Inventory of ICAR-VPKAS Technologies

95 Years of Science and Technology for Hill Regions of India

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan

(An ISO 9001:2015 Certified Institute)

Almora - 263 601, Uttarakhand, India

www.vpkas.icar.gov.in

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Edited By

Kushagra Joshi
Arunava Pattanayak
Renu Jethi
Johnson Stanley

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Director
ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan
Almora-263 601, Uttarakhand

Contributors

Head and Scientists of Crop Improvement Division
Head and Scientists of Crop Production Division
Head and Scientists of Crop Protection Section
Head and Scientists of Social Science Section

Assistance

Mrs. Renu Sanwal, T.O., PME Cell

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For Technology licensing, the manufacturers may contact:

The Director

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan

Almora-263 601 (Uttarakhand)

Telephone (O): (05962) 230208, 241012, Fax: (05962) 231539

E mail: director.vpkas@icar.gov.in, vpkas@nic.in

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Venus Printers and Publishers, B-62/8, Naraina Industrial Area, Phase II New Delhi 110 028
Phone: 45576780, Mobile : 98100 89097, E-mail: pawannanda2000@yahoo.co.in; pawannanda@gmail.com

PREFACE

The unique ecological entity and topographical diversities are the exclusive characteristics of the hill and mountain regions. Dominant features of hill farming namely small holdings, sharp variations in altitude and ecology, slopy land vulnerable to high soil erosion and rainfall-dependence makes it necessary to develop technologies specific to a microenvironment. Apart from this, a plethora of new challenges is also emerging.

During the recent past, weather patterns all over the world have changed and North-Western Himalaya is no exception. Agricultural production environment, being a dynamic entity, has kept evolving continuously. The present phase of changes being encountered by the agricultural sector, such as gradually reducing availability of quality water, nutrient deficiency in soils, climate change, farm energy availability, loss of biodiversity, emergence of new pest and diseases, fragmentation of farms, rural-urban migration, new IPRs and trade regulations, are some of the new challenges.

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora is working tirelessly for technology development and their efficacy demonstration to meet the challenges of hill agriculture. In its quest, the institute has developed more than 158 varieties and hybrids of different crops with suitable package of practices. The institute has also been disseminating location-specific technologies to the farmers to achieve an increased and sustainable crop production. The research efforts of the institute led to the development of high yielding, disease resistant varieties suited for rainfed and irrigated conditions; development of suitable crop production and protection technologies; conservation and management of rain water and nutrients; fodder production and dissemination of improved technology to the farmers of the region. In addition, significant contributions in the improvement of hill crops as well as resource and pest management have been made. Topography-specific farm mechanization and light weight tools and equipment have been developed, which will play a major role in increasing productivity along with reducing drudgery. Suitable species of fodder grasses, legumes and trees have been identified to fulfill the forage deficiency in hills.

Technologies that can contribute to an economically efficient farm sector and the financial viability for farmers while improving environmental performance and which are socially acceptable will provide "triple dividends" to sustainability. These location-specific technologies are required to be promoted and popularized among the farmers on a massive scale so that effective and wider diffusion of these technologies put forth a suitable strategy for ensuring holistic and sustainable development of hill agriculture.

This inventory includes the location–specific technologies developed/designed for hill agriculture, their importance, specifications, brief description and benefits/ advantages. It is presumed that introduction of these technologies, if promoted well, will make meaningful contributions to improve the hill farm economy and make hill agriculture move along the sustainability trajectory. A number of these technologies are also available for licensing at a nominal price to help entrepreneurs. We believe that this inventory will be of great use to researchers, extension personnel, research and development specialists in addressing the needs of farmers of hill terrains and transform hill agriculture to new heights through proper diffusion of these frontier technologies as a catalyst of change.

(Authors)

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Varieties of Crops and Vegetables

1 Maize

Technology 1

Vivek QPM 9

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hills), North-Eastern Hill region, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu
Notification no. and date	:	S.O. 2458 (E) 16.10.2008
Description/ Features of the variety developed	:	• QPM Version of Vivek 9 developed from the cross VQL 1 x VQL 2 • Plant height is 160-170 cm • Matures in 85-90 days • Cobs are long and cylindrical with good husk cover • Grains are medium bold (average 1000 grain weight: 325 g), yellow in colour and semi-flint in texture • Contains Tryptophan 0.83% (compared to 0.59% in Vivek 9), Lysine 4.19%, Fe 37 ppm and Zn 29 ppm
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Moderately tolerant to Turcicum and Maydis Leaf Blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. R Babu, HS Gupta, V Mahajan, VP Mani, Sudha K Nair, PK Agrawal, Mr. KS Koranga, Dr. GS Bisht, Mr. MC Pant, Drs. KA Gopinath, SK Pant and S Saha

Vivek Maize Hybrid 27

Notified for	:	Eastern UP, Bihar, Jharkhand, Orissa, West Bengal, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu
Notification no. and date	:	S.O. 1703 (E) 05.10.2007
Description/ Features of the variety developed	:	• Developed from the cross V 335 x V 345 • Plant height is 160-170 cm • Matures in 80-85 days • Cobs are long and cylindrical with good husk cover. • Grain is medium bold (average 1000 grain weight: 300 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Moderately tolerant to Turcicum and Maydis Leaf Blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, R Babu, VP Mani, HS Gupta, Mr. KS Koranga, Dr. GS Bisht, Mr. MC Pant and Dr. SK Pant

Vivek Maize Hybrid 33

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hills) and NE Hill Region (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura)
Notification no. and date	:	S.O. 2458 (E) 16.10.2008
Description/ Features of the variety developed	:	• Developed from the cross V 372 x CM 212 • Plant height is 200-210 cm • Matures in 85-90 days • Cobs are long and cylindrical with good husk cover • Grains are medium bold (average 1000-grain weight 265 gm), yellow in colour and dent in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 55-60 q/ha
Specific benefits and impact	:	Tolerant to Banded leaf & sheath blight and brown strip downy mildew
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, R Babu, VP Mani, HS Gupta, Mr. KS Koranga, Dr. GS Bisht, Mr. MC Pant, Drs. SK Pant and KA Gopinath

Vivek Sankul Makka 35

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hills) and NE Hill Region (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura)
Notification no. and date	:	S.O. 2187 (E) 27.08.2009
Description/ Features of the variety developed	:	• Selection from EYHP 1 • Plant height is 205-215 cm • Matures in 85-90 days • Cobs are long and cylindrical with good husk cover • Grains are medium bold, yellow in colour and flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 40-45 q/ha
Specific benefits and impact	:	Tolerant to Turcicum leaf blight
Unit cost	:	Breeder seed costs Rs. 69 per kg
Developed and Tested by	:	Drs. V Mahajan, HS Gupta, VP Mani, Dr. GS Bisht, Mr. MC Pant, Drs. SK Pant and JK Bisht

Vivek Maize Hybrid 39

Notified for	:	Himachal Pradesh and Uttarakhand
Notification no. and date	:	S.O. 456 (E) 16.03.2012
Description/ Features of the variety developed	:	• Developed from the cross V 373 x CM 212 • Plant height is 195-200 cm • Matures in 85-90 days • Cobs are long and cylindrical with good husk cover • Grain is bold (average 1000 grain weight: 335 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 65-70 q/ha
Specific benefits and impact	:	Tolerant to Turcicum and Maydis Leaf Blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, HS Gupta, VP Mani, Dr. GS Bisht, Mr. MC Pant, Drs. SK Pant, JK Bisht and D Mahanta

Vivek Maize Hybrid 43

Notified for	:	Uttar Pradesh, Madhya Pradesh and Rajasthan
Notification no. and date	:	S.O. 13 (E) 16.03.2012
Description/ Features of the variety developed	:	• Developed from the cross V 373 x V 341 • Plant height is 160-170 cm • Matures in 80-85 days • Cobs are long and cylindrical with good husk cover • Grain is bold (average 1000 grain weight: 335 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Tolerant to Turcicum and Maydis Leaf Blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, HS Gupta, VP Mani, Dr GS Bisht, Mr. MC Pant, Drs. SK Pant and JK Bisht

Vivek Sankar Makka 45

Notified for	:	Jammu & Kashmir, Himachal Pradesh and Uttarakhand
Notification no. and date	:	S.O. 312 (E) 01.02.2013
Description/ Features of the variety developed	:	• Developed from the cross V 373 x V 390 • Plant height is 200-205 cm • Matures in 85-90 days • Cobs are long and cylindrical with good husk cover • Grain is bold (average 1000 grain weight: 335 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Tolerant to Turcicum and Maydis Leaf Blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, PK Agrawal, SK Jha, GS Bisht, Mr. MC Pant, Drs. D Mahanta and Chandrashekara C

Vivek Maize Hybrid 47

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura
Notification no. and date	:	S.O. 1919 (E) 30.07.2014
Description/ Features of the variety developed	:	• Developed from the cross V 373 x V 391 • Plant height is 200-210 cm • Matures in 90-95 days • Cobs are long and cylindrical with good husk cover • Grain is medium bold (average 1000 grain weight: 310 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Moderately resistant to Turcicum and Maydis Leaf Blight, and resistant to Post-flowering Stalk Rot (PFSR) and Brown Stripe Downy Mildew (BSDM).
Unit cost		Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. PK Agrawal, HS Gupta, SK Jha, V Mahajan, JC Bhatt, GS Bisht, Mr. MC Pant, Drs. Chandrashekara and D Mahanta

Vivek Maize Hybrid 51

Notified for	:	Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh
Notification no. and date	:	S.O. 1919 (E) 30.07.2014
Description/ Features of the variety developed	:	• Developed from the cross V 405 x V 409 • Plant height is 160-170 cm • Matures in 80-85 days • Cobs are long and cylindrical with good husk cover • Grain is bold (average 1000 grain weight: 375 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Moderately resistant to Post-flowering stalk rot, Rajasthan downy mildew and shoot borer *(Chilo partellus)*
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. PK Agrawal, SK Jha, V Mahajan, HS Gupta, JC Bhatt, GS Bisht, Mr. MC Pant, Drs. Chandrashekara and D Mahanta

Vivek Maize Hybrid 53

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura
Notification no. and date	:	S.O. 1919 (E) 30.07. 2014
Description/ Features of the variety developed	:	• Developed from the cross 407 x V 409 • Plant height is 185-195 cm in mid-hills and 150-160 cm in plains • Matures in 85-90 days in mid-hills and in 80-85 days in plains • Cobs are long and cylindrical with good husk cover • Grain is bold (average 1000 grain weight: 370 g), yellow in colour and semi-flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Moderately resistant to Turcicum and Maydis leaf blight, Common rust, Post-flowering stalk rot and Brown stripe downy mildew
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. PK Agrawal, SK Jha, V Mahajan, HS Gupta, JC Bhatt, GS Bisht, Mr. MC Pant, Drs. Chandrashekara C and D Mahanta

VL Maize Hybrid 57

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hills) and NE Hill Region (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura)
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Developed from the cross V 412 x V 433 • Plant height is 190-200 cm • Matures in 95-100 days • Cobs are long and cylindrical with good husk cover • Grains are medium bold (average 1000 grain weight: 280 g), yellow in colour and flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 60-65 q/ha
Specific benefits and impact	:	Moderately resistant to Turcicum and Maydis leaf blight
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, HS Gupta, PK Agrawal, SK Jha, RK Khulbe, A Pattanayak, Dr. GS Bisht, Mr. MC Pant, Drs. Rajashekara C, Chandrashekara C, D Mahanta, Mr. DS Panchpal and GS Bankoti

VL Amber Popcorn

Notified for	:	Uttarakhand (Hills)
Notification no. and date	:	S.O. 19 (E) 14.01.1982
Description/ Features of the variety developed	:	• Developed through mass selection from a released popcorn population Amber developed by compositing six popcorn inbreds • Plant height is 190-195 cm • Matures in 100-105 days • Cobs are conico-cylindrical with good husk cover • Grain is small (average 1000 grain weight: 160 g), bright orange in colour and flint in texture
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-25 q/ha
Specific benefits and impact	:	Moderately tolerant to Turcicum leaf blight
Unit cost	:	Breeder seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. VP Mani, HC Joshi and JP Tandon

VL Baby Corn 1

Notified for	:	All over India
Notification no. and date	:	S.O. 122 (E) 02.02.2005
Description/ Features of the variety developed	:	• Developed by recurrent selection after two backcrosses from two elite populations VL Makka 16 and Murulia • Plant height is 205-210 cm in mid-hills and 175-180 cm in plains • Ready for harvest in 50-52 days in mid-hills and 48-50 days in plains. Cobs are conico-cylindrical with good husk cover • Average length of baby corn is 7.5-8.0 cm, diameter is 1.3-1.5 cm and colour is light yellow
Input required	:	Seeds of the variety
Output capacity	:	Average yield (dehusked baby corn ear) is 12-15 q/ha
Specific benefits and impact	:	• Moderately tolerant to Turcicum leaf blight • 325-385 q/ha green fodder can also be obtained
Unit cost	:	Breeder seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. VP Mani, R Singh, R Babu, AK Pandey, SK Pant, Mr. KS Koranga and GS Bisht

CMVL Baby Corn 2

Notified for	:	All maize growing states
Notification no. and date	:	S.O. 1007 (E) 30.03.2017
Description/ Features of the variety developed	:	• Developed by cross of V 335 x V 345 • Plant height is 190-200 cm in mid-hills and 160-170 cm in plains • Ready for harvest in 52-54 days in mid-hills and 48-52 days in plains • Average length of baby corn is 7.5-8.5 cm, diameter is 1.3-1.5 cm with regular seed rows
Input required	:	Seeds of the variety
Output capacity	:	Average yield (dehusked baby corn ear) is 18-20 q/ha
Specific benefits and impact	:	Tolerant to Turcicum leaf blight
Unit cost	:	Hybrid seed costs Rs. 200 per kg
Developed and Tested by	:	Drs. V Mahajan, R Babu, HS Gupta, PK Agrawal, SK Jha, RK Khulbe, SK Pant, Chandrashekara C, D Mahanta, Mr. KS Koranga, Dr. GS Bisht, Mr. MC Pant, NC Belwal and GS Bankoti

Central Maize VL 55

Notified for	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand, North East Hills, Tamil Nadu, Maharashtra, Karnataka, Telangana and Andhra Pradesh
Notification no. and date	:	S.O. 1007 (E) 30.03.2017
Description/ Features of the variety developed	:	• Developed by cross of V407 x V405 • Plant height is 185-190 cm in mid-hills and 150-160 cm in plains • Ready for harvest in 95-100 days in mid-hills and 85-90 days in plains • Corn is yellow in colour and semi flint, bold and round in shape
Input required	:	Seeds of the variety
Output capacity	:	Average yield is 60-65 q/ha
Specific benefits and impact	:	Moderately resistant to Maydis leaf blight, common rust and post-flowering stalk rot
Unit cost	:	Hybrid seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. V Mahajan, HS Gupta, PK Agrawal, SK Jha, RK Khulbe, D Mahanta, Chandrashekara C, Mr. GS Bisht, MC Pant, NC Belwal and GS Bankoti

Central Maize VL Sweet Corn 1

Notified for	:	All major maize growing states except Eastern states
Notification no. and date	:	S.O. 3540 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed by cross of VSL 16 x VSL 4 • Plant height is 200-210 cm in mid-hills and 165-175 cm in plains • Ready for harvest in 75-77 days in mid-hills and 72-75 days in plains • Grain is creamish white in colour with TSS 15.5-16% • Cob length is 18-20 cm, girth is 14-15 cm, weight 220-240 g with straight grain rows
Input required	:	Seeds of the variety
Output capacity	:	Average yield is 60-65 q/ha
Specific benefits and impact	:	Tolearnt to Turcicum leaf blight
Unit cost	:	Hybrid seed costs Rs. 700 per kg
Developed and Tested by	:	Drs. PK Agrawal, SK Jha, Chandrashekara C, GS Bisht, Mr. MC Pant and GS Bankoti

