



## RESEARCH HIGHLIGHTS

### Research Network:

The Directorate of Research with its headquarter at Kumarganj (Faizabad) governs the research activities in 26 districts belonging to seven revenue divisions viz. Faizabad, Basti, Devipatan, Gorakhpur, Varanasi, Azamgarh and Vindhyachal Dham of eastern U.P. under three agro-climatic zones i.e., North Eastern Plain Zone (NEPZ), Eastern Plain Zone (EPZ) and Vindhyan Zone (VZ). The university has seven research stations in different agro-climatic zones as given below:-

### Eastern Plain Zone:

1. **Main Campus, Kumarganj (Faizabad)-** Centre is established for basic and applied research through different colleges in various disciplines of Agriculture, Horticulture and Forestry, Veterinary Science and Animal Husbandry, Fisheries, Agril. Eng. & Tech. and Biotechnology.
2. **Crop Research Station (CRS), Masodha (Faizabad)-** Crop Research Station is an established research station and is well known for development of rice varieties suitable for this agro-climatic condition. The centre has developed **30 rice varieties** covering all the ecosystems viz, upland, lowland, irrigated & inland salinity and hybrid rice. At present, 07 research projects financed by different state, national & international agencies are running at this centre.
3. **Zonal Agricultural Research Sub-Station (ZARSS) Baribagh & Ankushpur Ghazipur-** Centre is established for research on crops and seed production. Research activities are site specific and is being carried out based on the problems of farmers pertaining to the jurisdiction of the centre.

### North Eastern Plain Zone:

4. **Crop Research Station (CRS) Bahraich-** Crop Research Station (CRS) Bahraich is an established Jute Research Station. At present 05 research projects financed by State Govt. and national agencies are running at the centre. The centre has developed **05 varieties of Jute and 03 varieties of Maize**.
5. **Crop Research Station (CRS) Ghaghraghat (Bahraich)-** The Crop Research Station, Ghaghraghat formerly known as Agriculture Flood Research Station, is only deep water research station in the state. At present 05 Research Projects Financed by State Govt. & ICAR are running at the centre. The centre has developed **05 rice varieties in which 03 have been released by SVRC**.
6. **Zonal Agril. Research Station (ZARS) Basuli (Mahrajganj) –** Centre is established for crop research and seed production. Research activities are site specific and is being carried out based on the problems of farmers pertaining to the jurisdiction of the centre.

### Vindhyan Zone:

7. **Zonal Agricultural Research Station (ZARS) Tissuhi, (Mirzapur)-** Centre is established for research on pulse and oil seed crops as well seed production.

### Research Projects:

Research Projects based on the locational specific problems to increase the productivity and farmers needs, 53 research projects/schemes, financed by various national and international agencies are in operation in the university at present.



## IRRI-NDUAT Partnership:

Under IRRI-NDUAT collaborative project entitled “Stress Tolerant Rice for Poor Farmers of Africa and South Asia”, submergence tolerant gene has been transferred in mega rice varieties through Marker Assisted Backcross Breeding (MABC). As a result 03 varieties namely **Swarna Sub-1**, **Sambha Sub-1** and **IR-64 Sub-1** have been developed. Likewise, drought and salt tolerant genes are also being transferred in mega rice varieties and research work is in progress.

## Varietal Improvement:

The major research thrust in crop production has been to develop high yielding varieties of all important crops resistant to biotic and abiotic stresses. As a result, the university has so far developed 180 improved varieties of various crops out of which 150 varieties have been released at central/state level by central/ state Varietal Release Committee (CVRC/ SVRC) and the rest have been identified for release. The list of crop varieties developed by University is given in Table-1.

## Registration of Varieties:

Wheat varieties NW-1012, NW-1014, NW-1067, NW-2036 & NW-5054, Lentil variety Narednra Masoor-1, Pigeonpea variety Narendra Arhar-2 and Rice variety NDR-8002 were registered by Protection of Plant Varieties & Farmers' Right Authority.

## Technological Achievements:

Location specific technologies regarding agronomic practices, fertilizer management, dry land agriculture, farming system, crop protection, vegetable production, horticultural crops, agro-forestry, aromatic & medicinal plants, mushroom production, apiculture, agro-meteorology, agricultural engineering and animal husbandry have been developed and popularized among the farmers. The details of technologies generated by NDUAT are as follows:

## Rice Improvement:

- Rice varieties NDR 2101 and Narendra Sona were notified by CVRC, New Delhi vide gazette notification no. S.O. 268 (E) dated 28.01.2015 for commercial cultivation in Uttar Pradesh.
- Rice varieties Narendra Lahar and Narendra Parag were released by SVRC, U.P. and notification proposal is under process.
- Pendimethalin (30EC)@1.00 kg a.i./ha(3-4 DAS) + Bispribac- sodium (10%SC)@35 g.a.i./ha at 15-20 days after sowing was recommended for weed control in aerobic rice.
- Botanicals Neemzal @ 1000 ml/ha and Neemarin @ 1000 ml/ha were found effective against leaf folder and stem borer of rice.

