AICRP- VEGETABLE CROPS

Objectives

GBPUAT, Pantnagar recognized as sub centre under AICRP (Vegetable crops) during 1971 has initiated work on crop improvement, production including seed production and crop protection technologies. The important crops covered are brinjal, chilli, tomato, cauliflower, French bean, peas, okra, cucumber, bottle gourd and some other cucurbits.

- Development of high yielding varieties in brinjal, chilli, cauliflower, French bean, tomato, okra & cucurbits etc.
- Development of hybrid varieties in crops like brinjal, tomato, cucumber etc.
- Breeding for varietal development for polyhouse cultivation.
- Standardization of improved agro-techniques of vegetable crops.
- Standardization of improved plant protection techniques for cultivation of vegetable crops.
- Development of improved agro-techniques for seed production of vegetables.
- Multiplication of breeder seeds of different vegetable crops.

1. Significant Achievements:

- **Awards and Honours:** AICRP-VC Pantnagar centre was conferred with Best Centre award during annual group meeting of 2014-15 at Varanasi**.**
- About 200 quintal quality breeder seed of different vegetable crops is being produced at Vegetable Research Centre, Pantnagar every year. The seed of garden pea, coriander, and turmeric is multiplied in large quantities which are in great demand among farmers of and outside the state.
- A total of 4294 genotypes of different vegetables have been evaluated, documented and conserved under medium term storage (MTS) at 'Pantnagar Centre for Plant Genetic Resources' (PCPGR).
- **Vegetable Improvement:** Forty-two varieties including six hybrids and four varieties suitable for protected cultivation have been developed and released since the start of the project. Some varieties like Pant Samrat and Pant Rituraj (Brinjal), Pant Chilli 1 (chilli), Pant T-3 (Tomato), Pant Shubhra (Cauliflower), Pant Anupma (French bean) and PSM-3 (Pea) are very popular among the farmers.
- Increase in production of green peas in U.P., Uttarakhand and M.P. with the use of 'Pant Sabji Matar 3' variety. This variety has occupied about 40% area in these states during 2011-2017.
- Landmark varieties 'Pant Samrat' and 'Pant Rituraj' of brinjal and Pant Anupma of frenchbean occupied around 30% and 40% area respectively in the states of Uttarakhand and U.P.
- Developed short duration cowpea varieties for cultivation as a niche crop in Wheat-Rice cropping system in summer season are becoming popular among the farmers of Uttarakhand, Uttar Pradesh, Madhya Pradesh, Karnataka and Kerala.
- Producing 150 q (avg.) of **breeder seed** every year resulted in increased vegetable production in the states and country.
- The centre has taken lead in development and release of varieties suitable for protected cultivation. Four varieties including Pant polyhouse Tomato-2, Pant Polyhouse hybrid tomato-1, Pant

Parthenocarpic khira-2 and Pant Parthenocarpic khira-3 have been released by SVRC, Uttarakhand.

- Recently, A vegetable pea variety PM 85; which was released in the name of '**Pant Sabji Matar 6**' (an early season variety, resistant to powdery mildew) by 'Uttarakhand State Horticulture Seed Variety Release Subcommittee', held on 10th Feb, 2018.
- **Publications:** More than 200 research papers and around 120 theses have been published based on experiments conducted under AICRP-VC.
- **Linkage with international programmes:** The center has collected germplasm from international institutes like AVRDC, Taiwan; CIAT, Cali Columbia; BARI, Bangladesh and IITA, Nigeria etc.
- **Molecular characterization of germplasm:** Molecular characterization has been done for all the vegetable varieties developed by Pantnagar.
- **Technologies generated:** Due emphasis has also been accorded to standardize the production technologies and vegetable seed production programme. Around fifty agro techniques have been standardized for vegetable cultivation including agro-techniques for improved cultivation practices, plant protection technology and seed production. The varieties/ technologies developed by the centre are being popularized among farmers through training & demonstrations. These technologies have been mentioned as below.
- **Tomato**