VL 804

Notified for	:	Timely sown rainfed (before 30th October) and irrigated (1-15th November) conditions of hills of Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Manipur and West Bengal
Notification no. and date	:	S.O. 937 (E) 04.09.2002
Description/ Features of the variety developed	:	• Developed from a three way cross and the pedigree is CPAN 3018/CPAN 3004//PBW 65 • Has light wax on whole plant body including ears at ear emergence • Ears are tapering and fully awned • Plant height is 92-100 cm • Flowers at 121-130 days and matures in 164-178 days • Grains are amber, medium bold (average 1000 grain weight: 37 g), semi-hard and ovoid in shape • Protein content is 11.05-11.60%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 25-30 q/ha (Rainfed) and 40-45 q/ha (Irrigated)
Specific benefits and impact	:	• Highly resistant to yellow and brown rusts • Good germination even under low moisture condition
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Jag Shoran, Lakshmi Kant, AS Hariprasad, SK Pant, Mr. BD Pandey, Dayashanker, Dr. AK Pandey and Mr. PC Pant

VL Gehun 802

Notified for	:	Timely sown rainfed (before 30th October) and irrigated (1-15th November) conditions of Hills of Uttarakhand
Notification no. and date	:	S.O. 122 (E) 02.02.2005
Description/ Features of the variety developed	:	• Developed from a three way cross and the pedigree is CPAN 3018/CPAN 3004//PBW 65 • Has light wax on whole plant body including ears at ear emergence • Ears are tapering and fully awned • Plant height is 90-100 cm • Flowers at 121-130 days and matures in 155-165 days • Grains are amber, medium bold (average 1000 grain weight: 38 g), semi-hard and ovoid in shape • Protein content is 11.35-12.20%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 25-30 q/ha (Rainfed) and 40-45 q/ha (Irrigated)
Specific benefits and impact	:	• Highly resistant to yellow and brown rusts and resistant to loose smut and hill bunt diseases • Good germination even under low moisture condition
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, Jag Shoran, AS Hariprasad, SK Pant, HS Gupta, Mr. BD Pandey, Dayashanker, Dr. AK Pandey and Mr. PC Pant

VL Gehun 829

Notified for	:	Early sown rainfed (before 10th October) conditions of Northern Hill Zone
Notification no. and date	:	S.O. 283 (E) 12.03.2003
Description/ Features of the variety developed	:	• Developed from a three way cross and the pedigree is IBWSN149/CPAN 2099 • Has wax on whole plant body including ears at ear emergence • Plant height is 80-100 cm • Flowers at 140-160 days and matures in 200-218 days • Fully awned, bold and tapering spikes which get inclined slightly to downwards at maturity • Grains are amber, medium bold (average 1000 grain weight: 45 g), semi-hard and ovoid in shape • Protein content is 11.38%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 25-30 q/ha (Rainfed) and 40-45 q/ha (Irrigated)
Specific benefits and impact	:	• Dual (green fodder and grain) purpose variety, provides 70-80 q/ha of green fodder in 70-90 days after sowing under medium fertility limited irrigated condition in hills and 50 q/ha fodder in plains • Highly resistant to yellow and brown rusts and resistant to loose smut and hill bunt diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, Jag Shoran, AS Hariprasad, SK Pant, HS Gupta, Mr. BD Pandey, Dayashanker, Drs. AK Pandey, JK Bisht and Mr. PC Pant

VL Gehun 832

Notified for	:	Timely sown rainfed (before 30th October) conditions of high altitude (>1700 M) of Northern Hill Zone
Notification no. and date	:	S.O. 161 (E) 04.02.2004
Description/ Features of the variety developed	:	• Developed from a two way cross and the pedigree is PBW 65/CPAN 3031 • Has heavy wax on whole plant body excluding ears at ear emergence • Fully awned and tapering brown colour spikes, inclined slightly to downwards at maturity • Plant height is 90-105 cm • Flowers at 131 days and matures in 183 days • Grains are amber, medium bold (average 1000 grain weight: 48 g), semi-hard and ovoid in shape • Protein content is 10.50%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 24 q/ha
Specific benefits and impact	:	Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, Mr. BD Pandey, Dayashanker and Dr K Pandey

VL Gehun 892

Notified for	:	Late sown rainfed (after November) conditions of Northern Hill Zone
Notification no. and date	:	S.O. 1108 (E) 08.05.2008
Description/ Features of the variety developed	:	• Developed from a two way cross and the pedigree is WH 542/PBW 226 • Has light wax on whole plant body including ears at ear emergence, is fully awned and has tapering spikes • Plant height is 76-83 cm • Flowers at 106 days and matures in 143 days • Grains are amber, medium bold (average 1000 grain weight: 36 g), semi-hard and ovoid in shape • Protein content is 10.69%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 24 q/ha
Specific benefits and impact	:	• Can be sown upto January month • Possesses high Zn (35.7 ppm), Cu (4.79 ppm) and Mn (49.8 ppm) • Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, V Mahajan, Mr. BD Pandey, Dayashanker, Dr Gopinath KA and Mr. GS Bankoti

VL Gehun 907

Notified for	:	Timely sown rainfed (before 30th October) and irrigated (1-15th November) conditions of hills of Uttarakhand, Himachal Pradesh, Jammu & Kashmir Manipur and West Bengal
Notification no. and date	:	S.O. 733 (E) 01.04.2010
Description/ Features of the variety developed	:	• Developed from a three way winter x spring cross and the pedigree is DYBR1982-83/842ABVD50/VW9365//PBW343 • Has wax on whole plant body including ears at ear emergence, is fully awned (long) and has tapering spikes • Plant height is 82-97 cm • Flowers at 121-124 days and matures in 167-180 days • Grains are amber, medium bold (average 1000 grain weight: 39-41 g), semi-hard and ovoid in shape • Protein content is 10.29 to 11.62%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 24-30 q/ha (Rainfed) and 45-47 q/ha (Irrigated)
Specific benefits and impact	:	• Possesses stay green trait and has better tolerance to low moisture conditions • Possesses high Fe (43.5 to 45.2 ppm), Zn (35.4 to 36.3 ppm), Cu (5.12 to 5.29 ppm) and Mn (41.8 to 42.5 ppm) • Highly resistant to yellow and brown rusts disease
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, JC Bhatt, V Mahajan, HS Gupta, Dibakar Mahanta, Mr. BD Pandey, Dayashanker, GS Bankoti and LD Malkani

VL Gehun 953

Notified for	:	Timely sown organic irrigated (1-15th November in hills) and timely sown irrigated (last week of October to 15th November in Plains) conditions of Uttarakhand
Notification no. and date	:	S.O. 3540 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed from a winter x spring cross and the pedigree is VW 0185/ DORADE 5 • Has medium wax on whole plant body including ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 85-90 cm • Flowers at 120-124 days and matures in 160-170 days • Grains are amber, bold (average 1000 grain weight: 46-48 g), semi-hard and ovoid in shape
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 24 q/ha
Specific benefits and impact	:	Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, SK Jain, Raghu BR, Mr. BD Pandey, Dayashanker, GS Bankoti, Dr D Mahanta and Mr. LD Malkani

VL Gehun 967

Notified for	:	Timely sown organic rainfed(15-13th October) and timely sown conditions in hills of Uttarakhand
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Developed through introduction and SHARP/3/PRL/SARAJ/TSIA/EE#5/5/VEE/LIRNIBOWI3IBCNI4IKAUZ#4 • Has high wax on whole plant body including ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 78-80 cm • Flowers at 120-125 days and matures in 165-170 days • Grains are amber, bold (average 1000 grain weight: 45-48 g), semi-hard and ovoid in shape
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 18-20 q/ha
Specific benefits and impact	:	Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, SK Jain, Raghu BR, Mr. BD Pandey, Dayashanker, GS Bankoti and Dr D Mahanta

VL Gehun 3004

Notified for	:	Late sown irrigated (after November) conditions in plains of Uttarakhand
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Developed from a cross HD 2844/PBW 486 • Has medium wax on whole plant body including ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 85-90 cm • Flowers at 80-85 days and matures in 120-123 days • Grains are amber, bold (average 1000 grain weight: 50 g), semi-hard and oblong in shape
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 40-45 q/ha
Specific benefits and impact	:	Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, SK Jain, Raghu BR, Mr. BD Pandey, Dayashanker, GS Bankoti and Dr D Mahanta

VL Gehun 2014

Notified for	:	Timely sown irrigated (November) conditions in plains of Uttarakhand
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Developed from Selection from Sale 6 (4TH SRR DSBWYT-40) • Has highwax on whole plant body excluding ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 90-95 cm • Flowers at 82-86 days and matures in 135-140 days • Grains are amber, bold (average 1000 grain weight: 40-45 g), semi-hard and ovoid in shape
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 50-55 q/ha
Specific benefits and impact	:	Highly resistant to yellow and brown rusts diseases
Unit cost	:	Breeder seed costs Rs. 65.20 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, SK Jain, Raghu BR, Mr. BD Pandey, Dayashanker, GS Bankoti and Dr D Mahanta

3 Barley

Technology 27

VLB 56

Notified for	:	Timely sown rainfed (before 15th November) organic conditions of hills of Uttarakhand
Notification no. and date	:	S.O. 122 (E) 02.02.2005
Description/ Features of the variety developed	:	• Developed from a two way cross and the pedigree is Morocco/VLB1 • Has light wax on whole plant body including ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 80 cm • Flowers at 124 days and matures in 150-155 days • Grains are hulled, medium (average 1000 grain weight: 30-32 g) and yellow in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 15-20 q/ha
Specific benefits and impact	:	• Highly resistant to yellow rust and stripe diseases • Suitable for organic conditions
Unit cost	:	Breeder seed costs Rs. 70.50 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, HS Gupta, Mr. NK Pathak, GS Bankoti, Drs. Jag Shoran, AS Hariprasad, AK Pandey and Mr. PC Pant

VLB 85

Notified for	:	Timely sown rainfed (before 15th November) organic conditions of hills of Uttarakhand
Notification no. and date	:	S.O. 1703 (E) 05.10.2007
Description/ Features of the variety developed	:	• Developed from a two way cross and the pedigree is HBL 348/VLB 49 • Has light wax on whole plant body including ears at ear emergence, fully awned and tapering spikes • Plant height is 80-85 cm • Flowers at 120-124 days and matures in 155-160 days • Grains are hulled, medium (average 1000 grain weight: 32 g) and yellow in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-25 q/ha
Specific benefits and impact	:	Resistant to yellow rust and stripe disease
Unit cost	:	Breeder seed costs Rs. 70.50 per kg
Developed and Tested by	:	Drs. Lakshmi Kant,V Tewari, SK Pant, V Mahajan, HS Gupta, Mr. NK Pathak, GS Bankoti and KA Gopinath

VL Jau 118

Notified for	:	Timely sown rainfed (before 15th November) organic conditions of hills of Uttarakhand
Notification no. and date	:	S.O. 1146 (E) 27.04.2014
Description/ Features of the variety developed	:	• Selected from an international nursery 14th EMBSN-9313 • Has light wax on stem, fully awned and has parallel spikes • Plant height is 80 cm • Flowers at 115-120 days and matures in 160-165 days • Grains are hulled, medium (average 1000 grain weight: 41 g) and yellow in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 28-30 q/ha
Specific benefits and impact	:	Highly resistant to yellow rust and stripe disease
Unit cost	:	Breeder seed costs Rs. 70.50 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Jain, JC Bhatt, Dibakar Mahanta, Mr. NK Pathak, GS Bankoti and LD Malkani

VLB 94

Notified for	:	Timely sown rainfed (before 15th November) organic conditions of hills of Uttarakhand
Notification no. and date	:	S.O. 3540 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed from a two way cross and the pedigree is DL 237/VLB 58 • Has light wax on whole plant body including ears at ear emergence, fully awned and tapering spikes • Plant height is 65-70 cm • Flowers at 115-125days and matures in 160-170 days • Grains are hulled, medium (average 1000 grain weight: 41 g) and yellow in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 18-20 q/ha
Specific benefits and impact	:	• Resistant to yellow rust and stripe diseases • Suitable for organic conditions
Unit cost	:	Breeder seed costs Rs. 70.50 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Pant, JC Bhatt, D Mahanta, NK Pathak, LD Malkani and GS Bankoti

VLB 130

Notified for	:	Timely sown rainfed (before 15th November) organic conditions of hills of Uttarakhand
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Developed from selection from IBON-HI-107(MSEL//BUCK.M.8.88/E. ACACIA) • Has high wax on whole plant body excluding ears at ear emergence, fully awned (long) and tapering spikes • Plant height is 65-70 cm • Flowers at 105-110 days and matures in 150-155 days • Grains are hulled, medium (average 1000 grain weight: 40-45 g)and yellow in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-22 q/ha
Specific benefits and impact	:	• Resistant to yellow rust and stripe diseases • A dual purpose (green fodder cum grain) variety which gives 25-27 q/ha green fodder under rainfed conditions when cut after 70 days after sowing by leaving 2.5" from the ground
Unit cost	:	Breeder seed costs Rs. 70.50 per kg
Developed and Tested by	:	Drs. Lakshmi Kant, SK Jain, Raghu BR, NK Pathak, GS Bankoti and Dibakar Mahanta

VL Dhan 81

Notified for	:	Irrigated transplanted conditions in the hills of Uttarakhand, Himachal Pradesh and Meghalaya
Notification no. and date	:	S.O. 425 (E) 08.06.1999
Description/ Features of the variety developed	:	• Developed from the cross of China 988 x HPU 741 • Has straw coloured bold grain (average 1000 grain weight: 25.90 g) • Plant height is 90-95 cm • Matures in 115-120 days
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 45-50 q/ha
Specific benefits and impact	:	Resistant to leaf and neck blast disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, VS Chauhan, JC Bhatt, KD Koranne, Prem Singh, JV Prasad, Mr. SK Pant, PC Verma and Devendra Lal

Vivek Dhan 82

Notified for	:	Irrigated transplanted conditions in the hills of Uttarakhand, Himachal Pradesh and Meghalaya
Notification no. and date	:	S.O. 1134 (E) 15.11.2001
Description/ Features of the variety developed	:	• Developed from the cross of VL Dhan 221 x UPR 82-1-7 • Has straw coloured bold grain (average 1000 grain weight: 31.96 g) • Plant height is 116-136 cm • Matures in 120-125 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 40-45 q/ha
Specific benefits and impact	:	Resistant to blast disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, JC Bhatt, HS Gupta, Subhash Chandra, SK Pant, Mr. PC Verma and Devendra Lal

VL Dhan 85

Notified for	:	Irrigated transplanted conditions of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of HPU 799 x VL Dhan 221 • Has straw coloured bold grain (average 1000 grain weight: 23.40 g) • Plant height is 115-120 cm • Matures in 118-120 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 40-45 q/ha under organic condition
Specific benefits and impact	:	• Resistant to blast, brown leaf spot and leaf scald diseases • Resistant to lodging
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, Rajesh Singh, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 86

Notified for	:	Irrigated transplanted conditions in the hills of Uttarakhand and Himachal Pradesh
Notification no. and date	:	S.O. 122 (E) 06.02.2007
Description/ Features of the variety developed	:	• Developed from the cross of VL Dhan 16 x VL Dhan 221 • Has small bold grain (average 1000 grain weight: 26.90 g) • Plant height is 110-120 cm • Matures in 112-120 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 45-50 q/ha
Specific benefits and impact	:	Resistance against leaf and neck blast disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 61

