

SALIENT ACHIEVEMENTS

All India Coordinated Research Project on Vegetable Crops has been instrumental in strengthening the vegetable research programme of the country. Since its launching in 1971, apart from identifying the promising varieties/ hybrids for agro-climatic zones of the country, it has also strengthened the genetic resource of the country. Under the programme a good number of technologies related to vegetable production and protection have also been standardized. Its achievement in brief has been described under following heads.

(A) Germplasm Collection, Evaluation and Maintenance

The germplasm, specifically plant genetic resources for food and agriculture are the living materials used by local communities, researchers and breeders to adapt food and agricultural production to changing needs. In today's world, there is significant pressure to improve agricultural production by developing food crops that can not only adapt to environmental changes, but also meet the growing food demands of a constantly increasing population. Maintaining and using the global pool of genetic diversity will be the foundation for managing the climate changes. Most of Asian countries depend heavily on the agricultural sector for employment and nutritional security. Effective and efficient conservation systems, accurate and reliable virus testing procedures, use of genomic-based approaches providing more information to facilitate development, and finally, reliable and transparent mechanisms for exchange are all essential to ensure that the germplasm development can take place.

The basic requirement of crop improvement and the success of any crop breeding programme depends upon the number and quality of germplasm lines available with the breeder. Considering these, germplasm collection programme was initiated during the second workshop (1972) held at PAU, Ludhiana by the collection of brinjal, okra and cucumis species at all the AICRP centres and reported in third workshop in 1975. Attempts have been made to collect the germplasm of 25 vegetable crops at 28 coordinating centres including ICAR based institutes viz; NBPGR, New Delhi, IHR, Bangalore, IIVR, Varanasi, IARI, New Delhi, and its regional research station at Katrain as well as 24 state agriculture universities located in different agro climatic zones of the country (Table 9)

Looking at the national scenario, vegetables have tremendous strength in terms of natural resources and biological assets. A large number of wild taxa and indigenous germplasm are available in the country and many have not been fully capitalized. This needs further efforts so that our pressing problems of biotic and abiotic stresses are minimized.

Vegetable germplasm is the vital component of crop improvement programme. Exploitation of germplasm with desired gene(s) having wide adaptability, desirable agronomic background, specific quality parameters, resistance against biotic and abiotic stresses etc. should be given top priority in crop improvement. Keeping the fact in mind a massive programme was started for exploration, collection, evaluation and conservation under All India Co-ordinated Research Project on Vegetable Crops with active collaboration of NBPGR.

More than 50 crops of vegetables are grown in the country. Many vegetable crops remained unpopular as no concerted research and development efforts have been made to promote such crops which are more than 25 in number. So far research work has been concentrated only on 30 vegetable crops out of which, tomato, eggplant, chilli, okra, cauliflower, melons, onion and peas etc. are the important crops on which adequate emphasis has been given.

Further, there are many crops which are grown in the country, but no systematic research has been executed on such crops. These crops are faba bean, lima bean, winged bean, clove bean, jack bean, sword bean, velvet bean, tree bean, chive, leek, welsh onion, broccoli, Brussels sprouts, Chinese cabbage,

celery, lettuce, globe artichoke, sweet corn, baby corn, aspergus, Indian spinach, *Chenopodium*, water leaf, drumstick, curry leaf, ash gourd, snake gourd, *Momordica dioica*, *M. cochinchinensis*, *Coccinia indica*, *C. cordifolia*, *Melorthia hetrophylla* (dioceous) and pointed gourd etc.

Sufficient infrastructure and technology are available for both conservation as well as utilization of genetic resources in India. These are being further developed to meet the emerging challenges. National Bureau is the focal point for all such activities. India, among the developing countries, holds rich agribiodiversity in plant genetic wealth. This diversity has been extensively explored, collected, conserved, partially characterized and put to use for plant breeding and crop improvement activities.