o The highest yield of tomato was obtained with 4 week old seedlings (453 q/ha) followed by 6 week (411 q/ha), 3 week (390 q/ha) and the poorest 2 week (384 q/ha) age. The hardening did not prove beneficial. For October second fortnight planting, 5 week old seedlings should be preferred. The AC -142 gave highest yield (498 q/ha) when planted on October 15 at narrowest spacing. The highest yield of 205q/ha was obtained when crop was transplanted on Feb. 14 at 30 x 20 cm spacing with extra determinate cultivar AC-142 during summer season. Thus for getting higher yield during winter season, the determinate varieties like AC 142 or HS 101 may be transplanted from end of Sept. to mid Oct. at narrower spacing of 30 x 20cm.

o The plant of tomato hybrid NS-812 spaced at 50 x 10 cm and tailored to have single shoot/plant resulted in maximum plant growth and yield (16.96 kg/m^2) under poly house

o At Pantnagar, maximum yield (314 kg/ha) and C: B ratio (1:2.14) along with TSS (5.7% and shelf life (7-6 days) were recorded in Pusa Hybrid-1 tomato with three foliar sprays of micronutrient mixture (b, Zn, Cu, Fe, Mn each @ 100 ppm and Mo ppm) at 10 days interval starting from 40 days after planting. Hence, it is recommended for tarai conditions of Pantnagar.

o Based on the mean yield of two years (2003-04 and 2004-05) and the production economics, the application of PSB as root dipping of seedlings and full recommended dose of NPK (150:90:90) in tomato proved to be the best treatment.

o The maximum yield (416 q/ha) and cost benefit ratio (1:1 .32) were recorded with application of 120 kg/ha each of N and P_2O_5 in ARTH-3 tomato hybrid.

o Application of two post mulching irrigations i.e., at 3rd flower cluster appearance and after 2nd harvest proved best and irrigation at 2nd flower cluster appeared more critical than the irrigation after 2nd harvest.

o The starter solution of IBA/2, 4-D @ 1 ppm or foliar spray of GA-3 @ 25 ppm or 2,4-D @ 5ppm increased yield by more than 50% when compared with the unsprayed control.

o The average tomato yield inside polyhouse was 1520 q/ha compared to the yield 890 q/ha in plastic low tunnel and 756 q/ha in open environment. In one year the yield was as high in 1950 q/ha inside polyhouse. The spray of 2,4-D was found to be beneficial.

o Application of PSB+ recommended doses of

NPK (150:90:60) gave the highest average yield of tomato i.e. 653.49q/ha along with maximum C:B ratio(1:3.49). It is recommended for tarai region of Pantnagar conditions.

- The average tomato yield inside the polyhouse was 1800qt/ha compared to the yield 890qt/ha in plastic low tunnel and 756qt/ha in open environment

- **Cucumber**

- The cucumber variety Poinsett produced significantly larger number of fruits/vine (45.8) and higher yield (19.31 kg/m^2) compared to all the rest varieties in a naturally ventilated polyhouse.

- Cv poinssette recorded maximum yield of 14.12kg/m^2 with highest C:B ratio 1:3.1 hence this is recommended for protected cultivation.

- In three years of experimentation, cucumber, CV. Poinsett recorded maximum yield of 14.12 kg/ m-$^{-2}$ with highest C:B ratio 1:31.01. Hence this variety is recommended for protection cultivation.

- **Cauliflower**

- Maximum yield of cauliflower cv. Pusa Snowball K-1 (304.5 q/ha) and C:B ratio (1:3.88) were recorded with the application of PSB @ 500 g/ha as seeding root dip along with recommended dose of NPK through fertilizers. Hence it is recommended for Pantnagar conditions.

- Cauliflower varieties *viz.,* Early Himlata, Early Kuwari, Pusa Deepali and Pusa Meghna are good for rainy season cultivation under a naturally ventilated polyhouse maximum CB ratio was obtained from Early Himlata (1: 1.36).