Notified for	:	Irrigated transplanted conditions of Uttarakhand and Himachal Pradesh hills
Notification no. and date	:	S.O. 401 (E) 15.05.1998
Description/ Features of the variety developed	:	• Developed from the cross of Jaya x Ta-poo-choz • Has small bold grain (average 1000 grain weight: 26.50 g) • Plant height is 110-120 cm • Matures in 130-135 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 45-55 q/ha
Specific benefits and impact	:	Resistance against leaf and neck blast disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, VS Chauhan, JC Bhatt, KD Koranne, Prem Singh, JV Prasad, PC Verma and Devendra Lal

Vivek Dhan 62

Notified for	:	Irrigated transplanted condition in the hills of Uttarakhand, Himachal Pradesh, Manipur and West Bengal
Notification no. and date	:	S.O. 92 (E) 02.02.2001
Description/ Features of the variety developed	:	• Developed from the cross of China 4 x BG 367-4 • Has small bold grain (average 1000 grain weight: 24.20 g) • Plant height is 100-105 cm • Matures in 125-130 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 45-55 q/ha
Specific benefits and impact	:	Resistance against leaf and neck blast, sheath rot and leaf scald
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, JC Bhatt, Subhash Chandra, Mr. SK Pant, PC Verma and Devendra Lal

VL Dhan 65

Notified for	:	Irrigated transplanted conditions of Uttarakhand hills.
Notification no. and date	:	S.O. 122 (E) 06.02.2007
Description/ Features of the variety developed	:	• Developed from the cross of Himalaya 2 x VL Dhan 16 • Has long slender grain (average 1000 grain weight: 23.20 g) • Plant height is 125-130 cm • Matures in 130-135 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 45-50 q/ha under organic condition
Specific benefits and impact	:	Tolerance against leaf and neck blast and resistance against brown leaf spot and sheath rot disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, Rajesh Singh, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 68

Notified for	:	Irrigated transplanted conditions in the mid hills of Uttarakhand and Meghalaya
Notification no. and date	:	S.O. 1919 (E) 30.07.2014
Description/ Features of the variety developed	:	• Developed from the cross of VL 3861/SR 1818BF-4B-1-2-1-2 • Has long slender grain (average 1000 grain weight: 24.27 g) • Plant height is 110-120 cm • Matures in 125-130 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 45-50 q/ha
Specific benefits and impact	:	Resistant to leaf and neck blast diseases
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. PK Agrawal, JP Aditya, JC Bhatt, BM Pandey, KK Mishra, J Stanley, Mr. Devendra Lal and JK Arya

VL Dhan 207

Notified for	:	Spring sown rainfed upland (Chaiti or Chetki) condition of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of VL Dhan 206 / Annada • Has long slender grain (average 1000 grain weight: 22.50 g) • Plant height is 100-110 cm • Matures in 155-160 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 15-20 q/ha
Specific benefits and impact	:	Moderately resistant to leaf and neck blast, leaf scald and false smut and resistance to stem borer and leaf folder
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, Rajesh Singh, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 208

Notified for	:	Spring sown rainfed upland (Chaiti or Chetki) conditions of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of VR 410-19 / VR 212 • Has short bold grain (average 1000 grain weight: 22.80 g) • Plant height is 100-110 cm • Matures in 160-165 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 19-20 q/ha under organic condition
Specific benefits and impact	:	Moderately resistant to blast, brown leaf spot, leaf scald, false smut and resistance against stem borer and leaf folder
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, Rajesh Singh, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 209

Notified for	:	Spring sown rainfed upland (Chaiti or Chetki) condition of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of Himdhan/K 39//VL Dhan 221 • Has short bold grain (average 1000 grain weight: 22.16 g) • Plant height is 110-120 cm • Matures in 155-160 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 17-20 q/ha under organic condition
Specific benefits and impact	:	Resistant to leaf, neck blast, stem borer, leaf folder and tolerance to brown leaf spot, leaf scald and false smut
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, SK Shukla, ON Singh, Sandeep Kumar, Rajesh Singh, HS Gupta, JC Bhatt, Subhash Chandra, SN Sushil, Pramod Kumar, Mr. PC Verma and Devendra Lal

Vivek Dhan 154

Notified for	:	June sown rainfed upland condition of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of VL Dhan 221 x VL 24 • Has medium bold grain (average 1000 grain weight: 23.80 g) • Plant height is 95-110 cm • Matures in 100-110 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 16-25 q/ha under organic condition
Specific benefits and impact	:	Resistant to leaf and neck blast, brown leaf spot, leaf scald, stem borer and leaf folder
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, ON Singh, Rajesh Singh, JC Bhatt, Subhash Chandra, SK Pant, Pramod Kumar, Mr. PC Verma and Devendra Lal

VL Dhan 157

Notified for	:	Rainfed upland June sown condition in lower hills of Meghalaya and medium elevated hills of Uttarakhand
Notification no. and date	:	S.O. 1919 (E) 30.07.2014
Description/ Features of the variety developed	:	• Developed from the cross of VR 9588/A-57 • Has light yellow, short bold awnless grain (average 1000 grain weight: 23.20 g) • Plant height is 95-105 cm • Matures in 100-110 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 20-25 q/ha in lower hills Meghalaya and 18-20 q/ha in medium hills of Uttarakhand
Specific benefits and impact	:	Resistant to leaf and neck blast
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. PK Agrawal, JP Aditya, JC Bhatt, BM Pandey, KK Mishra, J Stanley, Mr. Devendra Lal and JK Arya

VL Dhan 156

Notified for	:	June sown rainfed upland areas of Uttarakhand hills, up to 1300 meters amsl altitude
Notification no. and date	:	S.O. 3540 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed from the cross of VR 539-2 / VL 89-6036 // VL 6036 • Has straw coloured, long slender, awnless grain (average 1000 grain weight: 20 g) • Plant height is 95-100 cm • Matures in 115-120 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 20-25 q/ha under organic conditions of Uttarakhand
Specific benefits and impact	:	Resistant to leaf and neck blast
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. RK Sharma, JP Aditya, PK Agrawal, ON Singh, JC Bhatt, BM Pandey, J Stanley, Mr. Devendra Lal, PC Verma, JK Arya, JS Bisht, KS Rawat and Anand Singh

VL Dhan 158

Notified for	:	Rainfed upland areas of Uttarakhand and Himachal Pradesh hills up to 1300 meters amsl altitude
Notification no. and date	:	S.O. 1007 (E) 30.03.2017
Description/ Features of the variety developed	:	• Developed from the cross of RCPL 1-45/VL 3861 • Has light yellow, short bold awnless grain (average 1000 grain weight: 21.25 g) • Plant height is 102-124 cm • Matures in 110-120 days
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 25-30 q/ha in lower hills Himachal Pradesh and 15-25 q/ha in medium hills of Uttarakhand
Specific benefits and impact	:	Resistant to to leaf and neck blast disease
Unit cost	:	Breeder seed costs Rs. 66 per kg
Developed and Tested by	:	Drs. JP Aditya, PK Agrawal, J Stanley, BM Pandey, KK Mishra, Mr. Devendra Lal, PC Verma, JK Arya, DS Panchpal, KS Rawat and Anand Singh

5 Lentil

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VL Masoor 103

Notified for	:	Timely sown rainfed condition in Uttarakhand hills
Notification no. and date	:	S.O. 821 (E) 13.09.2000
Description/ Features of the variety developed	:	• Developed through selection from VHC 2776-1 collected from Bageshwar district of Uttarakhand • Grains are brown in colour with orange cotyledons with 30.40% protein in its seeds (average 100 grain weight: 1.4 g) • Average plant height is 37 cm • Flowering and maturity period is 113 days and 163 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 11.19 q/ha
Specific benefits and impact	:	Highly resistant to aschochyta blight and sclerotinia rot
Unit cost	:	Breeder seed costs Rs. 146.50 per kg
Developed and Tested by	:	Drs. RK Sharma, Rajiv K Sharma, MK Sinha, VP Mani, ND Majumdar, Prem Singh, Subhash Chandra, RK Mittal and Mr. MS Khati

VL Masoor 125

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from a cross of VL Masoor 1 x PL 406 followed by pedigree method of selection • Has semi-erect growth habit, vigorous in growth and light green foliage with pubescence • Grains are black with white coloured hilum, average 100 seed weight 1.82 g with 27.1% protein in its seeds • Average plant height is 30 cm • Flowering and maturity period is 97 days and 142 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 15.10 q/ha
Specific benefits and impact	:	Resistant to wilt and root rot
Unit cost	:	Breeder seed cost Rs. 146.50 per kg
Developed and Tested by	:	Drs. ND Majumdar, SV Sai Prasad, Shailesh K Shukla, V Mahajan, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Masoor 126

Notified for	:	Timely sown rainfed condition of Northern Hill Zone (Uttarakhand, H.P., J&K and NE hills)
Notification no. and date	:	S.O. 122 (E) 06.02.2007
Description/ Features of the variety developed	:	• Developed from a cross of VL 4 x PL 406 through pedigree method of selection • Average plant height is 30-35 cm • Has determinate, semi erect growth habit with dark green foliage • Flowering and maturity period is 124 days and 168 days, respectively • Grains contain black seed coat with orange cotyledons, average 100 seed weight 1.79 g with 25.05% protein in its seeds
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 13.42 q/ha
Specific benefits and impact	:	Resistant to wilt, rust and grey mould
Unit cost	:	Breeder seed cost Rs.146.50 per kg
Developed and Tested by	:	Drs.Vinay Mahajan, Shailesh K Shukla, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Masoor 129

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 211 (E) 29.01.2010
Description/ Features of the variety developed	:	• Developed from a cross of VL 101 x VL 1 through pedigree method of selection • Average plant height is 26.19 cm • Has semi-erect growth habit with small, dark brown grains, 100 seed weight is 1.93 g and has 24.6% protein in its seeds • Flowering and maturity period is 108 days and 151 days, respectively • Has determinate, semi erect growth habit with dark green foliage • Grains are small, dark brown in colour, average 100 seed weight is 1.93 g with 24.6% protein in its seeds
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 9.47 q/ha
Specific benefits and impact	:	Resistant to wilt and root rot diseases
Unit cost	:	Breeder seed costs Rs. 146.50 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, HS Gupta, KS Hooda, N Kumar, BL Mina, S Saha, Mr. MS Khati and Chandan Singh

VL Masoor 133

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 2326 (E) 10.10.2011
Description/ Features of the variety developed	:	• Developed from a cross of VL 103 x DPL 58 through pedigree method of selection • Average plant height is 25-30.5 cm • Flowering and maturity period is 102-114 days and 153-158 days, respectively • Grains are small, brown in colour with 100 seed weight of 2.05 g and 24.60% protein in its seeds
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 11.25 q/ha
Specific benefits and impact	:	Resistant against wilt and root rot diseases
Unit cost	:	Breeder seed costs Rs. 146.50 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, PK Agrawal, HS Gupta, JC Bhatt, KS Hooda, N Kumar, MD Tuti, S Saha, J Stanley, Mr. MS Khati and Chandan Singh

VL Masoor 507

Notified for	:	Timely sown rainfed condition Northern Hill Zone (J&K, H.P., Uttarakhand, and North-Eastern hills)
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed through selection from ILL 7978 • Grains are large, flat, globose and creamish brown in colour with 100 seed weight of 3.32 g and 33.59% protein in its seeds • Average plant height is 45 cm • Has semi-erect growth habit and light green foliage • Flowering and maturity period is 120 days and 160 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 12.54 q/ha
Specific benefits and impact	:	Resistant against wilt disease
Unit cost	:	Breeder seed costs Rs. 146.50 per kg
Developed and Tested by	:	Drs. ND Majumdar, SV Sai Prasad, Shailesh K Shukla, V Mahajan, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Masoor 514

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 2326 (E) 10.10.2011
Description/ Features of the variety developed	:	• Developed from the cross VL 501 x VL Masoor 103 through pedigree selection • Grains are large seeded (average 100 seed weight 3.05 g), brown in colour with minute spots on seed coat, possesses 21.13% protein in its seeds • Average plant height is 29.5 cm • Has semi-erect and determinate growth habit • Flowering and maturity period is 109 days and 157 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 9.84 q/ha
Specific benefits and impact	:	Moderately resistant against wilt and rust disease
Unit cost	:	Breeder seed costs Rs. 146.50 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, PK Agrawal, HS Gupta, JC Bhatt, KS Hooda, N Kumar, MD Tuti, S Saha, J Stanley, Mr. MS Khati and Chandan Singh

6 Field Pea

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VL Matar 42

Notified for	:	Timely sown rainfed condition of Northern Eastern Plain Zone (East U.P., Bihar, Jharkhand, West Bengal, Assam) & Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006/ S.O. 122 (E) 06.02.2007
Description/ Features of the variety developed	:	• Developed from the cross of VL Matar 1 x P 388 through pedigree selection • Grains are light yellow in colour with 100 seed weight of 18.70 g and 24.20% protein in its seeds • Average plant height is 139 cm • Has an indeterminate growth habit and tall stature • Flowering and maturity period is 65 days and 122 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 18.68 q/ha
Specific benefits and impact	:	Resistant against powdery mildew and moderate resistance against rust
Unit cost	:	Breeder seed costs Rs. 86.60 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, ND Majumdar, SV Sai Prasad, Shailesh K Shukla, HS Gupta,KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Matar 47

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 2326 (E) 10.10.2011
Description/ Features of the variety developed	:	• Developed from the cross of JVP 14 x HFP 4 • It is a afilla type with dwarf stature field pea variety • Grains are round, light yellow in colour with 100 seed weight of 14.7 g and 21.4% protein in its seeds • Average plant height is 51.15 cm • Flowering and maturity period is 102 days and 153 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average average yield potential is 14.17 q/ha
Specific benefits and impact	:	Resistance against wilt, rust and powdery mildew disease
Unit cost	:	Breeder seed costs Rs. 86.60 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, PK Agrawal, HS Gupta, KS Hooda, N Kumar, MD Tuti, S Saha, J Stanley, JC Bhatt, Mr. MS Khati and Chandan Singh

7 Horsegram

Technology 56

VL Gahat 8

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from the cross of VL Gahat 1 x P-1648 • Has semi erect and indeterminate growth habit • Grains are creamish yellow in colour with 100 seed weight of 5.75 g and 28.25% protein in its seeds • Average plant height is 86 cm • Flowering and maturity period is 78 days and 123 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 12.33 q/ha
Specific benefits and impact	:	Resistant against stem rot and anthracnose diseases
Unit cost	:	Breeder seed costs Rs. 320 per kg
Developed and Tested by	:	Drs. ND Majumdar, V Mahajan, Shailesh K Shukla, HS Gupta, KS Hooda, N Kumar, Mr. MS Khati and Chandan Singh

VL Gahat 10

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 122 (E) 06.02.2007
Description/ Features of the variety developed	:	• Developed from the cross of VL Gahat 1 x NIC 2659 • Has indeterminate growth habit • Grains are creamish yellow in colour with 100 seed weight of 3.35 g and 28.37% protein in its seeds • Average plant height is 90 cm • Flowering and maturity period is 71 days and 114 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 9.40 q/ha
Specific benefits and impact	:	Resistant against anthracnose disease
Unit cost	:	Breeder seed costs Rs. 320 per kg
Developed and Tested by	:	Drs. ND Majumdar, V Mahajan, Shailesh K Shukla, HS Gupta, KS Hooda, N Kumar, Mr. MS Khati and Chandan Singh