Table 12 : Maximum number of germplasms reported by the centres (1971-2013)

Crops	Centres	No.	Year	Crops	Centres	No.	Year
Amaranth	TNAU,Coimbatore	244	1987	Cabbage	IGKV, Raipur	76	2010
	KAU,Vellanikkara	105	2002		NBPGR,New Delhi	60	2007
	AAU, Jorhat	10	2004		Tripura	7	2007
	IIHR, Hessarghatta	28	2006		IIVR, Varanasi	200	2008
	HARP, Ranchi	24	2010	Capsicum	IARI-RRS, Katrain	421	1992
	JNKV, Jabalpur	9	2010		YSPUH&F, Solan	6	1996
	Hyderabad	59	2010	Carrot	YSPUH&F, Solan	25	1993
	Portblair	5	2011		SKUAS&T, Srinagar	20	1996
Bitter gourd	CSUA&T, Kalyanpur	27	1995		TNAU, Coimbatore	111	1975
	BAC (RAU), Sabour	2	2007		IARI-RRS, Katrain	106	2005
	KAU,Vellanikkara	95	1997		IIHR, Bangalore	16	2010
	JNKVV, Jabalpur	40	2003	HPKV, Palampur	3	2007	
	HARP, Ranchi	18	2008	Cauliflower (Early)	HAU, Hissar (Tropical)	76	1999
	IIVR, Varanasi	123	2010		YSPUH&F, Solan	28	1995
	Portblair	2	2010		IIVR, Varanasi	86	2010
Bottle gourd	NDUA&T, Faizabad	56	2010		IARI, RS, Katrain	39	2010
	AAU, Jorhat	4	1979	PAU, Ludhiana	2	2010	
	JNKVV, Jabalpur	77	1975	Cauliflower (Mid)	BAC (RAU), Sabour	85	1975
	MPKV, Rahuri	33	2010		IIVR, Varanasi	132	2011
	IIVR, Varanasi	101	2010		HARP, Ranchi	35	2001
Brinjal	JNKVV, Jabalpur	72	1992		Samastipur	2	2010
	IIHR, Hessarghatta	300	1979	IIHR, Bangalore	30	2011	
	O.U.A.&T.,Bhubaneshwar	181	1993	Cauliflower (late)	IARI-RRS, Katrain	314	1979
	BAC(RAU) Sabour	140	1983		YSPUH&F, Solan	107	1990
	BCKV, Kalyani	90	1993		IIVR, Varanasi	60	2002
	CSUA&T, Kalyanpur	160	1979				
	IARI, New Delhi	350	1972				
	Aurangabad	46	1979				
	AAU, Jorhat	60	2010				
	KAU, Vellanikkara	60	2009				
	HARP, Ranchi	54	2002				

Crops	Centres	No.	Year
	BCKV, Kalyani	51	2007
	UAS, Dharwad	40	1998
	SKUAST, Srinagar	219	2004
	IIVR, Varanasi	415	2010
	HARP, Ranchi	53	2007
	IIHR, Banagalore	34	2007
	NBPGR	48	2007
	Paprika	Srinagar	15
	IIHR	11	2006
	UAS, Dharwad	46	2005
	IARI,RS, Katrain	13	2007
	IIVR, Varanasi	20	2009
	Cucumber	MPKV, Rahuri	50
	SKUAS&T, Srinagar	17	1979
	BCKV, Kalyani	18	1979
	YSPUH&F, Solan	35	1997
	IIVR, Varanasi	143	2010
	HARP, Ranchi	33	2004
	HPKV, Palampur	3	2006
	GBPUA&T,Pantnagar	10	2008
	IIHR, Hessarghatta	500	1987
	MPKV, Rahuri	88	1987
	YSPUH&F, Solan	125	1996
	GBPUA&T,Pantnagar	204	2003
	Dharwad	90	2006
	Jorhat	10	2006
	IIVR, Varanasi	88	2010
	Garlic	NBPGR, New Delhi	877
	NHRDF, Karnal	131	1999
	NHRDF, Nasik	92	1987
	NRC (O&G), Pune	135	2003
	Muskmelon	IARI, New Delhi	80
	ARS, Durgapura	198	2004
	NDUA&T, Faizabad	75	1987
	PAU, Ludhiana	96	2003
	CSAU&T, Kalyanpur	-	-
	IIHR, Hessaraghatta	180	1981
	MPKV, Rahuri	35	2010
	IIVR, Varanasi	175	2010

