AICRP- SUGARCANE

Objectives

1. Development of high yielding, high sugar and disease resistant sugarcane varieties for Uttarakhand and neighboring states.
2. To develop agro-technology to enhance sugarcane productivity and quality in Uttarakhand state.
3. To develop approach for crop protection against major diseases.

A. Sugarcane Breeding

1. Significant Achievements:

Name of variety	Year of release	Region for which recommended	Maturity	Cane Yield (t/ha)	Sucrose (%)	Red Rot Reaction
CoPant-84211	1991 CVRC	North west plain zone	Early	650-750	16.0-19.5	Moderately resistant to red rot
CoPant -84212	1999 SVRC	Uttrakhand & U.P.	Mid-late	750-800	17.0-19.0	Moderately resistant to red rot
CoPant -90223	2000 SVRC 2001 CVRC	Uttrakhand & U.P.	Mid-late	750-850	17.0-19.0	Moderately resistant to red rot, Tolerance to water logging
CoPant -94211	2004 SVRC	Uttrakhand & U.P.	Early	650-750	17.0-19.0	Moderately resistant to red rot
CoPant -96219	2004 SVRC	Uttrakhand & U.P.	Mid-late	750-800	16.0-19.0	Moderately resistant to red rot
CoPant -97222	2005 SVRC 2006 CVRC	Uttrakhand & U.P.North west plain zone	Mid-late	800-850	17.0-19.0	Moderately resistant to red rot
CoPant -99214	2007 SVRC	Uttrakhand & U.P.	Mid-late	800-850	17.0-19.0	Moderately resistant to red rot
CoPant -03220	2011 SVRC	Uttrakhand & U.P.	Early	800-950	16.5-18.5	Moderately resistant to red rot
CoPant -05224	2012 SVRC	Uttrakhand & U.P.	Mid-late	800-850	16.5-18.5	Moderately resistant to red rot

1. A total of 09 varieties of sugarcane developed and released for cultivation, which includes 03 early and 06 mid-late maturing varieties. CoPant 84211 (1991), CoPant 90223 (2001), CoPant 97222 (2006) were released by CVRC for cultivation in North west zone, while CoPant 84212 (1999), CoPant 94211 and CoPant 96219 (2004), CoPant 99214 (2007), CoPant 3220 (2011) and CoPant 05224 (2012) were release by SVRC for the

state of Uttarakhand and Uttar Pradesh.

2. **Trials indented & conducted:** Pantnagar centre is mainly conducting trials under irrigated ecosystem that comprises the trials on early and mid-late maturing sugarcane varieties. Every year around 08 trials are being conducted to represent the Northern plain zone of the country. Besides 04 station trials (two each in early and mid-late group) were also conducted every year. Based on yield, resistance/tolerance to red-rot and smut, maturity duration and over all phenotypic acceptability under respective situations, promising clones were identified.

3. **Entries nominated in trials**: Pantnagar centre had nominating 2-4 entries of sugarcane clones every year in AICRIP for zonal testing and based on the performance these entries were being advanced in zonal testing. Since 1970-71 approximately more than 200 entries were nominated for different trials under irrigated ecosystem of north west zone.

4. **Breeding material generated:** In order to generate breeding material, Scientists were visiting SBI Coimbatore every year and executing 20-25 crosses through hybridization of desirable donars for yield, sucrose and biotic stress tolerance. On an average 20-25 thousands seedlings were raised every year and evaluated for morphological traits. About 500 best clones were being evaluated in clonal generation first and finally 20-25 superior clones were evaluated in station trialsand 2-4 nominations were proposed every year in AICRP sugarcane zonal trials.

5. **Nucleus & breeder seed production:** The centrehas produced sufficient quantity of nucleus seed of different varieties to supply to Breeder Seed Production Centreto produced sufficent breeder seed for supply to farmers of the state. All the 09 varieties developed from Pantnagar and some of the promising varieties of the zone are being maintained at the centre and nucleus seeds produced to meet the requirement of breeder seeds production in every year. Around 8-10 thousand quintals of breeder seed was being produced every year for supply to farmers.

Impact:

1. Sugarcane varieties developed under this Project since 1970-71 for all the 5 sugarcane growing zones in the country brought about 2.7 times increase in sugarcane production and added significantly to the National Exchequer.

2. The data from the office of Cane Commissioner Government of Uttarakhand clearly indicated that there has been an

increase of area brought under improved varieties developed under this project (upto 13.5 % of sugarcane area under pantnagar varieties).

2. Research Publications:

A. Research Papers:

1. Singh, S.P., Jeena, A.S., Tyagi, V.K and Khan, K.A. 2013. Co Pant 05224 – A superior alternative variety for sugarcane growers in Uttarakhand. Indian J. Sugarcane Technol., 28(01):16-18

2. Sharma, M.D., Dobhal, U., Singh, P., Kumar, S., Gaur, A.K., Singh, S.P., Jeena, A.S., Koshy, E.P. and Kumar, S. 2014. Assessment of genetic diversity among sugarcane cultivars using novel microsatellite markers. African J. Biotech., 13(13):1444-1451

3. Koujalagi, D., Jeena, A. S., Singh, S. P., Chourasia, K. N. and Khan, K. A. 2017. Hybridity tests to identify true hybrids in sugarcane. Journal of Hill Agriculture, 8(1): 10-16.