VL Gahat 15

Notified for	:	Timely sown rainfed condition of Northern and Central India
Notification no. and date	:	S.O. 454 (E) 11.02.2009
Description/ Features of the variety developed	:	• Developed from the cross of VL Gahat 1 x NIC 7321 • Has semi erect and indeterminate growth habit • Grains are yellowish brown in colour with 100 seed weight of 3.50 g and 26.96% protein in its seeds as well as better digestibility (86.2%) • Average plant height is 48.91 cm • Flowering and maturity period is 48 days and 98 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 7.75 q/ha
Specific benefits and impact	:	Moderate resistance against anthracnose and leaf spot disease
Unit cost	:	Breeder seed costs Rs. 320 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Gahat 19

Notified for	:	Timely sown rainfed condition of Northern India
Notification no. and date	:	S.O. 211 (E) 29.01.2010
Description/ Features of the variety developed	:	• Developed through selection from local germplasm VH 61 of Uttarakhand hills • Has semi erect and indeterminate growth habit • Grains are brown in colour with 100 seed weight of 3.34 g and 26.75% protein in its seeds • Average plant height is 48.94 cm • Flowering and maturity period is 46 days and 91 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 5.64 q/ha
Specific benefits and impact	:	Resistant to root rot and also exhibit moderate resistance against anthracnose, collar rot, powdery mildew and leaf spot diseases
Unit cost	:	Breeder seed costs Rs. 320 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, HS Gupta, KS Hooda, BL Mina, S Saha, J Stanley, Mr. MS Khati and Chandan Singh

8 Rajmash

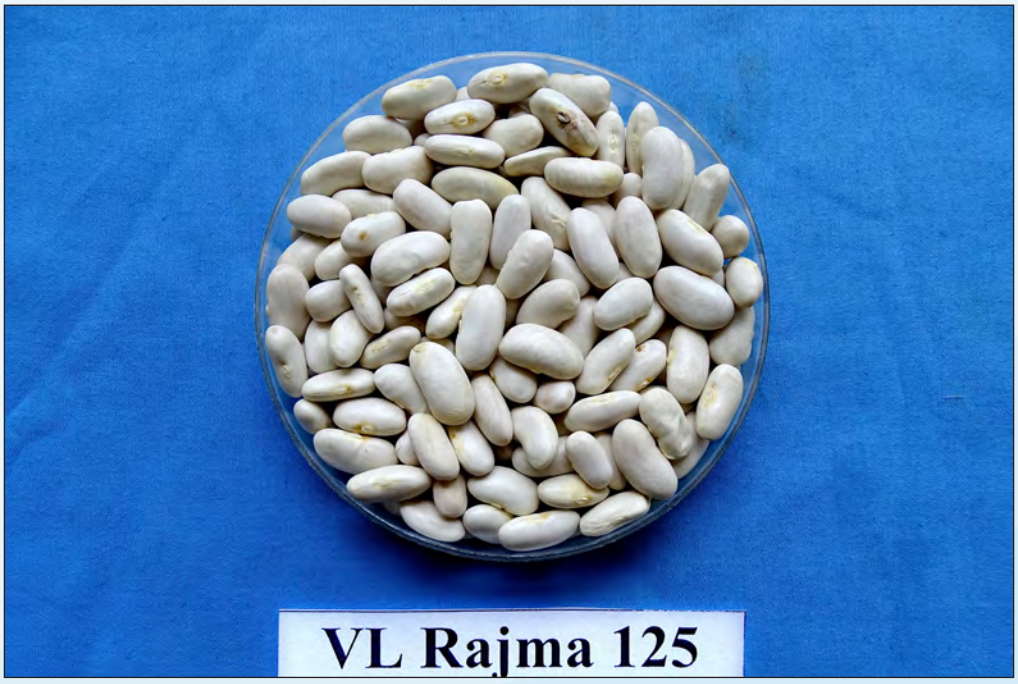
Technology 60

VL Rajma 63

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 19 (E) 14.01.1982
Description/ Features of the variety developed	:	• Developed through selection from local germplasm of Uttarakhand hills • Has semi erect and indeterminate growth habit • Bush type with light red grain with deep red patches • Average 100 seed weight is 29.70 g and has 26.60% protein in its seeds • Average plant height is 40-45 cm • Flowering and maturity period is 37 days and 73 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 11.56 q/ha
Specific benefits and impact	:	Resistant to bacterial blight, anthracnose and yellow mosaic virus
Unit cost	:	Breeder seed costs Rs. 450 per kg
Developed and Tested by	:	Dr. JP Tandon, Mr. HC Joshi and associated staff

VL Rajma 125

Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 1108 (E) 08.05.2008
Description/ Features of the variety developed	:	• Developed from the cross PI 339482 x EC 9160-3 through pedigree selection • Has erect and determinate growth habit • Grains are white in colour with 100 seed weight of 41.38 g and 25.74% protein in its seeds • Average plant height is 38 cm • Flowering and maturity period is 43 days and 82 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 11.62 q/ha
Specific benefits and impact	:	Resistant against bacterial blight and root rot disease
Unit cost	:	Breeder seed costs Rs. 450 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, Shailesh K Shukla, HS Gupta, KS Hooda, S Saha, Mr. MS Khati, NK Pathak and Chandan Singh



9 Pigeon Pea

Technology 62

VL Arhar 1

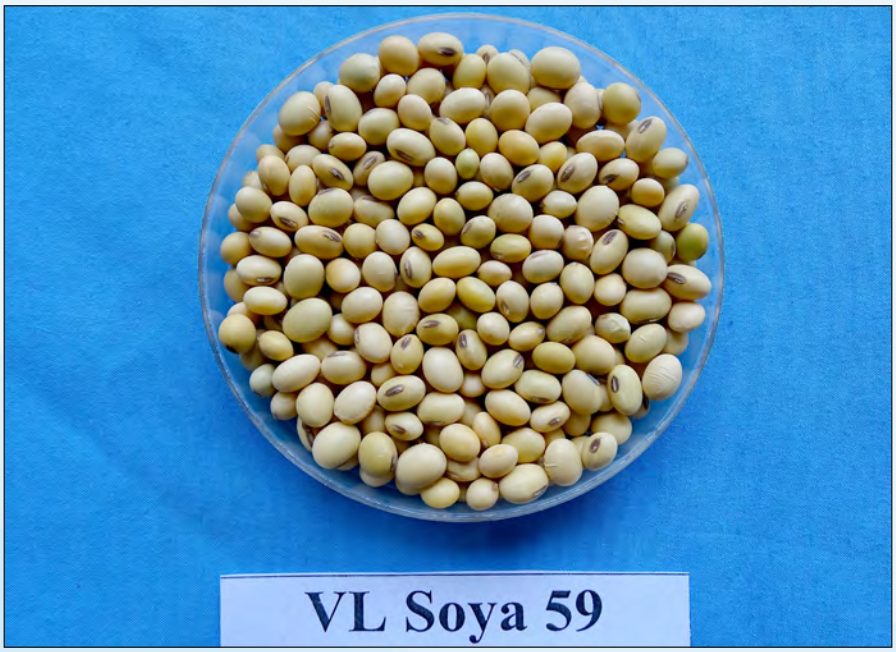
Notified for	:	Timely sown rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 1703 (E) 05.10.2007
Description/ Features of the variety developed	:	• An extra early variety introduced from ICRISAT, Hyderabad • Has semi erect and indeterminate growth habit • Grains are light tan in colour with 100 seed weight of 10.20 g and 21.40% protein content in its seeds • Average plant height is 150 cm • Flowering and maturity period is 64 days and 127 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 18.96 q/ha
Specific benefits and impact	:	Resistant to wilt and alternaria leaf blight and susceptible to blister beetle
Unit cost	:	Breeder seed costs Rs. 190 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, Shailesh K Shukla, HS Gupta, KS Hooda, M Mohan, S Saha, N Kumar, Vishwanath, RK Khulbe, Mr. NK Pathak and MS Khati

VL Soya 47

Notified for	:	Timely sown under rainfed condition of North Western Himalayan hills
Notification no. and date	:	S.O. 340 (E) 03.04.2000
Description/ Features of the variety developed	:	• Developed through pure line selection of germplasm KHSF 3 • Grains are yellow in colour with brown hilum and shiny luster • Average 100 seed weight is 14.7g and possesses 22.87% oil and 39.85% protein in its seeds • Average plant height is 96 cm • Flowering and maturity period is 61 days and 126 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 23.22 q/ha
Specific benefits and impact	:	• Tolerant to Cercospora leaf spot, bacterial leaf blight, frog eye leaf spot and anthracnose • Has tolerance to insect pests *viz.*, gray semi loopers, aphids and green semi loopers
Unit cost	:	Breeder seed costs Rs. 116.25 per kg
Developed and Tested by	:	Drs. MK Sinha, VP Mani, RK Mittal, ND Majumdar, Mr. MS Khati and Ved Prakash

VL Soya 59

Notified for	:	Timely sown under rainfed condition of Northern Hill Zone (Himachal Pradesh & Uttarakhand)
Notification no. and date	:	S.O. 2458 (E) 16.10.2008
Description/ Features of the variety developed	:	• Developed through three way cross (PB1 x VLS2) x EC 361336 • Grains are yellow in colour with brown hilum and shiny luster • Average 100 seed weight is 13.96 g and seed possesses 19.35% oil and 39.15% protein • Has determinate growth habit • Average plant height is 72.8 cm • Flowering and maturity period is 58 days and 120 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 25.62 q/ha
Specific benefits and impact	:	• Has registered genetic stock for low linolenic acid (C18:3 as 3.96%) which improves oxidative stability of soybean oil which improves its commercial value • Has moderate multiple resistance against pod blight and frog eye leaf spot
Unit cost	:	Breeder seed costs Rs. 116.25 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, G Singh, SK Shukla, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh



VL Soya 63

Notified for	:	Timely sown under rainfed condition of Northern Hill Zone (Himachal Pradesh & Uttarakhand)
Notification no. and date	:	S.O. 2458 (E) 16.10.2008
Description/ Features of the variety developed	:	• Developed through three way cross VLS 2 x (Bragg x VHC 3022) • Has determinate growth habit • Grains are yellow in colour with an average 100 seed weight of 15.12 g and 17.91% oil and 41.04% protein in its seeds • Average plant height is 67.2 cm • Flowering and maturity period is 52 days and 121 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 27.58 q/ha
Specific benefits and impact	:	Resistance against pod blight, target leaf spot and moderate resistance to frog eye leaf spot
Unit cost	:	Breeder seed costs Rs. 116.25 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, G Singh, SK Shukla, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Soya 65

Notified for	:	Timely sown under rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 211 (E) 29.01.2010
Description/ Features of the variety developed	:	• Developed through selection from a local germplasm collected from village Abu, district Bageshwar of Uttarakhand • Has determinate growth habit • Grains are black in colour with an average 100 seed weight of 14.65 g and 12.20% oil and 41.10% protein in its seeds • Average plant height is 76 cm • Flowering and maturity period is 58 days and 121 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 11.28 q/ha
Specific benefits and impact	:	Moderate resistance against frog eye leaf spot, pod blight and leaf blight
Unit cost	:	Breeder seed costs Rs. 200 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, Arun Gupta, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

VL Soya 77

Notified for	:	Timely sown rainfed organic conditions of Uttarakhand Hills
Notification no. and date	:	S.O.3546 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed from the cross PK 472/ JS 335 by pedigree method of selection from F_5 to F_7 generation • Grains are black in colour with an average 100 seed weight of 16.89 g and 18.60% oil and 38.91% protein in its seed • Average plant height is 77.68 cm (Ranges from 70.50 to 84.55 cm) • Flowering and maturity period is 57 days and 117 days (Range: 112 to 127 days), respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 25.66 q/ha
Specific benefits and impact	:	• Moderate resistance against frog eye leaf spot and pod blight • Moderately resistant to girdle beetle and stem fly with no incidence of aphid
Unit cost	:	Breeder seed costs Rs. 200 per kg
Developed and Tested by	:	Dr. Vinay Mahajan, G Singh, Anuradha Bhartiya, SK Jain, Sher Singh, J Stanley, RS Pal, Mr. M.S. Khati, Chandan Singh, GS Bankoti and Pan Ram

VL Bhat 201

Notified for	:	Timely sown rainfed organic conditions of Uttarakhand hills
Notification no. and date	:	S.O. 3546 (E) 22.11.2016
Description/ Features of the variety developed	:	• Developed through selection from local germplasm (VHC 3071) of Uttarakhand hills It has determinate growth habit • Grains are black in colour with an average 100 seed weight of 13.12 g and has 41.02% protein and 15.45% oil content in its seed • Average plant height is 69.17 cm (Range 63 to 78 cm) • Flowering and maturity period is 56 days and 117 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential 27 q/ha
Specific benefits and impact	:	High field resistant against frog eye leaf spot, target leaf spot and moderately resistant against pod blight
Unit cost	:	Breeder seed costs Rs. 200 per kg
Developed and Tested by	:	Drs. Anuradha Bhartiya, G Singh, V Mahajan, SK Jain, Sher Singh, J Stanley, RS Pal, Mr. MS Khati, Chandan Singh, GS Bankoti and Pan Ram

VL Moongphali 1

Notified for	:	Timely sown under rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 211 (E) 29.01.2010
Description/ Features of the variety developed	:	• Developed through selection from ICGV 86590 (X14-4-B-19-B x PI259747) • Spanish bunch type variety of groundnut which has erect and straight branches and nuts remain closely clustered around the base of the plant • Seed testa is of rose tan colour with an average 100 seed weight of 42.39 g and has 42.20% oil & 29.50% protein in its seeds • Average plant height is 58 cm • Flowering and maturity period is 35 days and 129 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 19.43 q/ha
Specific benefits and impact	:	Moderately resistant to tikka disease
Unit cost	:	Breeder seed costs Rs. 150 per kg
Developed and Tested by	:	Drs. Gyanendra Singh, Vinay Mahajan, HS Gupta, KS Hooda, N Kumar, S Saha, Mr. MS Khati and Chandan Singh

12 Mustard

Technology 70

VL Toria 3

Notified for	:	Timely sown under rainfed condition of Uttarakhand hills
Notification no. and date	:	S.O. 1703 (E) 05.10.2007
Description/ Features of the variety developed	:	• Developed through selection from a local collection VHC 86 • Has spreading nature during low temperature at vegetative phase and has ability to sustain during cold spell of mid altitudes of hills • Seed testa is of brown colour with an average 100 seed weight of 1.46 g and 37.04% oil in its seeds • Average plant height is 74.6 cm • Flowering and maturity period is 74 days and 139 days, respectively
Input required	:	Seeds of the variety
Output capacity	:	Average yield potential is 8.97 q/ha
Specific benefits and impact	:	Resistant to anthracnose and pod blight
Unit cost	:	Breeder seed costs Rs. 121 per kg
Developed and Tested by	:	Drs. Vinay Mahajan, ND Majumdar, Shailesh K Shukla, HS Gupta, KS Hooda, N Kumar, Mr. MS Khati and Chandan Singh

13 Finger Millet

Technology 71

VL Ragi 149

Notified for	:	All finger millet growing states including Uttarakhand mid hills for cultivation under rainfed conditions except Tamil Nadu and Maharashtra
Notification no. and date	:	S.O. 527 (E) 16.08.1991
Description/ Features of the variety developed	:	• Developed from a cross between VL Mandua 204 x IE 882 • Has open panicles with top curved fingers and grains are dark copper in colour • Average plant height is 85-90 cm • Medium duration variety, maturing in 100-105 days • Protein content in grains is 8.03%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 25-30 q/ha
Specific benefits and impact	:	• Resistant to neck and finger blast disease • Fingers are large in size • Has potential of giving good yields even at low fertilizer levels
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Devendra Mohan, A Seetharam, Mr. HC Joshi, Dr. KD Koranne, Mr. GS Bisht, JC Bhatt, SK Pant, V Prakash, HC Joshi, V Kunwar, KKS Bisht and VP Mani