Crops	Centres	No.	Year
Okra	NBPGR, New Delhi	1000	1990
	IIHR, Hessarghatta	400	1979
	OUAT&T,Bhubaneshwar	53	2010
	PAU, Ludhiana	126	1979
	CSAU&T, Kalyanpur	66	1979
	BAC (RAU), Sabour	33	1979
	IIVR, Varanasi	382	2008
	Anand	108	2008
	Dharwd	20	2007
	MPKV, Rahuri	200	2010
Onion	NBPGR, New Delhi	1464	1990
	MPKV, Rahuri	180	1997
	NHRDF, Nasik	569	1996
	TNAU, Coimbatore	750	1985
	UAS, Hebbal	-	-
	Junagarh	-	-
	NRC (O&G)	387	2004
	IIHR, Hessarghatta	10	2005
Pumpkin	IIHR, Hessaraghatta	130	1987
	NDUA&T, Faizabad	56	2010
	APAU, Hyderabad	65	2001
	TNAU, Coimbatore	166	1995
	IARI-RRS, Katrain	25	1979
	IARI, New Delhi	114	1985
	IIVR, Varanasi	119	2010
	Peas	IARI, New Delhi	540
	JNKVV, Jabalpur	298	1983
	MPKV, Rahuri	96	1979
	PAU, Ludhiana	209	1993
	CSUA&T, Kalyanpur	434	1985
	NDUA&T, Faizabad	22	1997
	YSPUH&F, Solan	7	2009
	Palampur	34	2005
	IIVR, Varanasi	450	2009
	Jammu	11	2008
	Radish	College of Agril. (RAU), Udaipur	41
CSAUA&T, Kalyanpur		22	1997

FOUR DECADES... ACCOMPLISHMENT OF AICRP ON VEGETABLE CROPS

Crops	Centres	No.	Year
Squash			
<i>C. maxima</i>	IIHR, Hessarghatta	30	1979
<i>C. pepo</i>	IARI-RRS, Katrain	66	1979
Tinda (Round gourd)	PAU, Ludhiana	77	1975
	College of Agril. (RAU), Udaipur	35	1979
	YSPUH&F, Solan	21	1979
	HAU, Hisar	38	1998
Tomato	NBPGR, New Delhi	668	1990
	IARI, New Delhi	53	1979
	PAU, Ludhiana	280	1987
	Aurangabad	192	1979
	IIHR, Hessarghatta	1000	1992
	CSUA&T, Kalyanpur	260	1992
	IIVR, Varanasi	500	2005
	YSPUH&F, Solan	120	2007
	TNAU, Coimbatore	134	2004
	HARP, Ranchi	128	2002
	Jammu	8	2008
	GBPUA&T, Pantnagar	100	2008
Turnip	YUSPUH&F, Solan	18	1977
Watermelon	ARS (RAU), Durgapur	400	1983
	NDUA&T, Faizabad	12	1992
	College of Agril. (RAU), Udaipur	205	1979
	MPKV, Rahuri	100	1979
	PAU, Ludhiana	55	2009
	IIHR	10	2008
Parwal	BAC (RAU), Sabour	52	1996
	BCKV, Kalyani	28	1992
	NDUA&T, Faizabad	85	2008
	IIVR, Varanasi	225	2003
	HARP, Ranchi	59	2009
	AAU, Jorhat	6	2010
	Bhubaneshwar	17	2008

Crops	Centres	No.	Year
Ivy gourd	IIVR, Varanasi	60	2002
	IGKV, Raipur	35	2001
	AAU, Jorhat	6	2008
	KAU, Vellanikkara	21	2002
	Navsari	13	2009
	Portblair	1	2010
<i>Dolichos</i>	Dharwad	-	-
	IIVR, Varanasi	300	2010
	HARP, Ranchi	33	2010
	Tripura	-	-
	IGKV, Raipur	63	2010
	UAS, Bangalaoe	-	-
	JNKV, Jabalpur	25	2010
	Cowpea	IIHR, Banagalore	84
HARP, Ranchi		-	-
IIVR, Varanasi		294	2010
NBPGR		-	-
IGKV, Raipur		40	2009
Periyakulum		24	2011
<i>Momordica</i>	Tripura	4	2008
	BCKV, kalyani	11	2010
	OUA&T, Bhubaneshwar	5	2010
	AAU, Jorhat	10	2010
	Navsari	16	2009
	Portblair	1	2010
Moringa	Periyakulum	9	2011