4. Kamat, D. N., Singh, S.P., Jeena, A.S., Khan, K.A., Kumar, A. and Kumar, V. 2015. Performance of early maturing sugarcane clones across the environments for cane and sugar yield. Frontiers in Crop Improvement, 3(2):131-136

5. Singh, R., Jeena, A. S., Singh S. P. and Khan, K. A. 2015. Genetic variability and heritability studies in early generation clones of sugarcane (Saccharum sp. Complex). Frontiers in Crop Improvement, 3(2):185-186

6. Bairwa, A. K., Ram, R., Neetu, Jeena, A. S., Singh, K. and Singh, S. P. 2017. Estimation of the extent of variability for different morphological and juice quality characters among early generation sugarcane clones. Int. J. Curr. Microbiol. App. Sci. 6(2): 1272-1278

7. Bisht, R., Jeena, A.S., Koujalagi, D., Singh, S.P. and Khan, K.A. 2017. Estimation of genetic diversity among sugarcane (Saccharum species complex) clones. J. Appl. Nat. Science 9(3):1469-1474

8. Negi, A.S., Singh, S.P., Jeena, A.S. and Talha, M. 2017. Estimation of variability parameters in early generation general collection progenies of sugarcane (Saccharum species complex). International J. Agriculture Innovations and Research 6(1):188-190

9. Bisht, R., Jeena, A.S., Meena, M. R., Koujalagi, D., Singh, S.P. and Khan, K.A. 2017. Genetic Diversity Assessment among the Early Generation Sugarcane (S. officinarum L.) Clones through Microsatellite Markers. Applied Biological Research 19 (3): 315-323

10. Negi, A.S., Singh, S.P., Jeena, A.S. and Khan, K.A. 2017. Estimation of genetic variability and heritability parameters in early generation clones of sugarcane (Saccharum species complex). Frontiers in Crop Improvement, 5(2):96-100

11. Pandey, D., Singh, S.P., Jeena, A.S., Khan, K.A. Tabassum, Negi, A.S., and Koujalagi, D., 2018. Study of genetic variability, heritability and genetic advance for various yield and quality traits in sugarcane genotypes (Saccharumofficinarum). Int. J. Curr. Microbio. Appl. Sci., 7(4):1464-1472

12. Koujalagi D., Jeena, A.S., Singh, S.P., Tabassum, A and Khan, K.A. 2018. Study of selection parameters for different drought tolerance imparting Physio-biochemical traits in sugarcane (Saccharum Sp. complex). Journal of Pharmacognosy and Phytochemistry, 7(5): 639-643

B. Abstract in symposium / seminars:

13. Singh, S.P. and Jeena, A.S. 2011. Co Pant 03220: Early maturing Sugarcane for higher production. In: National Symposium on "Technological Interventions for Sustainable Agriculture (TISA-2011)", May 3-5, 2011. College of Forestry & Hill Agriculture, GBPUA&T, Pantnagar. p 47

14. Belwal, V., Singh, S.P. and Jeena, A.S. 2012. Association of quantitative and quality characters of sugarcane under water logging conditions. In: National Seminar on "Food Security in India" Oct. 8-9, 2012. B.S.M.(P.G.) College, Roorkee, Uttarakhand p.55

15. Khan, K.A., Singh, S.P., Jeena, A.S. and Tyagi, V.K. 2012. Variability of yield components in relation to selection of desirable clones in sugarcane. In: Proceedings of the International Symposium on New Paradigms in Sugarcane Research, Oct. 15-18, 2012. Sugarcane Breeding Institute, Coimbatore. p 21.

16. Jeena, A. S., Singh, S. P., Khan, K. A. and Tyagi V. K. 2012. Genetic Diversity in Sugarcane Clones after Three Cycles of Clonal Selection In: Proceedings of the International Symposium on New Paradigms in Sugarcane Research, Oct. 15-18, 2012. Sugarcane Breeding Institute, Coimbatore. pp 27-28.

17. Singh, S.P., Jeena, A.S., Khan, K.A. and Tyagi, V.K. Genetic Diversity in Early Clonal Generation in Sugarcane In: Proceedings of the International Symposium on New Paradigms in Sugarcane Research, Oct. 15-18, 2012. Sugarcane Breeding Institute, Coimbatore. pp 30-31.

18. Belwal, V., Singh, S.P., Jeena, A.S., Khan, K.A. and Tyagi, V.K. Evaluation of Sugarcane genotypes for tolerance to water logging In: Proceedings of the International Symposium on New Paradigms in Sugarcane Research, Oct. 15-18, 2012. Sugarcane Breeding Institute, Coimbatore. p 140.

19. Singh, R., Jeena, A. S., Singh, S.P. and Panwar, R.K. 2014. Genetic variability and heritability studies in early generation clones of Sugarcane (Saccharum sp. Complex). In: National conference on emerging problems and recent advances in applied sciences: Basic to molecular approaches, Feb. 08-09, 2014. SSDAT and CCS University, Meerut p. 244.

20. Singh, Dheer, Singh, S. P. and Jeena, A.S. 2014. Possibilities exploration of sugarcane crop for the use of bioenergy in sub-tropical India. In: National symposium on Bio-energy for sustainable development-The potential role of Sugar crops. June 23-25, 2014. Sugarcane Breeding Institute, Coimbatore. p 72-73.

21. Jeena, A.S., Kamath, D.N., Singh, S. P. and Singh, Dheer. 2014. Sugarcane: Potential crop for sugar vis-à-vis energy security for future. In: National symposium on Bio-energy for sustainable development-The potential role of Sugar crops. June 23-25, 2014. Sugarcane Breeding Institute, Coimbatore. p 76-77.

22. Singh, R., Jeena, A. S., Singh, S. P. and Khan, K. A. 2014. Hybrid vigour in early generation clones of sugarcane (Saccharum species complex). In: National symposium on Bio-energy for sustainable development-The potential role of Sugar crops. June 23-25, 2014. Sugarcane Breeding Institute, Coimbatore. p 267-268.