VL Mandua 315

Notified for	:	Mid hill areas of Uttarakhand State under rainfed ecology
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• Developed from a cross between SDFM 69 x VL 231 • Plants are intermediate in height (90-100cm) with compact ear heads at maturity • Medium maturity variety, matures in 100-115 days • Grains are light copper in colour and partially covered with glume
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-25 q/ha
Specific benefits and impact	:	• Moderately resistant to neck and finger blast • Suitable for organic cultivation
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Mr. CS Kar, Drs. SS Bisht, Arun Gupta, Mr. GS Bisht, Drs. V Prakash and JC Bhatt

VL Mandua 324

Notified for	:	Lower and mid hill areas of Uttarakhand State under rainfed ecology
Notification no. and date	:	S.O. 599 (E) 25.04. 2006
Description/ Features of the variety developed	:	• Developed from a cross between VL 162 x IE 3808 • Plants are intermediate in height (80-95cm) with compact ear head and incurved fingers • Matures in 105-135 days • Grains are exposed at the time of maturity and are very light copper in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-25 q/ha
Specific benefits and impact	:	• Resistant to neck and finger blast disease • Suitable for organic cultivation
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Arun Gupta, CS Kar, HS Gupta, Mr. GS Bisht, V Prakash, Drs. JC Bhatt and Deeksha Joshi

VL Mandua 347

Notified for	:	States of Bihar, Gujarat, Jharkhand, Karnataka, Madhya Pradesh and Uttarakhand under rainfed ecology
Notification no. and date	:	S.O. 1708 (E) 26.07.2012
Description/ Features of the variety developed	:	• Developed from a cross between VR 708 x VL 149 • An early maturing (matures in <100 days) variety • Possess pigmented node and attains a plant height of 105-115 cm • Ear heads are open top curved with 6-8 fingers in each ear • Seeds are light copper in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-22 q/ha
Specific benefits and impact	:	• Moderately resistant to neck and finger blast disease • Suitable for higher hills (or areas where crop growth period is limited) because of its short duration
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Arun Gupta, PK Agrawal, JC Bhatt, Mr. GS Bisht, Drs. S Sood, BM Pandey, Deeksha Joshi and Chandrashekara C

VL Mandua 352

Notified for	:	All finger millet growing states including Uttarakhand hills for cultivation under rainfed ecology except the states of Tamil Nadu and Maharashtra
Notification no. and date	:	S.O. 1919 (E) 30.07.2014
Description/ Features of the variety developed	:	• Developed from a cross between VR 708 x VL 149 • Has non pigmented node and attains a plant height of 105-115 cm • Has incurved ear heads with 8-10 fingers • Matures in less than 100 days • Seeds are light copper in colour
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 25-30 q/ha
Specific benefits and impact	:	• Moderately resistant to neck and finger blast • Suitable for areas where crop growth period is limited because of its short duration and is also for contingent crop planning
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Arun Gupta, Salej Sood, RK Khulbe, PK Agrawal, JC Bhatt, BM Pandey, Chandrashekara C and Mr. GS Bisht

VL Mandua 376

Notified for	:	All finger millet growing states of the country
Notification no. and date	:	S.O. 399 (E) 24.01.2018
Description/ Features of the variety developed	:	• Developed from the cross GEC4172 x VL Ragi 149 • Plant height is 91-99 cm • Matures in 103-109 days • Semi-compact ear heads with top incurved fingers • Seeds are dark copper in colour with average 1000 seed weight of 2.95 g
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 29.9 q/ha
Specific benefits and impact	:	Resistant to neck and finger blast
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Salej Sood, Arun Gupta, RK Khulbe, BM Pandey, Chandrashekara C, H Rajashekara, Mr. GS Bisht, DS Panchpal and RS Kanwal

VL Mandua 379

Notified for	:	Uttarakhand, Bihar, Jharkhand, NE States and Madhya Pradesh
Notification no. and date	:	S.O. 1379 (E) 27.03.2018
Description/ Features of the variety developed	:	• Developed from the cross GEC440 x VL Ragi 149 • Plant height is 95-102 cm • Matures in 103-111days • Semi-compact ear heads with top incurved fingers • Seeds are dark copper in colour with average 1000 seed weight of 3.05 g
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 31.2 q/ha
Specific benefits and impact	:	Resistant to neck and finger blast
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Arun Gupta, Salej Sood, RK Khulbe, BM Pandey, Rajashekara H, Chandrashekhara C, Mr. GS Bisht, DS Panchpal, RS Kanwal

VL Mandua 380

Notified for	:	Uttarakhand (Hills)
Notification no. and date	:	S.O. 6318 (E) 26.12.2018
Description/ Features of the variety developed	:	• Developed from the cross GEC440 x VL Ragi 149 • Plant height is 71-95 cm • Matures in 116-118 days • Non-pigmented node and semi-compact ear head • Seeds are light copper in colour with average 1000 seed weight of 2.38 g
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 18-20 q/ha
Specific benefits and impact	:	Moderately resistant to neck and finger blast
Unit cost	:	Seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Salej Sood, Arun Gupta, RK Khulbe, BM Pandey, Rajashekara H, Chandrashekhara C, Mr. GS Bisht and Prahlad Singh

14 Barnyard Millet

Technology 79

VL Madira 172

Notified for	:	States of Uttarakhand, Uttar Pradesh, Gujarat and Karnataka under rainfed ecology
Notification no. and date	:	S.O.340 (E) 03.04.2000
Description/ Features of the variety developed	:	• Developed from a cross between EF 2 x VHC 5202 • Plants are intermediate in height (95-100cm) and mature in 85-90 days • Ears are green with intermediate raceme compactness • Protein content in grains is 9.02%
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 20-23 q/ha
Specific benefits and impact	:	• Tolerant to grain smut • Well suited to high cropping intensity
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. SS Bisht, VP Mani, Mr. CS Kar, Drs. JC Bhatt, V Prakash, H Chodhury and Mr. GS Bisht

VL Madira 207

Notified for	:	All barnyard growing states except Tamil Nadu and Gujarat under rainfed ecology
Notification no. and date	:	S.O. 2458 (E) 16.10.2008
Description/ Features of the variety developed	:	• Developed from a cross between VL 172 x GECH 506 • Plants are taller (115-125 cm) and mature in 90-95 days • Has pigmented ears with intermediate raceme compactness
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 16-19 q/ha
Specific benefits and impact	:	• Tolerant to grain smut • Has improved plant type with high harvest index
Unit cost	:	Breeder seed costs Rs. 62 per kg
Developed and Tested by	:	Drs. Arun Gupta, HS Gupta, Mr. Ved Prakash, Dr. Deeksha Joshi and Mr. GS Bisht

15 Amaranthus

Technology 81

VL Chua 44

Notified for	:	Uttarakhand hills
Notification no. and date	:	S.O. 599 (E) 25.04.2006
Description/ Features of the variety developed	:	• A pureline selection from IC 5564 • Plants are 120-150 cm tall and mature in 115-120 days • Contains higher protein (14.1%) and oil content (12.2%) • Grains are transparent and creamy at the time of maturity
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 10-13 q/ha
Specific benefits and impact	:	Non-spiny bracket allows easy threshing and reduced drudgery
Unit cost	:	Breeder seed costs Rs. 900 per kg
Developed and Tested by	:	Drs. CS Kar, SS Bisht, Arun Gupta and others

16 Buckwheat

Technology 82

VL Ugal 7

Notified for	:	Mid hills of Uttarakhand (900-1600 m amsl)
Notification no. and date	:	S.O. 814 (E) 04.11.1992
Description/ Features of the variety developed	:	• A pure line selection from USDA 1 • Plants of the variety are 105 cm tall and mature in 60-70 days • An extra early variety with white flowers and very bold black winged seeds • No serious threat of any disease shown in the variety • Being a self-incompatible crop, seed production requires isolation
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 8-10 q/ha
Specific benefits and impact	:	• Extra early maturity and can be planted anytime between spring and late kharif • Suitable for contingent crop planning in hills
Unit cost		Breeder seed costs Rs. 220 per kg
Developed and Tested by	:	Drs. Devendra Mohan, KD Koranne, Mr. HC Joshi, GS Bisht and Dr. GC Upreti

17 Rice Bean

Technology 83

VRB-3 (Him Shakti)

Notified for	:	Mid hills of North-Western and North-Eastern India
Notification no. and date	:	S.O. 2817 (E) 19.09.2013
Description/ Features of the variety developed	:	• A pure-line selection from local material (IC 538080) collected from the Nainital District of Uttarakhand • Has light green seeds, indeterminate growth habit and matures in 133 days • Grains contain high protein content (20.4%) and obtained highest score for organoleptic tests
Input required	:	Seeds of the variety
Output capacity	:	Average grain yield is 14-17 q/ha
Specific benefits and impact	:	Early maturity and takes minimum time for cooking in comparison to other ricebean varieties
Unit cost	:	Breeder seed costs Rs. 120 per kg
Developed and Tested by	:	Drs. JC Rana, Salej Sood, Arun Gupta, KS Negi and Hanuman Lal

VL Garlic 1

Notified for	:	Mid hills of North-Western and North-Eastern India
Notification no. and date	:	S.O. 642 (E) 31.05.2004
Description/ Features of the variety developed	:	• A clonal selection from exotic germplasm EC 158250 • Plants are erect (average plant height: 44.4 cm) with green leaves (average numbers 10-12) and stem • Bulbs are round to oval, medium in size, thin skinned with average bulb weight of 28 g • White colour medium size clove (varies from 18-20/ bulb) possess good flavour, pungency and high keeping quality • Takes 195-200 days for maturity in mid hills
Input required	:	Bulb of the variety
Output capacity	:	Average bulb yields around 140-150 (in hills) and 90-100 (in plains) q/ha
Specific benefits and impact	:	• High yield potential, good bulb and keeping quality with resistant to purple blotch disease • Helpful for varietal diversification in hills as well as plains
Unit cost	:	Breeder seed (seed bulb) costs Rs. 350 per kg
Developed and Tested by	:	Drs. Shri Dhar, Joseph John K, VP Mani, Mr. Ved Prakash and Shankar Lal

VL Lahsun 2

Notified for	:	Mid hills of North-Western and North-Eastern India
Notification no. and date	:	S.O. 456 (E) 16.03.2012
Description/ Features of the variety developed	:	• A clonal selection from garlic germplasm at the Institute • Long day garlic variety, plants are semi-erect (average plant height: 30-60 cm) with green leaves (average numbers 8-9) and pseudo-stem (green with purple strips) • Bulbs are oblate shape, compact, big in size, thin skinned (creamy white-violet strips) with higher bulb weight of 40-70 g and high TSS 37.3 ^{0}B • Cloves are creamy white in colour and are big in size varying from 11-15/ bulb
Input required	:	Bulb of the variety
Output capacity	:	Average bulb yields around 150-240 q/ha
Specific benefits and impact	:	• Variety exclusively meant for long day conditions with high yield potential • Resistant to purple blotch and *stemphylium* blight diseases under field condition • Helpful for varietal diversification
Unit cost	:	Breeder seed (seed bulb) costs Rs. 350 per kg
Developed and Tested by	:	Drs. NK Hedau, PK Agrawal, JC Bhatt, M Tuti, Chandrashekra C, Mr. ARNS Subbanna and Shankar Lal

19 Vegetable Pea

Technology 86

VL Matar 3

Notified for	:	North western hills in zone 1 especially the states of Himachal Pradesh, J&K, UP plains, Punjab and Bihar in zone IV and Haryana, Rajasthan in zone VI
Notification no. and date	:	S.O. 915 (E) 06.11.1989
Description/ Features of the variety developed	:	• Developed through pedigree method of cross 'Old Sugar / Wrinkled dwarf' • Medium in maturity, has determinate plant height (around 76 cms) with light green foliage and white flower • First pod sets at 10th node, pod is light green in colour, straight with an average length of 6.8 cm • Seedling to first picking days in hills are 140 and in plains about 100
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is about 100 q/ha
Specific benefits and impact	:	• Determinate variety with medium maturity group • Good yield potential with good pod quality • Suitable for irrigated rabi condition in hills and plains
Unit cost		Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Mr. HC Joshi, Drs. Vidya Sagar, KD Koranne, JP Tandon, Mr. Ved Prakash, Dr. AK Sharma, Mr. DK Garg, HC Joshi, Dr. RK Sarkar, Mr. Vikas Kanwar, D Sanwal, KS Bhakuni and Shankar Lal

Vivek Matar 6

Notified for	:	Zone-I (U.P. Hills, Himachal Pradesh and J&K) and zone-VI (Haryana, Delhi and Rajasthan) for irrigated conditions
Notification no. and date	:	S.O. 98 (E) 08.02.1997
Description/ Features of the variety developed	:	• Developed through the pedigree method of cross Pant Uphar (IP 3) / VL 3 • Plants are dwarf, vigorous with higher branching habit (2-6 in numbers) • Pod length is about 6.7 cm, pods are straight, completely filled and contains 6 seeds/pod with high TSS (15-17%)
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 103.58 q/ha
Specific benefits and impact	:	• Wider adaptable, high yielding medium maturity group garden pea suitable for sowing in November and in March (higher hills) • Better tolerance to cold and moisture stress • Helpful for varietal diversification
Unit cost		Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Dr. Shri Dhar, Mr. HC Joshi, Drs. VP Mani, SD Dube, Mr. Shankar Lal and KS Bhakuni

VL Ageti Matar 7

Notified for	:	Zone-VI and released in U.P. Hills
Notification no. and date	:	S.O. 408 (E) 04.05.1995
Description/ Features of the variety developed	:	• Developed through the pedigree method of cross IP 3 / Arkel • Plants are dwarf (65-70 cm), vigorous with white flowers and two pods per peduncle • Pods are attractive, slightly incurved towards suture at the distal end • Pods are completely filled and contain 6-7 wrinkled seeds/pod • Seeds are bold and dimpled with high TSS (16.8%) • Takes 120-125 days for the first picking, shelling percentage is 42%
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 102.66 q/ha
Specific benefits and impact	:	• Possesses superior yielding ability with extra-earliness • Shows 14% higher yield than Arkel in Zone IV • Suitable for sowing in November and in April-September (off-season) in hills
Unit cost	:	Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Dr. Shri Dhar, Mr. .HC Joshi, Dr. VP Mani, Dr. SD Dube, KD Koranne, Mr. V Prakash, Shankar Lal and KS Bhakuni

Vivek Matar 8

Notified for	:	For rainfed/irrigated conditions in zone-I (UP Hills, Himachal Pradesh and Jammu & Kashmir)
Notification no. and date	:	S.O. 1135 (E) 15.11.2001
Description/ Features of the variety developed	:	• Derived from the pedigree method of cross Perfection / Bonneville • Plants are dwarf (68.8 cm), bear two flowers/peduncle and take 7 nodes to start white colour flowers • Pods are light green, long (7.24 cms) and contain 6 wrinkled, bold and dimpled seeds/pod with high TSS (16.8%) • Matures in 138 days, shelling percentage is 43%
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 114.74 q/ha
Specific benefits and impact	:	Medium maturity garden pea variety with better yield, attractive longer pods
Unit cost	:	Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. Shri Dhar, MK Sinha, VP Mani, Ram Vinod Kumar, SD Dube, VS Chauhan, JC Bhatt, Mr. Shankar Lal and Ved Prakash