## Crop Varieties Developed by NDUAT

Crop	Name of varieties released/Identified	Total
Rice	Sarjoo-52, Narendra-1, Narendra-2, Narendra-80, Narendra-118, Narendra-97, Narendra-359, Jal Lahari, Jal Priya, Jal Nidhi, Barh Avrodhi, Narendra Usar Dhan-2, Narendra Usar Dhan-3, Narendra Sankar Dhan-2, Barani Deep, Narendra Sankar Usar Dhan-3, Narendra Dhan-8002, Narendra Dhan -2026 (Richa), Narendra Shushka Samrat (NDR -1045-2), Narendra Lalmati, NDR -2064, Narendra Narayani, Narandra Mayank, Narendra Jalpusp, Swarna Sub -1, Narendra Dhan - 3112-1, Narendra Usar Dhan 2008, NDR - 9930111, NDR- 9930077*, NDR – 9930017*, NDR&2065] NDR &6093, Narendra Usar Dhan 2009, NDGR-201, NDR-1055-6*, NDR-2101, NDR-370133, NDR-370134*, NDR-6244, NDR-4058-7*, Sambha Sub-1, NDR- 370135, NDR- 6330, IR-64 Sub-1	44



Maize	Shaktiman-1, UMH-8, UMC-10	3
Wheat	Narendra Wheat-1012, Narendra Wheat -1014, Narendra Wheat -1076, Narendra Wheat -2036, Narendra Wheat-1067, Narendra Wheat- 4018, NW-5054	7
Barley	Narendra Barley-1, Narendra Barley-2, Narendra Barley-3, Narendra Barley-4, Narendra Barley-1173, NDB-943, NDB-1445, NDB-1465, NDB-1464*	9
Mung	Narendra Mung-1, Narendra Mung-2*	2
Urd	Narendra Urd-1, Narendra Urd-2*	2
Pigeon Pea	Narendra Arhar-1, Narendra Arhar-2, Narendra Arhar-3*	3
Lentil	Narendra Masoor-1, Narendra Masoor-2*	2
Mustard	Narendra Rai-1, Narendra Sarson-2, Narendra Ageti Rai -4, Narendra Rai -8 (NDYR-8), NDYS-2018 (Jagrati), NDRE-07	6
Linseed	NDL- 2004-05, NDL-2002, Narendra Alsi-5*, Narendra Alsi-4	4
Cauliflower	Narendra Gobhi-1	1
Brinjal	Narendra Brinjal-1, Narendra Hybrid Brinjal-1, Narendra Hybrid Brinjal-2, Narendra Hybrid Brinjal-3, Narendra Brinjal-2, Narendra Brinjal-3	6
Tomato	Narendra Tomato-1, Narendra Tomato-2, Narendra Tomato-5, Narendra Tomato-6, Narendra Tomato-3, Narendra Tomato-4, Narendra Tomato-7, Narendra Tomato-8	8
Vegetable Pea	Narendra Sabji Matar-1, Narendra Sabji Matar-2, Narendra Sabji Matar-3, Narendra Sabji Matar-4, Narendra Sabji Matar-5, Narendra Sabji Matar-6	6
Muskmelon	Narendra Kharbuja-1, Narendra Kharbuja-2	2
Colocasia	Narendra Arvi-1, Narendra Arvi-2, PKS-1*	3
Pointed gourd	Narendra Parwal-260, Narendra Parwal-307, Narendra Parwal-604	3
Banda	Narendra Banda-1, Narendra Banda-3*	2
Pumpkin	Narendra Agrim, Narendra Amrit, Narendra Abhooshan (NPH -1), Narendra Upcar	4
Bottle gourd	Narendra Sankar Lauki-4, Narendra Rashmi, Narendra Shishir, Narendra Dharidar, NDBG-104, NDBG-132*, Narendra Madhuri, Narendra Shivani, NDBG-619, NDBG-10	10