23. Kumar, S. Singh, S. P., Jeena, A. S., and Kumar, Sundip. 2014. Study of genetic parameters for yield and quality traits in sugarcane (Saccharum species complex). In: National symposium on Bio-energy for sustainable development-The potential role of Sugar crops. June 23-25, 2014. Sugarcane Breeding Institute, Coimbatore. p 278.

24. Jeena, A.S., Kamath, D.N., Khan, K. A., Saini, Y.P. and Singh, S. P. 2014. Varietal status of sugarcane in Uttarakhand. In:National workshop on Retrospective and prospective analysis of Indian agriculture: the Roadmap ahead. Nov. 17-18, 2014. Directorate of Experiment Station, GBPUA&T, Pantnagar. p 220

25. Negi, A.S., Singh, S.P., Jeena, A.S., Pandey, D. and Khan, K.A. 2016. Hierarchical cluster analysis of early generation clones in

sugarcane. In: 10th Uttarakhand State Science and Technology Congress-2015-16. UCOST, Deherdun. p.6

26. Bisht, Rashmi, Jeena, A. S., Koujalagi, D. Singh, S. P. and Khan, K. A. 2016. Genetic diversity analysis in sugarcane (Saccharum species complex). In: International Conference & Exhibition on "Sugarcane value chain – Vision 2025 Sugar" at Vasantdada Sugar Institute, Pune. Nov. 13-16, 2016. p.134

27. Ram, R., Jeena, A.S., Singh, S.P., Bairwa, A.K., Khan, K. A. and Koujalagi, D.2016. Genetic Variability Study for Yield and Quality traits in Advanced Promising Clones of Sugarcane. In: National Conference on "Innovative and current advances in agriculture and allied sciences (ICAAAS-2016). Dec. 10-11, 2016 at Prof. JayashankarTelangana State Agricultural University, Hyderabad. p.100-101

28. Bairwa, A.K., Singh, S.P., Ram, R., Neetu, Jeena, A.S. and Khan, K. A. 2016. Estimation of genetic parameters for different morphological and juice quality characters among early generation sugarcane clones. In: National Conference on "Innovative and current advances in agriculture and allied sciences (ICAAAS-2016). Dec. 10-11, 2016 at Prof. JayashankarTelangana State Agricultural University, Hyderabad. Pp 125

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30. Ram, R., Jeena, A.S., Singh, S.P. and Khan, K. A. 2016. Studies on genetic parameters and interrelationship of yield and quality traits in sugarcane (Saccharum species complex). In: National Symposium on "Challenges, Opportunities and Innovative Approaches in Sugarcane: Agriculture, Bio-energy and Climate Change" Dec. 21–23, 2016, U.P. Council of Sugarcane Research, Shahjahanpur p.23-24

31. Bairwa, A.K., Singh, S.P., Jeena, A.S. and Khan, K. A. 2016. Studies on genetic parameters and divergence in sugarcane (Saccharum species complex) based on yield and quality traits. In: National Symposium on "Challenges, Opportunities and Innovative Approaches in Sugarcane: Agriculture, Bio-energy and Climate Change" Dec. 21–23, 2016, U.P. Council of Sugarcane Research, Shahjahanpur p.51-52

32. Bisht, Rashmi, Jeena, A. S., Koujalagi, D. Singh, S. P. and Khan, K. A. 2017. Genetic Diversity among the Early Generation Clones of Sugarcane revealed through Microsatellite (SSR) Markers. In: 11th Uttarakhand State Science and Technology Congress-2016-17. UCOST, Deherdun. pp.8

33. Negi, A.S., Singh, S.P., Jeena, A.S. and Khan, K.A. 2017. Estimation of genetic parameters in early generation clones of sugarcane. In: International symposium on Sugarcane research since Co 205: 100 years and beyond (SucroSym 2017), Sept. 18-21, 2017 Sugarcane Breeding Institute, Coimbatore. pp 144

34. Neetu, Jeena, A.S., Pant, Usha, Singh, S.P., Khan, K. A. and Koujalagi, D.2017. Genetic diversity among the early generation clones of sugarcane (Saccharum species complex) based on morphological characterization. In: International symposium on Sugarcane research since Co 205: 100 years and beyond (SucroSym 2017), Sept. 18-21, 2017 Sugarcane Breeding Institute, Coimbatore. p. 145-146

35. Bairwa, A.K., Singh, S.P. and Jeena, A.S. 2017. Estimation of Genetic Parameters in Early Generation Sugarcane Clones Based on Yield and Quality Traits. In: International

Symposium on Global Research Initiative for Sustainable Agriculture & Allied Science (GRISAAS 2017), Dec. 02-04, 2017 SSDAT Meerut and Rajasthan College of Agriculture, MaharanaPratap Univ. of Ag. & Tech., Udaipur (Rajsthan) p.

36. Neetu, Jeena, A.S., Bairwa, A.K., Koujalagi, D., Singh, S.P. and Khan, K. A. 2017. Genetic variability, heritability and genetic advance estimates for morphological and juice quality characters among early generation clones of sugarcane (Saccharum species complex). In: International Symposium on Global Research Initiative for Sustainable Agriculture & Allied Science (GRISAAS 2017), Dec. 02-04, 2017 SSDAT Meerut and Rajasthan College of Agriculture, MaharanaPratap Univ. of Ag. & Tech., Udaipur (Rajsthan) p.