Vivek Matar 9

Notified for	:	Rainfed/irrigated conditions during rabi in Uttarakhand hills
Notification no. and date	:	S.O. 664 (E) 11.05.2005
Description/ Features of the variety developed	:	• Derived from the pedigree method of a cross VP 8519 / P 185 • Plants are dwarf (60-70 cm), vigorous in growth with dark green foliage • Takes 7 nodes to start white colour flowers and bears two flowers/ peduncle • Pods are slightly curved, dark green, long (7.8 cms) and contain 6-7 semi-wrinkled seeds/pod with high TSS (20.0%) • Matures in 130-140 days (November sown), shelling percentage is 45%
Input required	:	Seed of the variety
Output capacity	:	Average green pod yield is 95.6 (90-110) q/ha
Specific benefits and impact	:	• Medium maturity garden pea variety with better yield • Moderate resistance to powdery mildew and white rot disease under field conditions
Unit cost		Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. Shri Dhar, VP Mani, JC Bhatt, Mr. HC Joshi and Shankar Lal

Vivek Matar 10

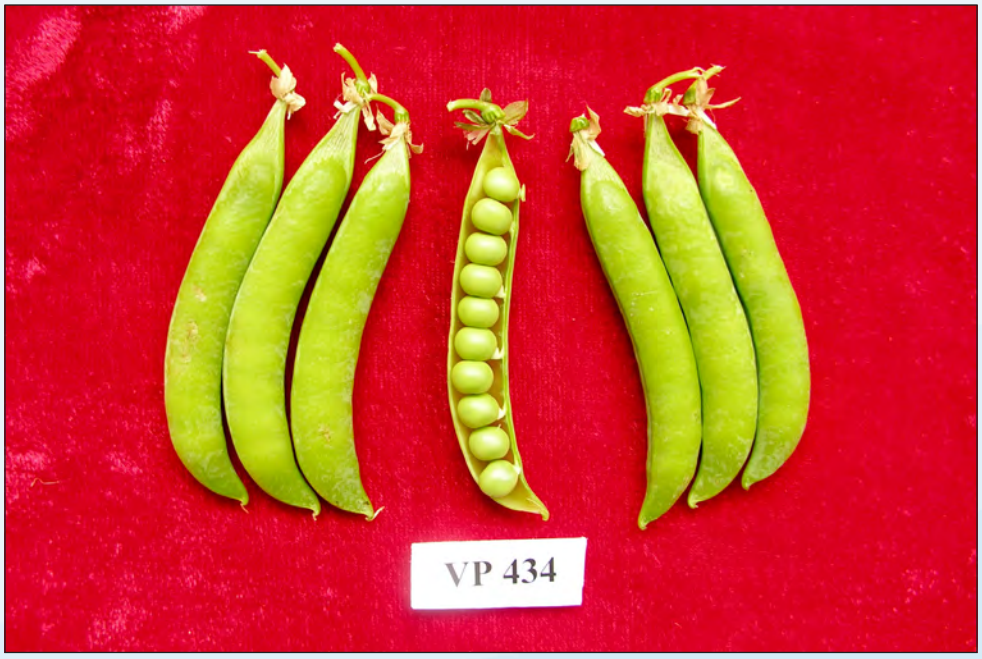
Notified for	:	Zone-I and zone-IV
Notification no. and date	:	S.O. 1714 (E) 18.07.2008
Description/ Features of the variety developed	:	• Derived through pedigree method of cross Azad pea 1 / PMR 3 • Plants are dwarf (50-60 cm) with green foliage • Takes 8-10 nodes to start white colour flowers • Pods are slightly curved, dark green, long (8-9 cm) and contain 7 greenish white wrinkled seeds/pod • Matures in 120-130 days (November sown in mid hills), shelling percentage is 45%
Input required	:	Seed of the variety
Output capacity	:	Average green pod yield is 77.51 (70- 100) q/ha in Zone IV whereas, 92.08 (90-110) in Uttarakhand
Specific benefits and impact	:	• Resulted in 31.98% and 18.08% higher yield potential over the national checks Arkel and VL 7, respectively in Zone I • Moderately resistant to powdery mildew, white rot & leaf blight
Unit cost	:	Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. Shri Dhar, KS Hooda and Mr. Shankar Lal

Vivek Matar 11

Notified for	:	Zone-I (Uttarakhand, Himachal Pradesh and Jammu & Kashmir)
Notification no. and date	:	S.O. 1979 (E) 12.08.2010
Description/ Features of the variety developed	:	• Derived from the pedigree method of a cross Azad Pea 1 / PRS-18-6-4-5-1 • Plants are dwarf (56.4 cm) with green foliage • Takes 7-10 nodes to start white colour flowers and bears two flowers/ peduncle • Pods are curved, dark green, long (8.1 cm) and contain 7-8 greenish wrinkled seeds/pod • Takes 132-135 days for maturity (in mid hills), shelling percentage is 46%
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 100-110 q/ha
Specific benefits and impact	:	• Has better yield potential i.e. 30.35% and 15.97% higher yield over the national check varieties Arka Ajeet and IP 3, respectively • Has high degree of resistance to powdery mildew, shows resistant against white rot, wilt & leaf blight diseases
Unit cost		Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. Shri Dhar, NK. Hedau, V Mahajan, HS Gupta, Mr. Vedprakash, Drs. KS Hooda, SRK Singh, M Mohan and Mr. Shankar Lal

Vivek Matar 12

Notified for	:	Zone I (Jammu & Kashmir, Himachal Pradesh and Uttarakhand) and Zone IV (Uttar Pradesh & Jharkhand)
Notification no. and date	:	S.O. 2277 (E) 17.08.2015
Description/ Features of the variety developed	:	• Derived from the pedigree method of cross (Azad Pea 1 / JP 83) / Azad Pea 1 • Possesses long pod length with 7-10 seeds/pod • Takes 130-136 days for first green pod harvest in mid hill conditions (November sown crop) • Has high shelling percent (48%)
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 120-125 q/ha
Specific benefits and impact	:	• Resulted in 99.96 q/ha mean green pod yield of 14.32% and 20.36% superiority over Arka Ajeet and IP3, respectively • Moderately resistant to powdery mildew under field conditions
Unit cost	:	Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. NK Hedau, Shri Dhar, JC Bhatt, Mr. Shankar Lal, OP Vidyarthi, Drs. M Tuti, Chandrashekra, Mr. RS Kanwal and Jeevan Singh Bisht



Vivek Matar 13

Notified for	:	Uttarakhand
Notification no. and date	:	-
Description/ Features of the variety developed	:	• Selection from the segregating population of the cross VP 272 / Arkel through pedigree method • Plant height is 65-75 cm • Early maturity, takes 120-125 days for first picking in mid hills • Possesses 8-10 peas/ pod, shelling percentage is around 48%
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 115 (110-130) q/ha
Specific benefits and impact	:	• Suitable for August sowing in high hills. • Being early in maturity it escapes incidence of powdery mildew when grown as Rabi crop
Unit cost		Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. NK Hedau, Shri Dhar, Chaudhari Ganesh Vasudeo, Mr. Shankar Lal, Mr. OP Vidyarthi, Drs. KK Mishra, Chandrashekara C, MD Tuti, Mr. Manoj Bhatt and RS Kanwal

Vivek Matar 15

Notified for	:	Uttarakhand
Notification no. and date	:	S.O. 2277 (E) 17.08.2015
Description/ Features of the variety developed	:	• Selection from the segregating population of the cross PC 531 / Arkel (Pedigree method) • Plant height is 60-70 cm • Medium maturity, takes 128-132 days for first picking in mid hills • Possesses 8-10 peas/ pod, shelling percentage is around 50 %
Input required	:	Seeds of the variety
Output capacity	:	Average green pod yield is 120 (110-130) q/ha
Specific benefits and impact	:	Exhibit field resistance against powdery mildew disease
Unit cost	:	Breeder seed costs Rs. 330 per kg
Developed and Tested by	:	Drs. Nirmal Kumar Hedau, Chaudhari Ganesh Vasudeo, Mr. Shankar Lal, Mr. OP Vidyarthi, Drs. KK Mishra, Chandrashekara C, BM Pandey, Mr. Manoj Bhatt and Prahlad Singh

20 Capsicum

Technology 96

VL Shimla Mirch 2

Notified for	:	Irrigated / rainfed / organic / inorganic conditions of Uttarakhand hills
Notification no. and date	:	S.O. 1979 (E) 12.08.2010
Description/ Features of the variety developed	:	• It is an introduction and selection from AVRDC line 9955-36 • Plant height 70-80 cm, days to maturity 80-100 in mid hills, fruit length and diameter ratio is >1 (1.21), thick pericarp (0.25 cm) with blocky fruit shape • Pendant, dark green fruit (immature) turns dark red on maturity • Number of fruits per plant varies from 10-20
Input required	:	Seeds of the variety
Output capacity	:	Organic: 162.7 (120-198) q/ha; Inorganic: 259 q/ha
Specific benefits and impact	:	• High yield potential, good fruit quality • Resistant to fruit rot, wilt and powdery mildew
Unit cost	:	Breeder seed costs Rs. 15000 per kg
Developed and Tested by	:	Drs. Shri Dhar, NK Hedau, V Mahajan, HS Gupta, Mr. Vedprakash, Drs. KS Hooda, SRK Singh and Mr. Shankar Lal

VL Shimla Mirch 3

Notified for	:	Irrigated conditions (Organic & Inorganic both) in Uttarakhand hills
Notification no. and date	:	S.O. 2277 (E) 17.08.2015
Description/ Features of the variety developed	:	• Derived through mass selection from introduced AVRDC line (ISPN2 # 2) • Plants are dwarf (plant height 55-70 cms) and compact in growth habit with dense green foliage cover • Leaf shape is deltoid, fruits are dark green, pendant, 3-4 lobes blocky fruits, thick pericarp (0.35 cm) with medium fruit (80-120 g) size • Number of fruits per plant varies from 8-12 • Matures in 70-100 days in hills • Fruit is green (immature) which turns red on maturity
Input required	:	Seeds of the variety
Output capacity	:	Organic: 150 (100 to 180) q/ha; Inorganic: 300 (200 to 300) q/ha
Specific benefits and impact	:	• Possess high yield potential • Has moderate resistance to powdery mildew, fruit rot and seedling rot complex
Unit cost	:	Breeder seed costs Rs 15000 per kg
Developed and Tested by	:	Drs. NK Hedau, Shri Dhar, PK Agrawal, JC Bhatt, KS Hooda, M Tuti, J Stanley and Mr.Shankar Lal

VL Tamatar 4

Notified for	:	Uttarakhand
Notification no. and date	:	S.O. 1979 (E) 12.08.2010
Description/ Features of the variety developed	:	• Developed through pure line selection of an introduced material from AVRDC i.e. line CL 5915-206 (EC 461691) • Plants are indeterminate (80-105 cm plant height) vigorous in growth with standard leaf type • Immature fruits are light green, mature fruits are medium large, smooth, round shaped and dark red in colour with slight locular impression • First picking starts 60-65 days after transplanting in mid hills • Fruit possesses good flesh thickness (0.5 cm) with a very good keeping quality • Number of fruits per plant varies from 10-35
Input required	:	Seeds of the variety
Output capacity	:	Organic condition : 175.0 (122-246) q/ha; Inorganic condition : 317.5 (300-325) q/ha; Polyhouse condition: 613.0 (550-650) q/ha
Specific benefits and impact	:	• Open pollinated tomato variety with high yield potential, good fruit quality • Resistant to fruit rot and seedling rot complex
Unit cost	:	Breeder seed costs Rs. 5000 per kg
Developed and Tested by	:	Drs. Shri Dhar, NK Hedau, V Mahajan, HS Gupta, KS Hooda, V Prakash, SRK Singh and Mr. Shankar Lal

VL Piaz 3

Notified for	:	Irrigated conditions in rabi season in Uttarkhand hills
Notification no. and date	:	S.O. 793 (E) 22.11.1991
Description/ Features of the variety developed	:	• Developed from a single cross between In. 13 (a male sterile line BYG 2207A) / In. 43 (developed from local collection from UP) and advancing F_1 to F_2 followed by three cycles of mass selection for bulb yield, colour, shape and size • Exhibits a plant height of 40 to 50 cm, medium size- round shaped bulb, with light red skin • Average bulb weight is about 80-120 gm with an average bulb diameter of 5.2 cm • Bulb dry matter content is about 12% while the T.S.S. is about 12% • Produces compact umbel and white flowers • Takes about 215-225 days for bulb production and 250-255 days for seed production
Input required	:	Seeds of the variety
Output capacity	:	Mean bulb yield of 332.9 q/ha
Specific benefits and impact	:	• First open pollinated improved variety recommended for long day conditions of U.P. (Uttarakhand) hills with less bolting character • Produces a mean yield of 332.9 q/ha which is 12.6 to 25.2% higher than the yield of check
Unit Cost	:	Breeder seed costs Rs. 3000 per kg
Developed and Tested by	:	Mr. HC Joshi, Dr. JP Tandon, Mr. TD Sanwal, Khim Singh Bhakuni, V Prakash and Shankar Lal

23 French Bean

Technology 100

VL Bauni Bean 1

Notified for	:	North Indian hills, Hills of Uttar Pradesh (Uttarakhand) Himachal Pradesh and Jammu & Kashmir
Notification no. and date	:	S.O. 13 (E) 19.12.1978
Description/ Features of the variety developed	:	• Composite of two introductions from the United States *viz.*, snap-bush and Rival (both are morphologically quite similar) • Dwarf plant (35-40 cms height), having round stringless, fleshy, smooth pods • Leaves are light green in initial stages but turn deep green during fruiting period • Flowers are white with light purplish tinge • Protein content in pods is 1.57%, total sugars 4.04%, crude fibre 1.23%, ascorbic acid 15.87 mgm/100gms, total minerals 0.82%, TSS 5.50 ^{0}B and moisture content 89.50%
Input required	:	Seeds of the variety
Output capacity	:	Yielded 115.93 q/ha of green pods in coordinated trials conducted in north Indian hills
Specific benefits and impact	:	• Suitable for March to August sowing • Being early in maturity, it can fit into multiple cropping patterns
Unit cost	:	Breeder seed costs Rs. 450 per kg
Developed and Tested by	:	Dr. JP Tandon, Mr. HC Joshi, GC Pant, GS Bhakuni and associated staff

VL Bean 2

Notified for	:	Low and mid hills of Uttarakhand
Notification no. and date	:	S.O. 2978 (E) 26.12.2008
Description/ Features of the variety developed	:	• Developed through the pedigree method of cross VL Bauni Bean 1 / Contender • Very early in maturity, first green pod picking 45-50 days after sowing in mid hills • Dwarf/ bushy (40-45 cm) plant type with light green foliage • Flower colour is pink. Pods are light green, long (14 cm), smooth round, stringless and fleshy • Dry seed colour is dark brown with slight mottling
Input required	:	Seed of the variety
Output capacity	:	Organic: 98.91 (82.08-131.03) q/ha; Inorganic: 126.50 q/ha
Specific benefits and impact	:	• Very early in maturity • Resistant to root rot and moderately resistant to anthracnose, rust and angular leaf spot • Can fit into multiple cropping patterns
Unit cost	:	Breeder seed cost Rs. 450 per kg
Developed and Tested by	:	Drs. Shri Dhar, NK Hedau, V Mahajan, HS Gupta, KS Hooda, Mr. Ved Prakash, Dr. SRK Singh and Mr. Shankar Lal