- Mid season variety Pant Shubhra was sown in first week of August for nursery establishment. Polythene base bed, coupled with top cover with low tunnel proved most effective. Sides were kept open to the height of 15-30 cm

- Planting of Pant Shubhra, cauliflower crop at 60 x80 cm spacing with application of 150 kg N/ha is recommended

- Application of 60 kg N/ha as basal followed by 3 foliar sprays of urea @ 10 kg N/ha at 10 days interval beginning after 30 days after transplanting is recommended for late cauliflower variety Snowball-16 under tarai conditions.

- **Brinjal**

- The planting of varieties Pant Samrat and Pant Rituraj during 1st week of July is recommended

- To find out the optimum spacing requirement, the two brinjal varieties Pusa Purple Long (dwarf) and Pant Samart (medium tall) were planted at 75 x 60, 60 x 50 and 80 x75 cm spacing. Three years trial indicated that both the varieties gave most economic return at 75 x 60 cm spacing.

- In the brinjal variety, Pant Samrat and Pant Rituraj most economic yields were obtained by dipping of seedlings in secondary and micronutrient solution supplemented with N100, P60, K60, kg/ ha. Secondary and micronutrients sources were $CaCl_2$ (0.5%). Mg So-$_4$ (0.5%), $FeSO_4$ (1%), Zn SO_4 (.5%), $MnSO_4$ (0.5%), CuSO-$_4$ (.25%), Ammonium Molebdate (0.05%), and Borax (0.05%).

- **Garden pea**

- Sowing of Arkel from 20th October to 19 November, Pant Uphar from 22 October to 10 November and New Line Perfection from 15 October to 12 November are recommended in tarai conditions .Arkel should be sown at 20 cm row spacing while IP-3 (Pant Uphar) and new line perfection may be sown at 20 to 30 cm row spacing.

- Pre-sowing irrigation followed by two irrigations first at beginning of flowering and second at full pod set are recommended for pea cv. Arkel

- Pea variety PSM-3 gave maximum green pod yield with application of FYM @ 20t/ha.

- Pre-emergence application of pendimethalin @ 0.75 kg ai/ha followed by one hand weeding at 40 DAS produced maximum seed yield (14.7 q/ ha) in green pea cv. 'Arkel' at Pantnagar; hence recommended for *tarai* conditions of Uttarakhand.

- **Chilli**

- Two sprays of Mixtalol 0.5 ppm solution (1 ml/20 liters of water) first in nursery on the day of transplanting and second three weeks after transplanting, increased the yield of chilli cultivar Pant C-1 by more than 50% in comparison to unsprayed control..
- The application of 120 kg N + 60 kg P_2O + 60 kg K_2O per hectare and spacing of seedlings at 45 x 30 cm are most suitable for high yield of Pant C-1 under tarai conditions.
- The application of 40 ppm NAA or 1 ppm 2, 4-D in two sprays i.e. first at 40 days flower bud initiations and second at 20 days after first spray are recommended for increased fruit yield of Chilli, Pant C-1, Pusa Jwala and NP 46-A cultivars.

- **Water melon**

- Application of GA at 25-50 ppm concentration as foliar spray at 3 true leaves stage and at the initiation of flowering resulted in maximum yield of above 280 q/ha

- **French bean**

- The sowing of French bean variety Pusa Parvati proved most remunerative, between 15 October to 15 Nov. and 15 January to 15 Feb. The application of 120 kg N/ha proved most effective.

- **Onion**

- Best transplanting period was observed from 10th Dec. to 15th Jan. though there was no significant difference till 20th January after which greater reductions were observed
- The distance of 15 x 7.5 cm produced the highest yield though statistically on par with 15 x 10 cm spacing. Six to eight week old seedlings were found most suitable for transplanting.
- Basalin @ 2 liters/ha as pre-planting incorporation coupled with one hand weeding 45 days after the transplanting proved most effective for highest bulb yield.
- Nitrogen @ 90 kg/ha applied as 2/3 basal, 1/3 top dressing after 30-40 days of transplanting along with 40 kg phosphorus and 100 kg of potash/ha gave the highest yield.
- Mixture of the elements *viz* Cu (1.0 ppm), Zn (3 ppm), B (0.5 ppm) Fe (100 ppm) sprayed
- twice in the crop gave highest bulb yield (460 q/ha)
- *Azospirillum* when used as seedling dip (400 g in 20 l of water) along with full amount of nitrogen (80 kg/ha) resulted in highest bulb yield.
- Bulb planting in the period from 10-15 October with 45 x 30 cm spacing gave the highest yield of seed with variety Agri- Found Light Red, 80 kg N/ha proved effective for seed yield.
- It was recorded that NAA (25 and 50 ppm), GA_3 (25 ppm) as sprays were effective for bulb yield but reduced the storage life of harvested bulbs in Pusa Red.
- 2500 ppm of M.H. was effective in reducing the bulb sprouting for considerable period of time when tested in cultivar Pusa Red.