37. Bairwa, A.K., Singh, S.P., Jeena, A.S. and Ram, R. 2018. Genetic Divergence analysis in Early Generation Sugarcane Clones. In: 12th Uttarakhand State Science and Technology Congress-2017-18. UCOST, Deherdun. pp.2

38. Ram, R., Jeena, A.S., Singh, S.P. and Bairwa, A.K. 2018. Correlation and Path analysis for yield and quality parameters in advanced promising clones of Sugarcane. In: 12th Uttarakhand State Science and Technology Congress-2017-18. UCOST, Deherdun. pp.46

39. Tabassum, Jeena, A. S. and Pandey, D. 2019. Phenotyping of the selected progeny clones of sugarcane from crosses involving resistant and susceptible parents against red rot using plug method of inoculation. In: 4th National Convention: Agrivision 2019. NAAS Complex, Delhi Jan 28-29, 2019 pp.142

40. Tabassum, Jeena, A. S. and Pandey, D. 2019. Problem of red rot disease in sugarcane, screening and identification of genotypes with resistance. In: 14th Agriculture Science Congress 2019 – Innovations for agricultural transformations. IARI, NewDelhi Feb 20-23, 2019 pp.470

41. Tabassum, Jeena, A.S. and Pandey, D. 2019. Field screenng of sugarcane clones against red rot for identification of resistant lines. In: PSRM 2019, UTU, Dehradun, Feb 16-17, 2019.

C. Invited lectures:

42. Singh, S.P. and Jeena, A. S. 2014. Complex crosses and handling of segregating material for cold, draught and excess water stress to tolerance in sugarcane. In: Winter School on "Changing climatic conditions: Issues and breeding strategies for abiotic stress tolerance in plants". February 11-March 3, 2014, Deptt. of Genetics and Plant Breeding, G.B. Pant University of Agriculture and Technology, Pantnagar

43. Jeena, A. S. 2014. Hybridization technique in sugar cane and handling of F1 and subsequent generations. In: Summer School on"New Paradigms in Heterosis Breeding: Conventional and Molecular Approaches" September 10 – 30, 2014. Deptt. of Genetics and Plant Breeding, G.B. Pant University of Agriculture and Technology, Pantnagar

D Articles / Extension Literature

44. thuk] vkuUn flag] frokjh] lh ,o ek;] jketh- 2014- xUukA iruxj fdlku Mk;jh 2014 i"B 22&24

45. thuk] vkuUn flag] frokjh] lh ,o ek;] jketh- 2016- xUukA iruxj fdlku Mk;jh 2016 i"B 23&25

3. Thesis Research:

1. Sangeeta Singh.2011. Studies on Genetic divergence in sugarcane (*Saccharum* spp. complex)submitted for Ph.D. to GBPUAT under supervision of Dr. S. P. Singh.

2. Sandeep Kumar. 2012.DUS characterization of Sugarcane clones, their evaluation and study of polymorphism for Sugar content

through SSR markersubmitted for Ph.D. to GBPUAT under supervision of Dr. S. P. Singh.

3. Dharm Nath Kamat. 2014.GXE interaction and Stability in sugarcane (*Saccharum* spp. complex) using AMMI Modelsubmitted for Ph.D. to GBPUAT under supervision of Dr. S. P. Singh.

4. Arvind Singh Negi. 2017.Screening for red rot and genetic diversity analysis among early generation clones of sugarcane (Saccharum Species Complexsubmitted for Ph.D. to GBPUAT under supervision of Dr. S. P. Singh.

5. Deepankar Pandey. 2018. Combining Ability for Yield and Quality Characters in Sugarcane (Sacchanum spp. Complex)submitted for Ph.D. to GBPUAT under supervision of Dr. S. P. Singh.

6. Deepak Koujalagi2018. Evaluation of drought tolerance potential in early generation progenies of sugarcane (*Saccharum* species complex)submitted for Ph.D. to GBPUAT under supervision of Dr. A S Jeena.

7. Vikas Belwal 2011.Association of Quantitative and Quality Characters of Sugarcane (*Saccharum* spp. complex) under water logging conditionssubmitted for M. Sc. Ag. to GBPUAT under supervision of Dr. S. P. Singh.

8. Vinod Kumar Joshi 2013.Studies on Association of Yield and Quality Characters in Sugarcane (*Saccharum* species complex)submitted for M. Sc. Ag. to GBPUAT under supervision of Dr. S. P. Singh.

9. Rajneesh Singh. 2013.Hybrid Vigour in Early Generation Clones of Sugarcane (*Saccharum* species complex)submitted for M. Sc. Ag. to GBPUAT under supervision of Dr. A S Jeena.

10. Rashmi Bisht. 2014.Genetic Diversity Analysis of Sugarcane (*Saccharum* species complex) clones based on morphological characterization and 'SSR' markerssubmitted for M. Sc. Ag. to GBPUAT under supervision of Dr. A S Jeena.

11. Rajeshwar Ram. 2016.Studies on association of yield and quality cgaracyers in asdvanced promising clones of sugarcane (*Saccharum* species complex)submitted for M. Sc. Ag. to GBPUAT under supervision of Dr. A S Jeena.

12. Neetu. 2017.Genetic diversity analysis of sugarcane (*Saccharum* species complex) clones based on morphological characterizationsubmitted for M. Sc. Ag. to GBPUAT under supervision of Dr. A S Jeena.

13. Anil Kumar Bairwa. 2016.Genetic variability and divergence analysis in early generation sugarcane (*Saccharum* species complex) clones based on morphological characterizationsubmitted for M. Sc. Ag. to GBPUAT under supervision of Dr. S. P. Singh.

14. Ninganagouda S H. 2017.Analysis of genetic parameters and diversity in sugarcane (saccharum species complex) clonessubmitted for M. Sc. Ag. to GBPUAT under supervision of Dr. S. P. Singh.