Natural Resource Management Technologies

24 Plasticulture Technologies

Technology 102

Low Cost Covering for Protecting Polythene Pond Lining

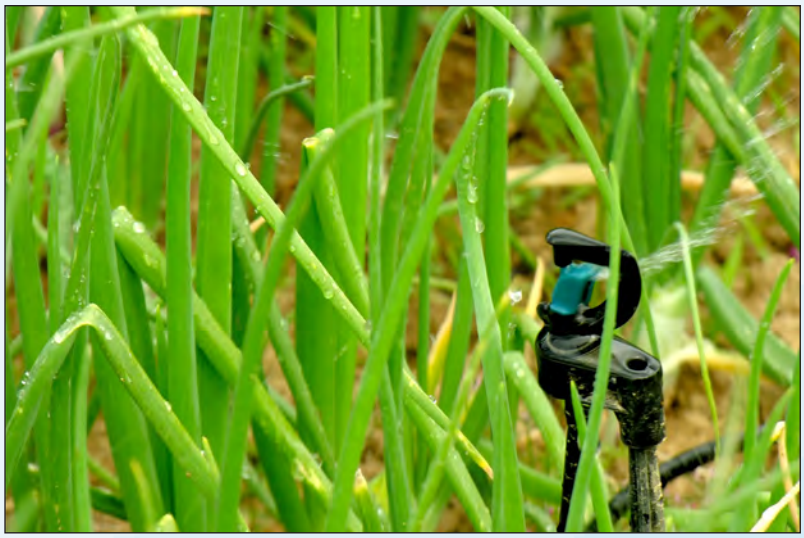
Application/ Use	:	For protection of LDPE lined tank / vermin-compost pits. Water tanks made by this technology are very useful for fish farming and irrigation.
Description/ Features of the product developed		Blocks are made using locally available material (sand collected from river / gadhera or nala /rivulets and sandy soils having more than 80 percent sand and stone) with 1:7:2 ratio of cement, sand and gravel. These blocks are used to cover the LDPE pond lining for protection.
Input required	:	Locally available material viz. sand collected from river / gadhera or nala / rivulets and sandy soils having more than 80 percent sand and stone.
Output capacity	:	The blocks are expected to extend life of LDPE tanks upto 40 years.
Specific benefits and impact	:	Technology is very simple so farmers can make it without any difficulty. It is not only economical but also environment friendly.
Unit cost	:	Covering material cost ranges from Rs. 90 to 150/m^3 for water storage structures
Developed by	:	Dr. SC Panday

Locally made Blocks

Block Covering silpaulin

Drip Irrigation for Small Terraces / Kitchen Gardens of Hills

Application/ Use	:	The large drip systems alongwith dug out ponds are not feasible in the hilly region because of small and fragmented landholdings. The wild animal menace damages force farmers to limit their cultivation especially vegetables in 200 to 1000 m^2 area nearby their homes. Mostly farmers apply irrigation manually through buckets for cultivating vegetables which is very tedious and time consuming. In order to solve these problems a drip system has been developed with roof top water harvesting or connected to a water sources (water tape/ water springs) and it is run by using gravity energy (keeping on terrace risers, roof top). It is useful for irrigating small terraces, fields and kitchen gardens and saves 60 to 80 percent water.
Description/ Features of the technology developed	:	One plastic tank of 500/1000 litter capacity (capacity of tank depend on area and rate of availability of water from source. Terrace risers / roof top used for gravity energy to give appropriate head to run the drip system. The sprinkler as well as drip system can be run with the 2 meter terrace risers which give pressure 2.90 m head including 0.9 m height of 500 litre plastic tank. The drip system can also be run with tank placed on soil surface with 0.9 m head without any extra terrace riser head. The clogging problem of drippers is major problem. One of the farmers suggested replacement of drippers with hole. Thus holes were made with the help of needle in 16 mm lateral pipes. These holes deliver water to the plants and work as dripper under low pressure and sprinkler under high pressure condition.
Input	:	Storage tank, drip system
Output capacity	:	It is very economic and can be easily adopted by the farmers. It requires Rs 8625/- to install for 200 m^2 area including drip irrigation. It is estimated that if farmer applies irrigation manually, its labour cost comes around Rs 4224/-. Hence the drip system becomes free after two to three crop seasons.
Specific benefits and impact	:	It is for irrigating small terraces, fields and kitchen gardens and saves 60 to 80 per cent water. System is very useful as it can be installed in hills very easily and runs on gravity energy.
Unit cost	:	500-1000 litre capacity tank: Rs. 2,100-4,200/- Drip system cost for one nail (200 m^2): Rs. 625/-
Developed by	:	Dr. SC Panday



Modified drip/sprinkler system for irrigation

Low Cost LDPE Lined Water Storage Tank

Application/ Use	:	Water storage tanks to store water for irrigation and fish farming. Tanks constructed without lining show percolation loss of 300 to 400 litre per day / m^2 of water. These low cost LDPE lined tanks reduce the percolation and have a relatively longer life.
Description/ Features of the technology developed	:	Tanks of 20 to 500 m^3 size can be constructed as per farmer's need. The tanks in general are constructed in a Trapezoidal shape having slope of 1:1 and 1 to 1.5 meter depth. The LDPE film of 200 to 400 micron (800 to 1000 gauge) and conforming to BIS standard 2508/1977/ BIS: 2508-1984 is used. LDPE film should be chosen according to width of tank to avoid leakage. Another lining material which is being used now a days for lining is multilayered cross laminated 200 to 250 GSM polythene sheet, which is popularly known by trade name i.e. silpaulin. If managed well, a tank can work 05 (without any pitching) to 40 years (with river boulder, bricks, and locally made blocks pitching).
Input required	:	LDPE film of 200 to 400 micron (800 to 1000 gauge) or multilayered cross laminated 200 to 250 GSM polythene sheet i.e. silpaulin.
Output capacity	:	100 m^3 capacity tank in one filing can irrigate 200 meter square vegetable field area
Specific benefits and impact	:	A 100 m^3 tank can irrigate 200 m^2 vegetable area in one filling . A farmer can earn gross income around RS 35 to 40,000 per year by growing vegetable crops in one year rotation i.e. capsicum tomato and onion.
Unit cost	:	The cost of polytank construction varies with size. The construction cost of 20 m^3 and 80 m^3 LDPE lined tanks comes around Rs. 9,450/ and Rs. 18,400/, respectively. The cost of construction reduces as the size increases. One cubic meter water can be stored by spending around Rs. 473/ in case of 20 m^3 tank and only Rs. 230/- in case of higher size tanks (80 m^3).
Developed by	:	Drs. RC Srivastava, VK Bhatnagar, SC Panday and others under AICRP on Water Management project

LDPE tank with block

LDPE tank with bolders

LDPE tanks with different types of pitching

Low Cost Vermi-composting and Vermi-wash Technology

Application/ Use	:	It is very useful to prepare vermin-compost and vermin-wash. This technology is more relevant in hills which require fertilizer transportation from distant places. The cemented pits with shed may not fit in the small farmer's resources, therefore vermi-compost and vermin-wash technology was refined to fit farmer's condition.
Description/ Features of the technology developed		Pit of size 2 x 0.75 x 3 m (length can vary as per the terraces length) are dug. The pits are not cemented and one cemented platform is constructed between two katcha pits for keeping vermin-compost or raw cow dung and biomass. These are constructed under trees to provide natural shed in mid hills whereas in higher hills, vermicomposting is possible in open or without shed because of low temperature. The vermi-compost under kiwi tree is a dual system which exerts synergetic symbiosis in the system. The vermi-compost gets shed and Kiwi tree absorbs nutrient from the vermi-compost pit.
Input required	:	Silpaulin/LDPE film, cement, sand, gravels.
Output capacity	:	In one year 345 q vermin-compost can be harvested from the above mentioned two pits and platform structure.
Specific benefits and impact	:	A pair of pits can produce 345 q vermin-compost in a year which can fetch Rs. 1.0 lakh per year (@Rs. 3.0/kg compost). The technology has the capacity to reach poor farmers.
Unit cost	:	• Two pits poly lining with platform: Rs. 11,491/- • Two pits only poly lining: Rs. 8,785/- • Two pits only block covering: Rs. 7,393/- • One pit poly lining + one katcha pit: Rs. 5,835/- • One pit block covering: Rs. 5,139/- • Two katcha pits: Rs. 2,886/- • Traditional system (three pits) of same size (3×2×0.75 m) with shed: Rs. 1,53,375/-
Developed by	:	Dr. SC Panday

Vermi-composting & vermiwash system in farmer's field

VL Portable Polyhouse

Application/Use	:	For vegetable cultivation, covering fish ponds during severe winter, drying of farm produce, covering of harvested material, etc. thus making the multiple use.
Description/ Features of the Machinery developed	:	In higher hills, it is difficult to find a single field/terrace of at least 100 m^2 or larger area. Even if the field or terrace of 100 m^2 size is available, then either it is narrow in width (2 to 5 m) or it is not straight in length (being curved in shape). Also merging the two or more fields/terraces not only involves huge earth work but also increases the cost. It also raises the vertical height between two field/terraces. A small size (62.4 m^2 surface area with 12.0 m length x 5.2 m width x 2.6 m height) low cost portable polyhouse structure can be very useful under such field conditions. This portable polyhouse is made up of 3 pieces which can be placed adjacent to each other and can be covered with single piece polythene. It can easily be shifted from one field/ terrace to the other as per requirement.
Input required	:	Seed or seedlings of crops to be cultivated, the material to be dried or kept
Output capacity	:	50 sq m floor area
Specific benefits and impact	:	• Protection of crops from any adverse environment • Increase in production • Can protect crops by preventing the entry of animals and birds • Any crop throughout the year as per requirement can be grown
Unit cost	:	Rs. 60,000/-
Developed by	:	Dr. Sher Singh, Ers. Shyam Nath, Jitendra Kumar, Dr. A Pattanayak and Dr. JK Bisht

High Density Plantation of Mango in Lower Hills

Application/ Use	:	Hilly areas are famous for temperate fruits. However, mango cultivation is more beneficial for lower hills and valley areas. High density plantation can increase fruit yield and productivity especially when the land is fragmented or scattered in small plots. In the plains, mango season extends upto end of July whereas, with this intervention specifically in lower hills, fruits can be harvested in the first fortnight of August when the supply from plain areas is almost over. Therefore, high density mango in lower hills can fetch more returns as compared to main mango season.
Description/ Features of the technology developed	:	In this intervention a dwarf variety of mango (say Amrapali) is taken for plantation with a spacing of 3x3 m. A total number of 22 plants can be planted in 200 m^2 area (One Nali). Pits of 100 cm^3 are dug during the month of June and filled with 25 kg well rotten FYM and soil. The time of planting is the beginning of monsoon season. During planting, earth ball of the sapling should remain intact and the graft union above ground level. In the initial two to three years, it is advisable to protect plants against frost and low temperature injury by covering them and resorting to flood irrigation. In the first year, in non-bearing trees, 70 g Nitrogen, 100 g Phosphorous and 50 g Potash are applied. The above doses are multiplied with the age of the tree for application in the subsequent years. The recommended doses of fertilizers are applied twice in a year i.e. beginning of monsoon (June-July) and after the fruit harvesting (September), whereas, FYM is applied in a single dose during the month of September. The first harvesting of fruits can be taken from the beginning of 4th year of plantation.

High Density Plantation of Mango variety Amrapali in Lower hills

Input required	:	Plants of dwarf variety of mango, Fertilizers, FYM, Agri- chemicals
Output capacity	:	After three year of plantation, 440 kg can beharvested from 200 m^2 plantation. Whereas, with traditional method it will be only 3 q in the same area after 7 years of plantation.
Specific benefits and economic impact	:	The plantation with normal density plantation fetches net return of Rs. 4896/200 m^2, whereas, plantation with high density can give Rs. 10654 from the same area. The net return in high density planting in lower hills is more than double the traditional method and this profit can be earned much earlier. The high net return is due to high density plantation and late season harvesting in lower hills.
Unit cost	:	• One time cost- Cost of 22 plants- Rs. 2200 /- Layout, pit digging, plantation and basin preparation- Rs. 3300/- • Annual cost of cultivation- Fertilizers, FYM, Agri- chemicals: Rs. 1040/- One year cultural operations: Rs. 2640
Introduced by	:	Dr. Pankaj Nautiyal, KVK Chinyalisaur, Uttarkashi

Farm Mechanization Technologies

26 Farm Machinery and Implements

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VL Paddy Thresher

Application/Use	:	For threshing of paddy in all rice growing hill districts of Uttarakhand
Description/ Features of the Machinery developed	:	It is a manual-cum-power operated paddy threshing machine. It works on the principle of impact on the grain for the purpose of threshing. The light weight pedal operated paddy thresher (VL Paddy Thresher) has been developed for hill region where the drudgery caused by the weight of the machine is a major concern. Polycarbonate sheet is used to reduce its weight to 45-50 kg, is rust proof thereby reduces the maintenance cost. The frame of the machine is made of 32 x 32 x 5 mm angle and 38/40 mm MS pipe. Drum of the thresher is made of MS flat (25 x 3 mm), MS Sheet (1 mm) and MS angle (25 x 25 x 3 mm). The machine is manually operated by single man. The design specifications of the machine are: Length x Width x Height = 1030 x 630 x 975 mm, Weight of the machine : 35 kg, Threshing drum speed : 350 rpm
Input required	:	Harvested paddy crop
Output capacity	:	Capacity of the machine: 80-100 kg/hr; Efficiency of the machine: 98%
Specific benefits and impact	:	The threshing of paddy is normally carried out manually, either by beating out the grains with sticks or by rubbing out under feet, both of which are time- and labour- intensive. The sharp edges of paddy kernels often wound feet of the worker. The machine is environmental friendly, as it is pedal operated and socially acceptable by the farmers. The machine is most suitable for the marginal and small farmers of hilly terrain where transportation of harvested rice crop is difficult. The machine can be taken to the field by two persons.
Unit cost	:	Rs. 6,000/- (Pedal Operated)
Developed by	:	Drs. KP Singh, Shailesh Kumar and HS Gupta

Millet Thresher-cum-Pearler

Aplication/Use	:	Pearling and threshing of finger millet and barnyard millet and dehusking of barnyard millet in all millet growing areas.
Description/ Features of the Machinery developed		It works on the principal of impact and shear on the grains. The threshing drum is provided with six leather flats fitted on the six MS flats to generate mild impact, shear and abrasive action for threshing, de-husking, pearling and polishing of the grains. A sieve assembly is attached with the threshing housing to enable easy placement of sieves of different sizes for different operations. Optimum threshing and pealing efficiency is obtained at threshing drum speed of 900 rpm with crop ear heads at moisture content below 12% at the time of threshing. The specifications of the machine are as follows: Length x Width x Height = 1000 x 590 x 1331 mm (electric motor) Length x Width x Height = 1000 x 800 x 1331 mm (engine operated) Weight : 45 kg (without electric motor) & 55 kg (without engine)
Input required	:	Harvested earheads of finger millet and barnyard millet
Output capacity	:	Threshing capacity (Electric motor operated) : 40-60 kg grain/h Threshing capacity (Engine operated) : 80-120 kg grain/h Pearling capacity for finger millet (Electric motor operated) : 60-80 kg grain/h Pearling capacity for finger millet (Engine operated) : 120-160 kg grain/h Dehulling capacity for barnyard millet (Electric motor operated) : 2.5-4.0 kg grain/h Dehulling capacity for barnyard millet (Engine operated) : 5.0-8.0 kg grain/h
Specific benefits and impact	:	As the traditional method of threshing and pearling requires more time and drudgery and the farmers want to get rid of from millet cultivation, introduction of the machine among marginal and small farmers will save their time and energy for other alternatives of livelihood.
Unit cost	:	Rs. 17,000/- (Eclectic motor operated) Rs. 31,000/- (Engine operated)
Developed by	:	Drs. KP Singh, HS Gupta and S Kundu