Okra	NDO-10*	1
Bittergourd	Narendra Barahmasi-1, Narendra Barahmasi-2*	2
Cowpea	Narendra Lobia-1, Narendra Lobia-2	2
Sweet Potato	Narendra Shakarkand-9, NDSP-10*	2
Elephant Foot	Narendra Zimikand-5, Narendra Zimikand-9	2
Turmeric	Narendra Turmeric-1, Narendra Turmeric-2, Narendra Turmeric-3, NDH-98*, NDH-8	5
Coriander	Narendra Corinader-1, Narendra Corinader-2*	2
Fenugreek	Narendra Methi-1, Narendra Methi-2*	2
Sauf	Narendra Sauf-1	1
Aonla	Narendra Aonla -4, Narendra Aonla -5, Narendra Aonla -6, Narendra Aonla -7, Narendra Aonla-10, Narendra Aonla-20	6
Bael	Narendra Bael -4, Narendra Bael -5, Narendra Bael -7, Narendra Bael-9, Narendra Bael -17*, Narendra Bael-16	6
Ber	Narendra Ber Selection-1, Narendra Ber Selection-2	2
Opium Poppy	Narendra Posta-1 (Kirtiman)	1
Mandookparni	Vallabh Medha	1
Babchi	IC-111226*	1
Lemongrass	NLG-84*	1
Jute	Reshma, NDC-9102, NDC-2008, NDC-2028, NDJC-2011, NDJC-2013	6
Crotolaria	Narendra Sanai-1	1
Bajra (Forage)	NDFB-2, NDFB-3, NDFB-5, NDFB-11	4
Oat	NDO-1, NDO-2, NDO-10, NDO-711, NDO-1101	5
<b>Total</b>		<b>180</b>

\* Varieties identified in National Workshops/Group Meetings of AICRP's.





## Wheat and Barley Improvement:

### Wheat :

- NW 5054 released by CVRC for irrigated, timely sown condition and found resistant to brown rust.
- NW 5013 identified and release proposal have been submitted to SVRC for rainfed condition.
- NW 6078, NW 6082 and NW 6093 were resistant to stem rust and leaf rust at national level.
- NW 6088 showed resistant to leaf rust at national level.
- NW 6078 contains the protein 12.2%.

### Barley :

- NDB 1465 released for saline sodic soil of UP by SVRC.
- NDB 1554 and NDB 1577 identified by Research Advisory Committee U.P for timely sown irrigated condition.
- At national level NDB 1445 was found resistant to black & brown rust.

## Pulses :

### Urdbean & Mungbean :

In integrated weed management post and pre emergence herbicides, recorded significantly higher grain yield 1062 kg/ha due to application of Pendimetheline 30 EC + Imazethapyr 2 EC @ 0.75 kg/ha PE, followed by application of Pendimetheline 30 EC + Imazethapyr 2 EC @ 1.0 kg/ha PE (1037 kg/ha).

In evaluation of bio-inoculants against the insect pests of Mungbean, spray of Thiamethoxan @ 0.3 g/lit was most effective in reducing white fly infestation which is at par with spray of Clothionidin @ 0.1 g/lit.

### Fieldpea & Lentil :

Imazethapyr @ 37.5 g/ha or Quizalofop ethyl

@ 50 g/ha applied at 30-40 DAS managed the weeds across the zone.

Foliar spray of 2% urea/DAP at flowering and 10 days thereafter in rainfed crop, more than 20% yield increase has been observed at farmer's field in lentil.

## Irrigation Water Management :

- Improved water management practice in rice : 7cm water 1-3 days after disappearance of ponded water applied in check basins of 10x10m in canal command.
- Improved water management practice in wheat : 6cm water, at CRI, late jointing and milking stages in check basin of 10x5m in canal command.
- Pigeon pea grown on raised bed in paired rows at 50cm spacing intercropped either with 5 rows of short duration rice (NDR -97) in sunken beds or 3 rows of urd (blackgram) on raised beds at tail end of canal command.
- Multiple use of water through integrated farming system with pisciculture and duckery at head of the canal command.

## Dry land Management:

- Ridge-furrow system in pigeonpea + rice (1:2) intercropping is most suitable for Eastern Uttar Pradesh.
- Bund height 15 cm & date of sowing 1<sup>st</sup> week of July is suitable for enter plot rain water harvesting in rain fed rice.
- Sowing on ridges for in situ moisture conservation for higher productivity of maize under rainfed condition of eastern U.P.
- Deep tillage up to 35 cm with tractor drawn subsoiler at 2 m interval with cross pass once in three years for rain fed rice.

## Integrated Farming System:

- Inclusion of vegetable in cropping system



proved to be more remunerative, and energy efficient as compared to pulse, oilseed and cereal based crop component in rice-wheat cropping system. Further, system productivity (kg/day), apparent nutrient use productivity (kg/ha/kg) and system profitability (Rs/ha/day) were more where vegetable/pulse crop dominated the cropping system. Ex- Rice - potato- green gram, rice – cauliflower-cowpea.

- Inclusion of pulses in rice-wheat cropping system either with vegetables, fodder or cereals proved to be economical as compared to cereal crop component in rice-wheat cropping system and helped in improving organic carbon of the soil.
- From 1ha model of Integrated Farming System (crop + dairy + vermi-compost + fisheries and horticulture enterprises) a net return of Rs.228304=00 can be achieved by the incurred cost of Rs.196093=00 per annum.