4. Future Thrusts:

1. Development of early maturing drought tolerant varieties.

2. Development of mid-late maturing drought tolerant varieties.

3. Integration of molecular markers in crop improvement to overcome bottleneck problems of conventional breeding.

4. Development of high biomass yielding medium duration varieties for energy cane production.

5. Development of low input and high nutrient use efficient varieties for doubling the farmer's income.

B. Sugarcane Agronomy:

1. Significant Achievements:

- About 20 recommendations of Crop Production and Crop Protection have been made. The notable recommendations are as follows:

1. Late planted sugarcane can be grown with 75% of recommended nitrogen to save input.
2. Application of subsoiler enhances cane yield.
3. Paired row planting was found superior than conventional and FIRB methods with respect to water productivity.
4. Winding weed could be managed with Metribuzin @1.25 kg ai/ha (PE) with a spray of Dicamba @350 g ai/ha at 75DAP.
5. Addition of 40 kg sulpher and 25 kg Zinc with recommended dose of fertilizer enhances sugarcane yield.
6. Highest cane yield in planted cane and ratoon can be achieved with the application of 20 ton FYM + inorganic nutrients applied on the soil test basis.
7. The germination percent can be hastend 20 days earlier by soaking cane setts in Ethephon @ 100 ppm overnight.
8. GA3 spraying @ 35 ppm on 90, 120 and 150 days after planting enhance the cane production.
9. Trench planted paired row (30 : 120 cm) with mulch increase NMC and cane yield over flat method of planting and no mulch.
10. In sugarcane-ratoon-wheat cropping system, highest cane yield and wheat yield was recorded with trash mulch alongwith trichoderma application

2. Research Publications:

Research Papers:

1. Kumar, Jitendra and Singh Dheer 2009 weed management in sugarcane ratoon crop. Proceedings of National Seminar on Sugarcane, held at G.B. Pant University of Ag. & Tech. Pantnagar Feb 14-15 2008:242-243.
2. Singh, Dheer.; Saini, S.K.; Singh Vand; Kumar Jitendra, 2012. Weed management studies in sugarcane ratoon crop. Biennial conference on "weed threat agriculture" biodiversity and environment April 19-20, 2012 at Kerala Agriculture University, Thrissur (Kerala), 108pp.
3. Singh,D; Saini, S.K.; and Singh, V.; 2012. Studies on control of *Ipomia* spp. In spring planted sugarcane Biennial conference of Indian Society of weed science on "weed threat to Agriculture, Biodiversity and environment" 19-20 April, 2012 Kerala agriculture, University. Thrissur, Kerala, 141 pp"
4. Singh, R; Kumar, Jitendra, Rampal and Singh, D. 2012. Ganne ki phaslon me kharpatwaron ka niyantran. Kheti (July 28-29).
5. Yadav, R. D.; Singh Dheer; Bhatnagar Amit, 2014 Effect of sett size, seed rate and seed treatment on yield attributes and productivity on spring sugarcane (*Saccharum officinarum* L.) in sub tropical india. Madras Agricultural journal (TNAU)
6. Yadav R. D., Singh Dheer, Bhatnagar Amit, 2014. Growth, sugar yield and profitability of spring sugarcane (*Saccharum officinarum* L.) as influenced by different setts size, seed rate and sett treatment. Madras Agricultural journal (TNAU). Vol. 100 No. 7-9 pp 726-729.
7. Singh, Dheer.; Dharmendra Kumar Mahur.; Vijendra Singh & R.D. Yadav 2014. Strategies to maximize the cane yield through proper weed management in sugarcane (*Saccharum officinerum* L.). Processing of Biennial conference of Indian Soc. Of weed science (15-17 feb. 2014) Page 240.
8. Kumar, Rajeev and Dheer Singh (2014). Effect of macro and micro nutrients on growth, yield

and juice quality of sugarcane (*Saccharum officinerum* L.) in national symposium on "ECM technology for safe, secure and profitable food, production" held at G.B.P.U.A & T. Pantnagar, Oct. 10-11 pp 150.

9. Singh Dheer, Vijendra Singh & R. D. Yadav (2014). Improved technique for augmenting productivity and sugar recovery of sugarcane in sugarcane-wheat cropping system. Paper presented in national symposium on "ECM technology for safe, secure and profitable food, production" held at G.B.P.U.A & T. Pantnagar, oct 10-11, pp 158.

10. Jeena A. S.; Kamath, D.N.; Singh S.P. and Singh Dheer (2014). Sugarcane potential crop for sugar vis-A-vis energy security for future symposium held at Coimbatore "Bio-energy for sustainable Development- The potential Role of sugar crop". June 23-25, 2014, S – 111-P5, Page 76-77.

11. Dheer Singh; Singh S.P. and Jeena A. S. (2014). Possibility Exploration of Sugarcane crop for the use of Bio-energy in sub-Tropical India symposium held at Coimbatore "Bioenergy for sustainable Development - The potential Role of sugar crop". June 23-25, 2014, Coimbatore S – 111-P3, Page 72-73.

12. Singh, D. (2014). Improved planting technique for high productivity in sugarcane-ratoon-wheat cropping system insub-tropics. NASA 2014, International Symposium on New Dimensions in Agrometerology for Sustanable Agriculture. Held at G.B.P.U.A.&T., Pantnagar, October 16-18. pp 220.

13. Kumar, R. and Singh 2014. Balanced use of macro and micro nutrients to improve the growth, cane yield and juice quality in spring planted sugarcane in sub-tropics. International Symposium on New Dimensions in Agrometerology for Sustanable Agriculture. Held at G.B.P.U.A. & T., Pantnagar, October 16-18. Pp120.