- **Garlic**

- Planting done in first fortnight of October gave the highest yield and the crop of last week of September was almost on par to it.
- Based on cost benefit ratio, application of 100 kg N/ha plus K_2O 50 kg/ha without phosphate fertilizer proved most economical (C:B ratio - 1:3.4) and hence it has been recommended for growers.

- **Coriander**

- In both the dates (October month) two leaf cuttings were found effective for spice yield and sowing in first fortnight of October was better. For having good spice yield, two cuttings are essential to boost up the number of branches.

- **Fennel**

- The fennel spacing was kept as 60 x 30 cm. Maximum spice was produced when fenugreek

was taken as the intercrop followed by coriander for leaves. But total income was maximum when pea was taken as intercrop followed by potato (2.5 and 2 times of pure fennel crop respectively).

- **Capsicum**

- The highest yield of capsicum hybrid Bharat (167.5 q/ha) along with C:B ratio of (1.52 were recorded with three foliar sprays of water soluble fertilizers (15:15:30 @ 0.5%) at 10 days interval starting from 30 days after transplanting. Hence, it is recommended for Pantnagar conditions.
- One row of capsicum with single row of maize in ridges gave maximum yield as well as net profit.
- Under polyhouse production of capsicum hybrid Indra, based on highest yield (9.64kg per meter square) and C:B ratio(1:6.50); spacing of 60x30 cm without training is recommended under naturally ventilated polyhouse under Tarai conditions of Pantnagar.

- **Bitter gourd**

- Bitter gourd variety Pant Karela-1 gave highest fruit yield (81.43 kg/ha) with maximum C: B ratio (1.294).
- Under naturally ventilated polyhouse conditions, bitter gourd cv. Pant Karela-1 gave the maximum yield (812.2 kg/ha). Hence, this bitter gourd cultivar is recommended for protected cultivation under Pantnagar conditions of tarai region of Uttarakhand.
- Sowing of bitter gourd in mid September is recommended for getting off-season crop in naturally ventilated polyhouse.
- Cropping system of nursery of cucurbits-coriander-bitter gourd is recommended for tarai condition of Pantnagar in naturally ventilated polyouse.

- **Broccoli**

- Based on highest yield170qt/ha and C:B ratio 1:3.4 planting of briccoli hybrid Fiesta around 15th October at 45x 30cm spacing is recommended for tarai condition of Uttarakhand.
- The maximum avg. yield163.5qt/ha .with highest C:B ratio 1:4.58 of the hybrid Fiesta was obtained with application vermi compost @ 2.5t/ha + half recommende dose of NPK. Hence recommended for tarai condition of Uttarakhand.

- **Palak:**

- Sowing palak cv. 'All Green' in the first fortnight of October with one leaf cutting produced the highest seed yield of 29.21 q/ha with highest seed quality at Pantnagar; hence recommended for *tarai* conditions of Uttarakhand.

- **Awards and Honours:** AICRP-VC Pantnagar centre was conferred with Best Centre award during annual group meeting of 2014-15 at Varanasi**.**

- **Vegetable Improvement:** Forty-two varieties including six hybrids and four varieties suitable for protected cultivation have been developed and released since the start of the project. Some varieties like Pant Samrat and Pant Rituraj (Brinjal), Pant Chilli 1 (chilli), Pant T-3 (Tomato), Pant Shubhra (Cauliflower), Pant Anupma (French bean) and PSM-3 (Pea) are very popular among the farmers.

