions for addressing seed

spices R&D related issues in the context of climate change and emphasized the need for contributing to societal well being through individual and collective efforts. Dr. Saxena elaborated upon the importance of 26<sup>th</sup> January since our freedom struggle days and progress made by country in horticulture sector in general and seed spices sector in particular. All the staff of ICAR-NRCSS, Ajmer participated in the function. The Director thanked all the staff for their wholehearted support for the growth of the institute.



## Training/Workshop/Seminar/Virtual Meet/Webinar etc.) attended

S. No.	Name of Programme (Training/workshop/seminar etc.) attended	Organized By (Name of Institute)	Date of Programme	Participant (Name)
1	Stall of ICAR-NRCSS in 'Farmers Fair' to showcase institute technologies to the farmers	ICAR-CSWRI Avikanagar, Rajasthan	04.01. 2022	Dr S.N. Saxena & Dr M.D. Meena
2	Online training program on "Analysis of experimental data"	ICAR-NAARM, Hyderabad	17-22 January, 2022	Dr Chetan K. Jangir

## Publications

### Research Paper

Meena, N. K., Verma, A.K., Ravi, Y., Ram, N. and Meena, B.M. 2021. Efficacy evaluation of different dosages of imidacloprid 600 FS (Gaucho) against aphid in cumin (*Cuminum cyminum* L.) under field conditions. *The Pharma Innovation Journal*, 10 (12): 2474-2478.

Kumar, S., Kumar, S., Kumar, S, Kumar, K., Kumar, M., **Kumar**, C., Jat, R.D., Ahmed G., Ahmed A. A. and Hossain, A. 2022. Integrated nutrient management improves the productivity and nutrient use efficiency of *Lens culinaris* Medik, *Sustainability* (MDPI), 14, 1284.

Devi, D., Gupta, S.B. Mishra, B.K. and Verma, N.P. 2022. Isolation and identification of zinc solubilizing fungal isolates from cumin of semi-arid region of Rajasthan. *Pharma Innovation*, 11(2):1036-1040.

Devi, D., Gupta, S.B., Mishra, B.K., Uma and Sheshma, M.K. 2022. Isolation and characterization of endophytic-rhizospheric phosphate solubilizing bacteria of cumin and their evaluation in vitro. *Pharma Innovation*, 11(2):1608-1617.

Chaudhari, H.A., Antala, V.G., Radadiya, N.G., Mahatma, M.K. and Tomar, R.S. 2022 Selection of suitable reference gene for gene expression studies during groundnut seed germination. *Research Journal of Biotechnology* 17:64-71.

Jacob, F., Mahatma, M., Deshmukh, Y., Kandoliya, U.K., Maraviya, G.V., Joshi, M., and Vala, A. 2022. Altered expression levels of transcripts of GNAC TFs during drought stress in susceptible and tolerant cultivars of groundnut. *Plant Stress* 3: 100062.

### Book chapter

Radhakrishnan, T., Rathnakumar, A.L., Mahatma, M.K., Chandramohan, S., Patel, S. 2022. Genetic Resources of Groundnut. In: Cash Crops, Priyadarshan P., Jain S.M. (eds). Springer, Cham. [https://doi.org/10.1007/978-3-030-74926-2\\_10](https://doi.org/10.1007/978-3-030-74926-2_10).

Singh, A.L., Singh, S., Kurella, A., Verma, A., Mahatma, M.K. and Venkatesh, I. 2022. Plant bio-stimulants, their functions and use in enhancing stress tolerance in oilseeds. In: New and Future Developments in Microbial Biotechnology and Bioengineering Sustainable Agriculture: Revitalization Through Organic Products, Singh HB and Vaishnav A(eds). Elsevier, (ISBN: 978-0-323-85579-2)pp 264-284

### **Book**

Meena, N.K., Meena, R.S., Saxena, S.N., Lal, G., Lal, S., Meena, M.D., Chaudhary, N. and Meena, R.D. 2022. Success stories: impact of technological interventions through integrated farming system approaches in tribal districts of Rajasthan. Published by ICAR-NRCSS, Ajmer, ISBN: 978-93-84189-945

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