14. Singh , D. 2014. Integration of inorganic and organic sources of nutrients to augment the soil fertility and productivity in sugarcane. In : Proec. of 29th training cource on "Augmentation of soil and crop productivity through organics." Conducted by CAFT, Deptt. of Agronomy. Held at G.B.P.U.A.&T., Pantnagar, Sept 26 – Oct. 16, 2014 pp 79-83.

Technical Bulletin:

1. Singh, V.P.; Singh, R.; Singh, D.; Singh, T.P.; Guru, S.K.; Tondan, S. and Singh, S.P. 2012. Hovoc caused by *Parthenium hysterophorus* and its management (hindi) G.B.P.U.A. & T., Pantnagar

3. Thesis Research:

1. Nirdesh Kumar. 2012. Studies on planting geometry for mechanized inter-cultivation of sugarcane (*Saccharum officinarum* L.) submitted for M. Sc. Ag to GBPUAT under supervision of Dr. S. K. Saini.

2. Brijesh Kumar Yadav.2011. Irrigation scheduling in sugarcane (*Saccharum officinarum* L.) under different planting method. submitted for M. Sc. Ag to GBPUAT under supervision of Dr. S. K. Saini.

3. Dharmendra Kumar Mahur.2012. Weed management in spring planted sugarcane (*Saccharum officinarum* L.) submitted for M. Sc. Ag to GBPUAT under supervision of Dr. Dheer Singh.

4. Ram Das Yadav. 2012. Studies on seed cane economy in sugarcane (*Saccharum officinarum* L.) cultivation submitted for M. Sc. Ag to GBPUAT under supervision of Dr. Dheer Singh.

5. Rajeev Kumar. 2013. Nutrient management studies on productivity and profitability in spring planted sugarcane (*Saccharum officinarum* L.) submitted for Ph.D. to GBPUAT under supervision of Dr. Dheer Singh.

6. Jyoti Pawar. 2015. Integrated nutrient

management in sugarcane (*Saccharum officinarum* L.) submitted for Ph.D. to GBPUAT under supervision of Dr. Dheer Singh.

7. Subhashisha Praharaj. 2015. Use of plant hormones regulators enhance: the emergence yield and quality of Sugarcane (*Saccharum officinarum* L.) submitted for M. Sc. Ag to GBPUAT under supervision of Dr. Dheer Singh.

B. Sugarcane Pathology:

1. Significant Achievements:

1. Furrow application of Zinc Sulphate @ 25kg/ h + Copper Sulphate @ 5kg/h+ Borex @ 10kg/h can be used to reduces the incidence of red rot under field condition and also enhanced the yield attributes
2. A large number of resistant (40) and moderately resistant (60) genotypes were identified against red rot disease during the period under report.
3. Similarly 14 resistant and 34 moderately resistant genotypes were also identified against smut disease during the period under report.

2. Research Publications:

Research papers:

1. Sahu, R.K and Kumar A. 2012. Observation on screening and management practices for red rot and smut of sugarcane. Paper published in Compendium of Research Paper during sugarcane breeder and Pathologist Meet held at Sugarcane Breeding Institute (ICAR), Coimbatore. January 23: 100-102.
2. Neelam, Sahu, R.K. and SrinivasRaghavan 2012. Role of weather parameters on incidence and development of sugarcane smut disease. Bioinfolet. 9(4A): 497-499. NAAS rating 4.2
3. Bhardwaj, Nikhil and Sahu, R.K. 2014. Evaluation of some fungicides, botanicals and essential oils against the fungus Colletrotrichumfalcatum causing red rot of sugarcane. The Bioscan. 9(1): 175-178. NAAS rating 4.7
4. Neelam, and Sahu, R.K. 2014. Sugarcane smut and bio agents. Bioscan (MS/3137/IG-15) accepted for pub. In coming issue. NAAS rating 5.1.
5. Arya, Anshul and Sharma, Geeta. 2016. Evaluation of Cow Urine on Fusariummoniliforme var. subglutinans causing Pokkahboeng disease of sugarcane. Journal of Asian Agrihistory, 20 (3):219-222.
6. Arya, Anshul and Sharma, Geeta. 2016. In vitro Efficacy of Essential oils on Fusariummoniliforme var. subglutinans causing Pokkahboeng Disease of Sugarcane. Journal of Sugarcane Research 6 (1): 56 – 58.
7. Arya, Anshul and Sharma, Geeta. 2017. Evaluation of efficacy of different botanicals against sugarcane Pokkahboeng disease causing fungus Fusariummoniliforme var. subglutinans Sheldon. Environment & Ecology 35 (3D): 2409—2412.
8. Sharma, Geeta, Singh, Jai, Arya, Anshul and Sharma, S.R. 2017. Biology and Management of sugarcane Red Rot: A Review. Plant Archives, 17(2), 775-784.
9. Arya, Anshul Sharma, Roopali, Sharma, Geeta, Kabdwal, B. C., Negi, Archana and Mishra, Bhavya. 2018. Evaluation of fungal and bacterial antagonists for managing phytopathogenFusariummoniliforme var. subglutinans Sheldon causing Pokkahboeng disease of Sugarcane. Journal of Biological Control 31(4): 217-222, 2017, DOI: 10.18311/ jbc/2017/15456.

Abstract in symposium / seminars:

10. Neelam and Sahu, R.K. 2010. Impact of climatic change in the incidence of smut caused by *UstilagoScietaminea*Sydow. Of sugarcane (*Saccharumofficnarum*). International

Conference held at CBSH GBPUAT, Pantnagar. November 15-17.