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- **Publications:** More than 200 research papers and around 45 theses have been published based on experiments conducted under AICRP-VC.

Important Vegetable Varieties released from Pantnagar

Pant Sabji Matar-3

Pant Sankar Lauki-2

Pant Samrat

Pant Bahar

Pant Rituraj

Pant Chilli 1

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2. Suphal Chandra Mandal. 1994. Hybrid seed Production in Brinjal (*Solanum melongena* L.). to GBPUAT under supervision of Dr. Y.V.Singh

3. Rakesh Kumar Agnihotari. 1995. Inheritance of Rust Resistance in Pea (*Pisum sativum*). to GBPUAT under supervision of Dr. Y.V.Singh

4. Kamal Joshi. 1996. Studies on Heterosis in Experimental Hybrid of Brinjal (*Solanum melongena*. L). to GBPUAT under supervision of Dr. Y.V.Singh

5. Arvind Chandra Sharma 1996. Evaluation of Vegetable Pea (*Pisum sativum* L.) Verities for Agronornic and Processing Attrilutes. to GBPUAT under supervision of Dr. Y.V.Singh

6. Vikash Kumar. 1997. Studies of Genetic Diversity and ideal Plant Type in vegetable Pea. to GBPUAT under supervision of Dr. Y.V.Singh

7. Amarjeet Gupta. 1999. Heterosis and genetic diversity in Brinjal (*Solanum Melonge* L.). to GBPUAT under supervision of Dr. Y.V.Singh

8. Pratibha. 2002. Studies on Heterosis and character Association in Brinjal (*Solanum melagena* L.). to GBPUAT under supervision of Dr. Y.V.Singh

9. Amarjeet Gupta. 2002. Combining ability and seed protein profiles in Vegetable Peas (*Pinum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

10. Biswajit Singh. 2003. Studies on heterosis combining ability and gene action in brinjal (*Solanum melon gene* L.). to GBPUAT under supervision of Dr. Y.V.Singh

11. Deepali Pandey 2004. Genetic Diversity in Pea (*Pisum sativum* L.) through morphological and protein poly morphic variants. to GBPUAT under supervision of Dr. Y.V.Singh

12. Shiv Prasad Yadav 2005. Effect of planting ratio and method of seed extraction yield and quality of hybrid seed in Brinjal cv. Pant Brinjal Hybrid -1. to GBPUAT under supervision of Dr. Y.V.Singh

13. Pratibha 2005. Studies on selection procedures in vegetable Pea (*Pisum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

14. Pradeep Karmakar 2007. Studies on Interspecific Hybridization In Brinjal (*Solanum melongena* L.). to GBPUAT under supervision of Dr. Y.V.Singh

15. Neelima Joshi 2007. Heterosis Breeding and protein profiling in Brinjal (Solanum Melongena L.). to GBPUAT under supervision of Dr. Y.V.Singh

16. Bhawana Bisht 2008. Genetic trends in combining ability Heterosis and protein profiling vegetable Pea (*Pisum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

17. Kumar Bharat Bhushan 2009. Heterosis Breeding and protein profiling through SDS-PAGE in Brinjal (*Solanum melangena* L.). to GBPUAT under supervision of Dr. Y.V.Singh

18. Bhawana Pandey 2010. Heterosis combining ability stability analysis and protein profiling in cowpea (*Vigna lnguiculata* L.) walp. to GBPUAT under supervision of Dr. Y.V.Singh

19. Manish Nautiyal 2011. Characterization of Germplsm genetic variability and character association in Brinjal (*Solanum tuberosum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

20. Abdul Majid Ansari 2012. Heterosis Gene Action and PCR Based Molecular analysis in Brinjal (*Solanum tuberosum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

21. Pallavi 2012. Genetic Variability and characters association in F2 generation of Pea (*Pisum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

22. Tanuja Buckseth 2013. Genetic analysis and molecular characterization for powdery mildew resistance in Pea (*Pisum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