Varieties or cultivars in current use have generally undergone a vigorous selection process by plant breeders for plant type, response to input, predictability of yield and are more or less homogeneous genetically. The released varieties possess a “highly tuned” set of elite genes but a considerably narrowed gene base against the foundation parents from which they have come. Ultimately these foundation stocks trace back to landraces in diverse parts of the world. The released advanced varieties most favoured by farmers are the ones most widely and frequently used as partners in current breeding programs for the next cycle of varieties. On average, varieties are replaced every 5 to 10 years, so they have a commercial lifetime of maybe 7 years. Some released varieties are knocked down by either pests or pathogens the year they are released, so there are no guarantees on the durability of new varieties.

In developing and developed countries the deep well for the genepool in landraces and farmer maintained varieties, which has been the foundation of the past breeding process, is disappearing. Current elite varieties yield better than the varieties they displace. Once a displaced variety is no longer planted, its genes are lost to future generations unless it is conserved. Primitive forms also are lost because of bad land use. Extinction of a species or a genetic line represents the loss of a unique resource. This type of genetic and environmental impoverishment is irreversible. Any reduction in the diversity of resources narrows society’s scope.

Vegetables that owe their origin to Indian gene centres include Brinjal (*Solanum melongena*) and allied non tuberiferous *Solanum* species, several of which have genes for crop improvement (e.g. *S. incanum*, *S. insanum*) or may have medical importance (e.g. *S. surattense*, and *S. khasianum* etc.). Similarly, okra (*Abelmoschus esculentus*) and other related species have good build up of diversity. Other vegetable crops of Indian origin include *Cucumis melo*, *Cucumis sativus*, *Luffa acutangula*, *Luffa cylindrica*, *Momordica charantea*, *Trichosanthes dioica*, *Lagenaria dicenaria*, *Cucurbita pepo*, *Citrus vulgaris* and *C. Ianatus*. Several leafy vegetables Amaranths, lettuce, *Convolvulus Fortulacca*, etc. exhibit remarkable variability. Taros -*Colocacia/Alocasia* and yams - *Dioscorea* species further enrich diversity in Indian tuber crops.

Considerable exchange of germplasm has taken place in the past and accelerated efforts have continued in the present times. ICAR has Memorandum of Understanding as well as bilateral agreements with several such international organisations and national programmes. The plant genetic resources activities are carried out by NBPGR through active involvement with them. The important bilateral programmes currently operative include those with USSR, China, Pakistan, Vietnam, Japan, USA, Canada, UK and several other countries in Europe and Africa.

Table 13: Sources of availability of the germplasm collections

Crop	India	Abroad
Tomato	IIVR, Varanasi; IARI Regional Station, Katrain; IARI, New Delhi; PAU, Ludhiana; HAU, Hissr; GBPUA&T, Pantnagar; CSAUA&T, Kanpur; NDU&T, Faizabad; BCKV, Kalyani; TNAU, Coimbatore; OUA&T, Bhubaneshwar; AAU, Anand; IIHR, Hessarghatta; KAU, Vellanikkara; YSPUA&F, Solan; MPKV, Rahuri	Australia, Bulgaria, Canada, Cuba, France, Germany, Italy, Netherland, Taiwan, USA, Russia, Denmark
Brinjal	IIVR, Varanasi; AAU, Jorhat; APAU, Hyderabad; CSAUA&T, Kanpur; AAU, Anand; GBPUA&T, Pantnagar; HAU, Hisar, IARI Reg. Station, Katrain, IARI, New Delhi, NDU&T, Faizabad; MPKV, Rahuri; OUA&T, Bhubaneshwar; TNAU, Coimbatore; IIHR, Hessarghatta; CHES, Ranchi; KAU, Vellanikara	Australia, Bangladesh, Brazil, Denmark, France, Hungary, Nigeria, Sri Lanka, Phillipines, USA, Russia