11. Bhardwaj, Nikhil, Pandey, P. and Sahu, R.K. 2012. Integrated Pest Management for Control of Tomato Diseases under protected cultivation. Paper published in proceeding of National Saminar on "Protected cultivation of Vegetable and Flowers - A value chain Approach". January 11-12: 100

12. Sahu, R.K. and Kumar, A. 2012. Performance of some promising genotypes of sugarcane against red rot incited by *Colletotrichumfalcatum* Went. in plant and ratoon crops. Paper presented and published in the proceeding of International symposium on new paradigms in sugarcane research held at sugarcane Breeding Institute, Coimbatore (Tamil Naidu) October 15-18: 220.

13. Sahu, R.K. and Kumar, A. 2012. Persistence of *Ustilagoscitaminia*Syd., the cause of smut disease in ratoon crops of sugarcane. Paper presented and published in the proceeding of International symposium on new paradigms in sugarcane research held at sugarcane Breeding Institute, Coimbatore (Tamil Nadu). October 15-18: 250.

14. Bhardwaj, Nikhil and Sahu, R.K. 2012. Impact of some micronutrient and essential oils on the management of red rot of sugarcane. Papers presented and published in the proceeding of International symposium on new paradigms in sugarcane research held at sugarcane Breeding Institute, Coimbatore (Tamil Nadu). October 15-18: 215.

15. Mehra, P. and Sahu, R.K. 2012. Impact of some chemicals, plant extracts, biocontrol agents, essential oils and organic amendments in-vitro on sugarcane smut pathogen. Papers presented and published in the proceeding of International symposium on new paradigms in sugarcane research held at sugarcane Breeding Institute, Coimbatore (Tamil Naidu). October 15-18: 214.

16. Mehra, P. and Sahu, R.K. 2012.*In-vitro*efficacy of some chemicals, plant extracts and bio control agents against sugarcane smut pathogen and effect of climate on disease incidence. Paper presented and published in the National Conference on Managing Threating Disease of Horticultural, Medicinal, Aromatic and Field crops in Relation to changing climate situation and Zonal meeting to Indian Phytopatho. Society held at IISR, Lucknow. November 3-5. Poster no. 7.7

17. Neelam and Sahu, R.K. 2012.Sugarcane smut management through sett treatment with fungicides and biofungicides. Paper presented in Uttrakhand state science and Technology Congress held at Graphic Era, Dehradun : 22-24.

18. Bhardwaj, N.; Sahu, R.K. and Pandey, P. 2013. Effect of essential oils on the management of red rot of sugarcane caused by *Colletotrichumfalcatum*. Presented and published in Souvenir and Abstract Book of National Saminar on Innovations in Traditional Agriculture. November 15-16, 2013 held at GBPUAT Pantnagar (organised by Asian Agri- History foundation and ICAR. P-53:95.

19. Mehra, P. and Sahu, R.K. 2013.Impact ofIndigenous practices on Environment and disease management. Presented and published in Souvenir and Abstract Book of National Saminar on Innovations in Traditional Agriculture. November 15-16, 2013 held at GBPUAT Pantnagar (organised by assianAgri-History foundation and ICAR. P-66: 105.

20. Mehra, P. and Sahu, R.K. 2013.Management of sugarcane smut (*SporisoriumScitamineum*) with some plant extracts, bioagents and essential oils. Presented and published in National Saminar on Microbes Promoting Crop Health Productivity and Sustainability and Zonal Meeting of Indian Phytopathological Society held at CSIR-CIMAP Lucknow and jointly organised by CIMAP and NBRI Lucknow. October 26-27. 2.23: 43.

21. Chauhan, Harshvardhan, Vishvanath and Sahu,

R.K. 2014. Evaluation of fungicides for management of *Fusariummoniliforme*causing Pokkahboeng of sugarcane. Paper presented and abstract published in souvenir cum abstract in "National workshop on Retrospective and Prospective analysis of Indian Agricultute: The Roadmap Ahead", Nov. 17-18, S1-10:180-181. Organised by Directorate of Experiment station, GBPUAT, Pantnagar.

22. Sharma Geeta, Sahu, RK and Kumar, Ajit. 2015. Screening of sugarcane genotypes for resistance against smut disease caused by UstilagoscitamineaSydow. Abstract in souvenir: 17th Indian Agricultural Scientists & farmers Congress on Agri- Innovation for Enhancing Production & Rural Employment, 21-22 February, 2015, p.51.

23. Arya, Anshul and Sharma, Geeta. 2016. Efficacy of different botanicals against Fusariummoniliforme var. subglutinans causing Pokkahboengdiseaseof sugarcane. Abstract in souvenir:6th International conference on Plant Pathogens and People: challenges in plant pathology to benefit of Humankind. February 23-27, 2016, New Delhi, 358.

24. Sharma, Geeta, Sahu R.K. and Kumar, Ajit 2016. Current status of sugarcane diseases in Uttarakhand. Abstract in souvenir: 6th International conference on Plant Pathogens and People: challenges in plant pathology to benefit of Humankind. February 23-27, 2016, New Delhi, 275.

25. Arya, Anshul and Sharma, Geeta. 2016. Bioefficacy of fungicides and essential oils on Fusariummoniliforme var. subglutinans causing Pokkahboengdiseaseof sugarcane. Abstract in souvenir: National conference on Hill Agriculture in Perspective, February 26-28, 2016, GBPUA&T, Pantnagar. 690p.

26. Arya, Anshul and Sharma, Geeta. 2017. Evaluation of management practices for Pokkahboeng Disease of Sugarcane caused by Fusariummoniliforme var. subglutinans. Abstract in souvenir: International symposium on sugarcane Research since Co 205: 100 years and beyond (SucroSym- 2017) September 18-21, 2017, Coimbatore.