### Weed Management:

- Experiment conducted on weed management under rice-wheat system in conservation agriculture experiment, the highest grain yield of wheat was obtained under TPR (CT)- wheat (CT). However, in rice maximum grain and straw yield recorded in CT-ZT-ZT treatment.
- Various conservation systems influenced microbial properties significantly at both the stages. Among various conservation systems maximum microbial properties were observed under ZT+R, ZT+R and ZT treatment. However, among weed management practices, maximum microbial properties were recorded under integrated weed management treatment during both season.

### Vegetable Production:

- Potato-Onion-Maize cropping system has been recommended for getting better return to the farmers of eastern U.P.
- For management of late blight of potato 1

prophylactic spray of Mancozeb @ 2.5 g/l followed by IInd spray with the mixture of Fenmidon + Mancozeb 3% (2g/l) and one more spray with Mancozeb @ 2.5 g/l.

- For management of black scurf of potato, tuber should be treated with *Trichoderma viride* @ 8 g/kg tuber.
- In rice-potato-wheat crop rotation Kufri Ashoka variety of potato was found most suitable in comparison to other varieties due to its early maturity. It could be harvested after 70-80 days of planting.

### Fruit Production:

- Narendra Ber Selection-1 and 2 continuously gave excellent performance with respect to yield, size and quality of fruits.
- Foliar application of 2% urea along with 250 ppm Ethrel one month after fruit setting was found most effective to induce early ripening, higher yield and better quality of guava fruits.
- A suitable technique for integrated management of mango malformation, caused by *Fusarium monoliformis*, has been developed by the university.
- 50% pruning of 1 year old in determinants shoot gave maximum fruit yield and better quality fruit.
- Application of 0.5% Zinc Sulphate + 0.1% Thio urea followed by 0.5% Borax + 0.1% Thio improved plant growth, fruit set, yield and quality attributes.

### Medicinal and Aromatic Plants:

- **Kalmegh** : The best planting and harvesting time is First week of July and second week of November respectively, for maximum herbage yield. The optimum spacing 40x20 cm The application of NPK @ 40:20:20 kg per ha along with 7.5 tons F.Y.M. was found best.
- **Asparagus** : The last week of July was observed the best planting time of sataver. The



optimum spacing is 1X1 m. The harvesting of sataver after 18-21 months resulted the maximum root yield.

### Apiculture:

- Apiculture with *Apis mellifera* in arhar, mustard and sunflower crops produced 50-70 kg honey/ha. It also helped to increase the yield of these crops by about 40-50%.

### Agro-meteorology:

- Agro-advisory bulletins are prepared and distributed among the farmers. Short term weather forecasting is also being done which helps the farmers in planning the farm operations for obtaining higher production in adverse weather conditions.
- Rice transplanted on 5<sup>th</sup> July recorded higher days to different phenophases followed by transplanting on 20<sup>th</sup> July. Transplanting on 4<sup>th</sup> August, however reduced the crop duration by 8 days over 5<sup>th</sup> July and 5 days over 20<sup>th</sup> July. Among the varieties, Swarna took relatively longer duration and ultimately matured 20 days delayed over NDR 359.

### Agro-forestry:

- There was a concentrated leaf litter fall in *Populus deltoids* based system during October-January. During this period, leaf litter accounted for about 88.9% of the total annual

leaf fall ( $516 \text{ g m}^{-2} \text{ yr}^{-1}$ ). After decomposition, litter had 64.8% dry weight loss over annual cycle. Carbon dioxide evolution (root+soil+litter) from this system amounted to about  $284 \text{ g. m}^{-2} \text{ Yr}^{-1}$ .

- Yield potential of paddy and mustard varieties under *C. equisetifolia* and *D. sissoo* based agri-silvi system, the higher paddy grain yield has been obtained in variety Sarjoo-52 ( $1.83 \text{ \& } 1.73 \text{ t ha}^{-1}$ ) as compared to other varieties under *C. equisetifolia* and *D. sissoo*, respectively. The higher mustard grain yield ( $1.24 \text{ \& } 1.41 \text{ t ha}^{-1}$ ) was obtained in variety NDR-8501 under *C. equisetifolia* and *D. sissoo*, respectively.
- The maximum Urd grain yield was achieved in variety Narendra Urd-1 than other varieties under *C. equisetifolia* and *D. sissoo* system.

### Animal Husbandry:

- Improved breed of buffalo, housing design and complete health package suited for eastern U.P. is being developed.
- Semen bank of improved breed/strains of various livestock species is being established.

### Miscellaneous :

The university is playing important role in Prime Minister's dream projects “Bringing Green Revolution in Eastern India” as well as Doubling Farmers Income by 2020.



Hon'ble Vice Chancellor visiting the field of Arid Zone Fruits crop



Dr. P.L. Saroj, Director, CIAH with Scientists of College of Horticulture