FOUR DECADES... ACCOMPLISHMENT OF AICRP ON VEGETABLE CROPS

Crop	India	Abroad
<i>Capsicum</i> spp.	IIVR, Varanasi; IARI, Reg. Station, Katrain; IARI, New Delhi; NBPGR; Amravati; APHU,RS,Lam; APHU, Hyderabad; PKV, Akola; MPKV, Rahuri; OUA&T, Bhubaneswar; PAU, Ludhiana; YSPUA&F, Solan; GBPUA&T, Pantnagar; TNAU, Coimbatore; IIHR, Hessarghatta; JNKVV, Jabalpur; DARL, Almora	Australia, Bulgaria, Czechoslovakia, Hungary, Italy, Netherland, Nigeria, Brazil, Taiwan, USA, Russia, Yeman, France, Germany, Sri Lanka
Pea	IIVR, Varanasi; IARI, Reg. Station, Katrain; IARI, New Delhi; PAU, Ludhiana; HAU, Hisar; GBPUA&T, Pantnagar; CSUA&T, Kanpur; NDUA&T, Faizabad; ARS, Durgapura; MPKV, Rahuri; JNKV, Jabalpur; YSPUA&F, Solan; IIHR, Hessarghatta; VPKAS, Almora; IIHR, Hessarghatta	Nordic Gene Bank, Lund, Sweden, Taiwan, Netherland, Italy, USA, Russia, Czechoslovakia, Germany
Cowpea	IIVR, Varanasi; BCKV, Kalyani; IARI, New Delhi; NDUA&T, Faizabad; PAU, Ludhiana; IIHR, Hessarghatta	IITA, Nigeria, USA, Brazil, Tanzania, Burkinpo Faso, Ghora, Kenya, Senegal, Haithi, Phillipines,
Frcnch bean	IIVR, Varanasi; IARI, Reg. Station, Katrain; IARI, New Delhi; YSPUA&F, solan; IIHR, Hessarghatta; ICAR, Res. Complex for NEH region, Barapani; CSK HPKV, Palampur; VPKAS, Almora	USA, Columbia, Canada, Netherland, Poland, Phillipines, Nigeria, Australia
<i>Allium</i> species	NBPGR, New Delhi; MPKV, Rahuri; TNAU, Coimbatore; NHRDF, Nasik; NHRDF, Karnal; UAS, Hebbal; IIHR, Hessarghatta; GBPUA&T, Pantnagar; IARI, New Delhi; PAU, Ludhiana; VPKAS, Almora; YSPUH&F, Solan	Austarlia, Brazil, Denmark, France, Germany, Hungary, Indonesia, Iran, Italy, Japan, Hethetland, Nigeria, Polanad, Syria, Taiwan, USA, USSR
Cucurbitaceaus species	IIVR, Varanasi; IARI, Regional Station, Katrain; IARI, New Delhi; PAU, Ludhiana; HAU, Hisar; GBPUA&T, Pantnagar; CSAUA&T, Kanpur; NDUA&T, Faizabad; BCKV, Kalyani; TNAU, Coimbatore; OUA&T, Bhubaneshwar; AAU, Anand; IIHR, Hessarghatta; KAU, Vellanikkara; YSPUA&F, Solan; MPKV, Rahuri	China, Japan, USA, Russia, Ghana, Namibia, South Africa, Brazil, Peru, Bulgaria, Mexico, Phillipines, Thailand, Indonesia, Hungary, Guatemala, Afganistan, Taiwan
Cole crops	IIVR, Varanasi; IARI, Regional Station, Katrain; GBPUA&T, Pantnagar; MPKV, Rahuri; YSPUA&F, Solan; IARI, New Delhi; PAU, Ludhiana	UK, Canada, France, Germany, Italy, Japan, Korea, Netherland, USA, Russia, Denmark, China
Root crops	IARI, Reg. Station, Katrain; IARI, New Delhi; PAU, Ludhiana; HAU, Hisar; CSAUA&T, Kanpur; TNAU, Coimbatore; IIHR, Hessarghatta; YSPUH&F, Solan	Korea, Japan, France, Hungary, Italy, Netherland, Poland, Taiwan, UK, USA, Russia, Australia, Brazil, China, Egypt
Okra	IIVR, Varanasi; NBPGR, New Delhi; Akola; Trichur; Jodhpur; PAU, Ludhiana; AAU, Anand; MAU, Parbhani; IIHR, Hessarghatta; HAU, Hisar; TNAU, Coimabtore; IARI, New Delhi	Sri Lanka, Bangladesh, Phillipines, Sudan, Senegal, Nigeria, Cote, d Ivoive, Brazil, China, Indonesia, Australia, Popua, New Guinea, USA