27. Delna Rose S and Sharma, Geeta. 2019. Impact of Soil amendments using Rice husk biochar on Colletotrichumfalcatum causing red rot disease of sugarcane. Abstract in souvenir: National Symposium on Recent Challenges and opportunities in Sustainable Plant Health Management w.e.f. February 26-28, 2019, BHU, Varanasi.

Popular articles:

28. Neelam and Sahu R.K. 2011. Smut/ Whip smut disease of sugarcane and their management. Indian Farmer Digest, 44(3):41-42.

29. Sahu R.K. and Neelam 2011. Red rot: A dreaded disease of sugarcane. Indian Farmer Digest. 44(4): 30-31.

30. Neelam and Sahu R.K. 2011. Wilt disease of sugarcane and their management. Indian Farmer Digest. 49(8): 35-36.

31. Arya, Anshul, Sharma, Geetaand Kumar, Ajeet 2016. PokkahBoeng Disease: an emerging threat to sugarcane cultivation. Indian Farmers Digest, 49(07), 31-32.

32. Sharma Geetaand Suma 2016. Identification and Diagnosis of Sugarcane Diseases. Indian Farmers Digest, 49(07), 35-37.

Proceeding papers:

33. Sharma,Geeta2016. Changing Disease scenario in Sugarcane. Proceedings of the 32nd training on Plant Disease management: strategies in changing Agro-Eco System, February 04-24, 2016 organized at centre for advanced faculty training in Plant Pathology, GBPUA&T, Pantnagar.

34. Sharma, Geeta2017. Minimizing Pre-Harvest Disease Scenario of Sugarcane. Proceedings of 35th Training on Technological Advances to

Minimize Pre-and Post Harvest Losses in Agricultural and Horticultural Crops to Enhance Farmer's Income November 22 to December 12, 2017 under Centre of advances Faculty Training in Plant Pathology, GBPUA&T, Pantnagar, 149-154.

35. Sharma,Geeta, Delna Rose and Kausar,Hina2018. Biopesticides and Plant Disease Management with Particular Reference to Sugarcane. Proceedings of 36th Training on Bio-pesticides for Crop Protection and Improvement: Emerging Technology to Benefit Farmers"February 02-22, 2018 under Centre of advances Faculty Training in Plant Pathology, GBPUA&T, Pantnagar, 52-66.

36. Sharma,Geeta and Kunwar,Deepshikha2018. Pest Risk Analysis and plant health Management of Sugarcane. Proceedings of 37th Training on "Advanced Technology in Plant Health management and Pest Risk Analysis for Improvisation of Indian Agriculture and Farmers Income" w.e.f. September 05-25, 2018 under Centre of advances Faculty Training in Plant Pathology, GBPUA&T, Pantnagar, 52-56.

Technical Bulletins:

37. Geeta Sharma and Ajit Kumar (2016). GanneKaLalSadanRog: PahchanevamNidan.

38. Geeta Sharma and Ajit Kumar (2016). GannaUtpadankiekaurChunoti: Pokkahboengbimari.

39. Geeta Sharma and Ajit Kumar (2016). GanneKaKandwa (Whip smut) Rog: PahchanevamNidan.

3. Thesis Research :

1. Neelam. 2010. Studies on the smut of sugarcanesubmitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

2. Rashid Husain. 2011. Studies on Red rot of sugarcane incited by *Colletotrichum falcatum* Went submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

3. Nikhil Bhardwaj. 2012. Impact on some micronutrients, essential oils, organic amendments, botanicals, bioagents and chemicals on the management of red rot of sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

4. Prateeksha Mehra. 2012. Management of smut of sugarcane and effect of climate on disease incidence submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

5. Ambika Rautela. 2014. Effect of fungicides, botanicals, bioagents and essential oils on *Colletotrichum falcatum* went, incident of red rot of sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

6. Harshvardhan. 2014. Cultural, physiological and management studies on *Fusarium moniliformae* var. *subglutinence* causing Pokkah boeng disease of Sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

7. Anshul Arya. 2015. Evaluation of different inoculation methods and mgt practices for Fusarium moniliform var. subglutinans causing Pokkah boeng disease of sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr Geeta Sharma.

8. Nitika Panwar. 2015. Evaluation of micronutrients, indigenous products and fungicides in the management of red rot of sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr Geeta Sharma.

9. Suma,. 2016. Studies on disease distribution and Pathogenic variability of C. falcatum causing Red rot Disease of sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr Geeta Sharma.

10. Delna Rose S. 2018. Studies on Eco-friendly Methods for Sustainable Management fo *Colletotrichum falcatum* went causing Red Rot

Disease of Sugarcane. submitted for M.Sc.Ag. to GBPUAT under supervision of Dr Geeta Sharma.

11. Hina Kausar. 2018. Studies on status of Pokkah Boeng disease of Sugarcane caused by *Fusarium moniliforme* f. sp. *subglutinans* (Sheldon) in District Udham Singh Nagar and its variability analysis submitted for M.Sc.Ag. to GBPUAT under supervision of Dr Geeta Sharma.
12. Himani Jeena. 2018. Studies on Yellow Leaf Disease of Sugarcane submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.
13. Prarthana Jagoori. 2018. Evaluation of popular cultivars and introgression lines against red rot disease of sugarcane. submitted for M.Sc.Ag. to GBPUAT under supervision of Dr R K sahu.

4. Future Thrusts:

1. Collection and maintenance of virulent strains and bio types of pathogens causing major diseases of sugarcane
2. Screening of germplasms of sugarcane to identify the source of resistance against major diseases.
3. Development of eco-friendly, sustainable management techniques for major diseases
4. Identification of new disease problems and ascertaining its cause and economic importance.

Integrated approach to manage red-rot and smut diseases of sugarcane.