23. Snehlata. 2014. Genetic parameters and residual standard heterosis for yield and its components in Vegetable Pea (*Pisum sativum* L.). to GBPUAT under supervision of Dr. Y.V.Singh

24. Anand Singh 2014. Determining Heterosis response combining ability and gene action for yield and yield contributing traits in Cowpea (*Vigna ungniculata* (L.) Walp.). to GBPUAT under supervision of Dr. Y.V.Singh

25. Risha Varan 2015. Studies on combining ability and heterosis for seed yield and its component traits in cowpea [Vigna unguiculata (L.) Walp.]. to GBPUAT under supervision of Dr. Y.V.Singh

26. Tribhuwan Singh Negi 2018. Mutation Breeding for leaf Thrips Resistance in Cowpea (Vigna unguiculata). to GBPUAT under supervision of Dr. Y.V.Singh

27. Pallavi 2018. Heterosis, combining ability and gene action for yield and quality triats in cowpea Vigna unguiculata (L.) Walp. to GBPUAT under supervision of Dr. Y.V.Singh

28. Gurubaksh Singh 2008. Studies on genetic variability in mid season cauliflower (Brassica oleracea var. botrytis L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

29. Deepak Kandpal 2008. Studies on genetic variability and heritability in French bean (Phaseolus vulgaris L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

30. Dipti Mehra 2009. Screening and characterization of French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

31. Mukesh Topwal. 2010. Evaluation and genetic variability studies in French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

32. Anand Singh 2011. Genetic variability, character association and path coefficient analysis in French bean (*Phaseolus vulgaris* L) germplasm. to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

33. Savita 2012. Genetic variability, heritability, and correlation studies in French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

34. Suresh Kumar 2013. Response of French bean (*Phaseolus vulgaris* L.) genotypes to mulching. to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

35. Akshay Chittor 2014. Variability and correlation studies in early cauliflower (*Brassica oleracea* var. *botrytis*). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

36. Ankit Panchbhaiya 2015. Studies on genetic variability, correlation and path coefficient analysis in French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

37. Vivek Kumar 2017. Variability, heritability and genetic advance studies in mid-season cauliflower (*Brassica oleracea* var. *botrytis* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

38. Ankit Panchbhaiya 2015. Studies on genetic variability, correlation and path coefficient analysis in French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

39. Saurabh Bhatt 2017. Evaluation of brinjal (*Solanum melongena* L.) germplasm under *Tarai* region of Uttarakhand. to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

40. Dipti Mehra 2012. Heterosis, combining ability and gene action studies in early cauliflower (*Brassica oleracea* var. *botrytis* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

41. Basavaraj Makanur 2014. Stability analysis in French bean (*Phaseolus vulgaris* L.). to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

42. Kannan D. 2017. Stability analysis of cauliflower (*Brassica oleracea* var. *botrytis*) genotypes under different environments in *tarai* region of Uttarakhand. to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

43. Neeraj Singh 2018. Heterosis and combining ability studies in okra[*Abelmoschus esculentus* (L.) Moench] for yield and quality paramerers. to GBPUAT under supervision of Dr. Dhirendra Kumar Singh

44. Swadesh Banaerjee 2017. Characterization of Brinjal (*Solanum melongena* L.) Germplasm. to GBPUAT under supervision of Dr. Alka Verma

45. Yashpal Singh Bisht 2018. Evaluation of Brinjal (*Solanum melongena*) under organic Condition. to GBPUAT under supervision of Dr. Alka Verma

4. Future Thrusts:

1. Enrichment of germplasm base of different vegetable crops:
2. Development of high yielding varieties in different vegetable crops:
3. Breeding for resistance to major diseases in important vegetable crops:
4. Development of superior F_1 hybrids in different vegetables crops.
5. Development of OP varieties/ F_{-1} hybrids for protected cultivation.
6. Development of suitable varieties and production of seeds for organic vegetable cultivation.
7. Standardization of production technologies including micro-irrigation systems, protected cultivation and organic farming.
8. Quality breeder seed production of important vegetable crops.