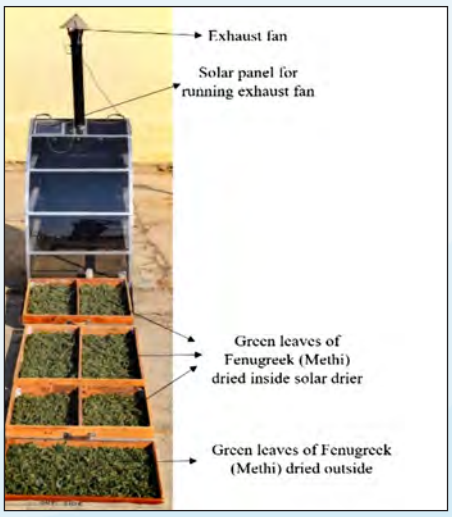
Processed Finger Millet Grains

VL Syahi Hal

Application/ Use	:	Ploughing and planking
Description/ Features of the implement	:	An environment friendly, complete metallic plough of 11-13 kg weight (2600 mm x 1070 mm x 195 mm) with more working efficiency (150 per cent higher in comparison to the traditionally used wooden hal). It can be used for ploughing as well as planking with arrangements to adjust the depth of ploughing as per the height of the farmer and the bullocks with safety device for wear and tear of share assembly and beam.
Input required	:	Pair of bullocks and one person
Output capacity	:	0.06 ha/h (ploughing and leveling of fields)
Specific benefits and impact	:	Environment friendly as every component is metallic and saves trees from deforestation. Enables efficient ploughing and ergonomically better for the bullocks. It is more durable due to all metallic components. There is frequent breakdown of the wooden ploughs, thereby interrupting the operation and wasting more time in repair. VL syahi hal saves times and cost of operation due to uninterrupted working. The working efficiency is 150 per cent more in comparison to the traditionally used wooden plough. This is two in one type, in which both ploughing as well as planking works can be done.
Unit cost	:	Rs 1,715.00 per piece Unit cost of operation: Rs. 12,900.00/ ha for human and bullock power
Developed by	:	Dr. DC Sahoo, Mr. Shiv Singh, Drs. BM Pandey and Pratibha Joshi

VL Solar Dryer

Application/ Use	:	Drying of different perishable, semi-perishable and non-perishable agricultural commodities/produce/food and wet processed food material
Description/ Features of the implement developed	:	Conventionally produce/food is dried in open in hilly areas due to non-availability of domestic type solar dryer. A solar dryer, being an enclosed unit, helps to keep the agricultural commodity/produce/food safe from damage, birds, insects, and unexpected rainfall. The agricultural commodity/produce/food can be dried using solar thermal energy in a cleaner and healthier way. It can help marginalized and poor farmers who can't afford hi-tech facilities and equipments to preserve their agricultural products and to eliminate the unwanted and unpredictable food spoilage due to lack of facilities in the region. The solar dried products can be stored for longer time in less volume. A successful enterprise can be run based on this principle which can easily utilize the surplus produce facing the seasonal glut. In off seasons, the farmer can sell the dried products at higher price. There are three trays in Vivek Solar Drier. It has wheels and can easily be transported from one place to other. Since this is solar operated, the operational cost is nil.
Input required	:	Perishable, semi-perishable and non-perishable agricultural commodities/ produce/food and wet processed food material
Output capacity	:	5 to 20 kg per batch as per type of produce
Specific benefits and impact	:	• Promotes hygienic drying • Provides safety from damage from birds, insects, animals Runs with zero operational cost
Unit cost	:	Rs. 10,000/-
Developed by	:	Dr. Sher Singh, Er. Shyam Nath, Dr. A Pattanayak, Er. Jitendra Kumar, Mr. Tilak Mondal, Er. DC Mishra and Dr. JK Bisht



Hand Operated VL Small Tool Kit

Application/ Use	:	For cultural practices
Description/ Features of the tool developed	:	Environment friendly, completely metallic hand tools viz., VL Line Maker (dimension 1250 x 760 x 340 mm and approx. weight 2.13 kg) VL Garden Rake (dimension 1220 x 210 x 135 mm and approx. weight 1.1 kg) VL Hand Hoe (dimension 1200 x 130 x 160 mm and approx. weight 1.1 kg) VL Hand Fork (dimension 310 x 100 x 125 mm and approx. weight 0.5 kg) VL Kutla or Hand weeder (dimension 312 x 155 x 45 mm and approx. weight 0.5 kg) VL Khurpi or shovel (dimension 320 x 75 x 38 mm and approx. weight 0.3 kg) VL Badi Darati or large sickle (dimension 315 x 150 x 85 mm and approx. weight 0.25 kg) VL Chhoti Darati or small sickle (dimension 290 x 150 x 75 mm and approx. weight 0.2 kg) were developed. Iron handles of kutla, khurapi, hand fork and sickles are coated with rubber grip at one point, while handles of line maker, hand hoe and garden rake are coated at two points.
Input required	:	One person
Output capacity	:	VL Hand Fork: 0.0054ha/hr VL Hand hoe: 0.0057 ha/hr VL Kutla: 0.0052 ha/hr VL Line maker: 0.214 ha/hr
Specific benefits and impact	:	Environment friendly and durable as every component is metallic or rubber, which saves number of broad leaves trees and saves time wasted in repair of wooden handles. These tools are cost effective, more efficient and ergonomically better over traditional one.
Unit cost	:	VL Line Maker :Rs. 400.00/- VL Garden Rake: Rs. 230.00/- VL Hand Hoe: Rs. 210.00/- VL Hand Fork Rs. 120.00/- VL Kutla: Rs. 105.00/- VL Khurpi: Rs. 90.00/- VL Badi Darati: Rs. 115.00/- VL Chhoti Darati : Rs. 90.00/-
Developed by	:	Dr. KP Singh, Mr. Shiv Singh, Drs. BM Pandey, Sher Singh and Er. DC Mishra

VL Kutla for White Grub Management

VL Seed-cum-Ferti Drill

Application/ Use	:	Used for direct sowing of seeds and drilling the fertilizers
Description/ Features of the implement developed	:	VL seed-cum-ferti drill has been designed and developed for hill farmers to facilitate line sowing in hills. Crops like wheat, lentil, green gram, blackgram, paddy etc. can be sown in lines along with fertilizer application using this machine. The machine can be operated by 2 persons in a prepared seedbed and by a pair of bullocks in case of no-tillage. The specifications of the tool is as follows: Length : 640 mm, Width : 500 mm, Weight : 23 kg Number of furrow opener : Two; Furrow to furrow spacing: Adjustable (175 to 250 mm); Furrow open: Inverted T-type; Share: Mild steel hardened by arc; Volume of seed box : 5600 cc; Volume of fertilizer box: 5600 cc
Input required	:	A pair of bullocks and one person (for bullock drawn) or three persons (for manual drawn)
Output capacity	:	0.05 to 0.09 ha/h for seed drilling of wheat/lentil
Specific benefits and impact	:	Conventionally seed are sown through broadcasting method in hilly areas at higher seed rate, leading to poor germination and poor plant population per unit area ultimately resulting into low crop yields. VL seed-cum-ferti drill helps in line sowing with uniform sowing depth and germination leading to better crop stand and yield. It also applies fertilizers alongwith sowing.
Unit cost	:	Rs. 3,200/- (Manually operated); Rs. 3,500/- (Manually operated)
Developed by	:	Drs. KP Singh, HS Gupta and Mr. Shailesh Kumar

VL Mulch-cum-Inline Drip Laying Machine

Application/Use	:	Laying of plastic mulch and inline drip simultaneously and marks (punching) small holes on the laid plastic mulch for transplanting/planting of seedlings/ crops
Description/ Features of the Machinery developed	:	In hills, mulching is done manually which is time and labour consuming. The mechanized way of mulching available is only suitable for plains and large scale mulching. Due to small size land holding, manual operated Mulch-cum-Inline Drip Laying Mulch useful to farmers in hills has been developed. Only two labours (draft of 32.2 kg) are required for operating the machine and the machine performs multiple operations in a single run. The effective area of standard width (1.2 m) plastic mulch after laying varied from 0.90 to 0.95 m. Plastic mulch of less than 1.2 m width can also be laid with its the adjustable nature of frame as per the need of farmer. It also marks (punching) small holes on the laid plastic mulch and the marking can be done as per spacing (row to row and plant to plant) required for a crop. Facility of laying inline drip pipe/ tape beneath the plastic mulch has also been provided in the machine
Input required	:	Plastic mulch, Inline drip, Manpower: two persons to operate the machine
Output capacity	:	590 sq m area per hour
Specific benefits and impact	:	• Performs three operations (mulch laying, inline drip laying and punching) in single run • Field capacity of the machine is 0.059 ha/h which is almost 10 times faster than manual laying
Unit cost	:	Rs. 12,000/-
Developed by	:	Er. Shyam Nath, Dr. Sher Singh, Er. Jitendra Kumar, Mr. Shiv Singh, Er. DC Mishra and Dr. JK Bisht

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Vivek Solar Vermi-compost Sieving Drum

Application/Use	:	Sieving of vermi-compost
Description/ Features of the Machinery developed	:	Vermi-composting is very feasible and eco-friendly technique for the bio waste resource conversion of agricultural wastes into a useful and high quality vermi-compost. Since organic production is need of the hour, little awareness and capital investment in vermin-compost production can be done very easily. The whole material is not converted into vermi-compost and the earth worm are also needs to be re-used, the Vivek Vermi-compost Sieving Drum can be very helpful in sieving the decomposed vermi-compost and separating the un-decomposed material along with earth worm without any mortality. This is a solar-cum-manual operated continuous vermi-compost strainer. The length of the cylinder of the machine is 90 cm with 50 cm diameter and sieve of 3 mm mess sized has been used.
Input required	:	Decomposed Vermi-compost along with earthworms
Output capacity	:	200 to 225 kg vermi-compost per hour
Specific benefits and impact	:	Sieving of vermi-compost into a uniform grade, separation of un-decomposed material with almost no mortality of earth worms.
Unit cost	:	Rs. 10,000/- (approx.)
Developed by	:	Er. Shyam Nath, Dr. BM Pandey, Mr. Shiv Singh, NC Belwal, Dr. Sher Singh, Er. Jitendra Kumar, Drs. JK Bisht and A Pattanayak

VL Pedal Operated Chaff Cutter

Application/Use	:	Chaff cutting of green and dry fodder
Description/ Features of the Machinery developed	:	Keeping in view the acute shortage of quality green fodder during winter months, wastage of fodder and straw resulting from direct feeding and erratic electricity supply, a pedal operated chaff cutter suitable for hills has been developed. In this machine, it is easy to feed the straw/fodder in the hopper by the same person who is running the machine while in conventional chaff cutter two persons are required. The output capacity of the machine is about 170 kg/hr for green fodder and 29.4 kg/hr for dry fodder. The machine has 39.2% higher RPM than conventional manual hand operated chaff cutter with 18.1% higher output capacity. However, in pedal operated chaff cutter the heart rate was slightly higher (9.1%) than conventional manual hand operated, which is mainly due to the fact that the test subjects were not habitual cycle riders.-
Input required	:	Green or dry fodder and one person to operate the chaff cutter
Output capacity	:	Green fodder: 170 kg/hr Dry Fodder: 30 kg/hr
Specific benefits and impact	:	The operator can easily feed the straw/fodder in the hopper and simultaneously perform chaff cutting, much efficiently and quickly.
Unit cost	:	Rs. 9,000/-
Developed by	:	Dr. Sher Singh, Er. Shyam Nath, Drs. Kushagra Joshi and JK Bisht

VL Feed Block Machine

Application/Use	:	To make feed blocks of fodder
Description/ Features of the Machinery developed	:	In hills, there is acute shortage of fodder specialy that of green fodder during winter months. Two types of animal feed are required in hills. One, for milking (dudharu) animals and other, for relief (rahat) animal. The available feed block machines are too much costly and heavy to be adopted in hilly region. Feed blocks can be made when fodder is available in plenty. The Vivek Feed Block Machine developed by the Institute is light in weight and very easy to operate. Screw pressing is done manually to make blocks of 300 mm x 300 mm x 150 mm size. Weight of the feed blocks is about 2.0 kg depending on its composition. The feed remained compress until the screw is reversed back.
Input required	:	Fodder, grains (if required), mineral mixture and molasses etc.
Output capacity	:	5 blocks/hr
Specific benefits and impact	:	The volume of fodder is reduced to one-third, blocks can be stored in less space.
Unit cost	:	Rs. 4,000/-
Developed by	:	Er. Shyam Nath, Drs. A Pattanayak, BM Pandey, Sher Singh, Kushagra Joshi and JK Bisht

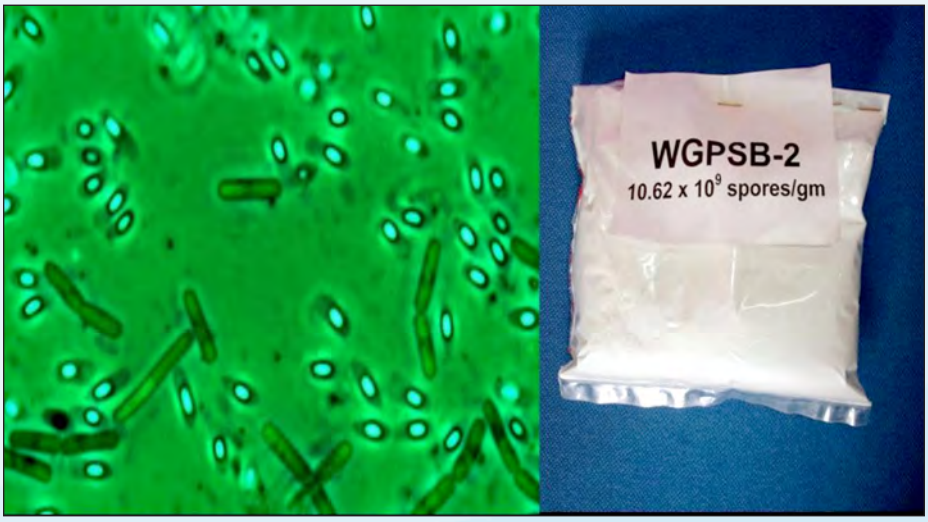
Vivek Smokeless Chulha (Stove)

Application/Use	:	Burning of pine needle briquettes
Description/ Features of the Machinery developed	:	Forest fire under pine forest is very spontaneous, massive and devastative. This occurs due to the presence of carpet of pine needle which has high lignin content. The forest fire causes loss to human, animals and environment. Once the pine forest catches fire, it burns crop fields, houses and domestic animals. It is very difficult to control the fire and sometimes it persists even for weeks. VL Smokeless Chulha developed by the Institute for burning of pine needle briquette can reduce forest fire problems, as it is related to the public interest and daily house hold activities. The briquette is prepared from pine-char and mud in the ratio of 3:1 (technology developed by GB Pant National Institute of Himalayan Environment and Sustainable Development, Almora). Once the dried briquette caches fire, it lasts upto 45 minute to an hour. The burning heat may be used for multiple uses like heating room, water and cooking food without any smoke while burning.
Input required	:	Pine needle briquettes
Output capacity	:	1 briquette/hr
Specific benefits and impact	:	• Can be used even inside a room since there is no smoke. • The flame can be adjusted as per requirement.
Unit cost	:	Rs. 650/-
Developed by	:	Er. Shyam Nath, Drs. A Pattanayak, BM Pandey, Sher Singh, Kushagra Joshi and JK Bisht

Crop Protection Technologies

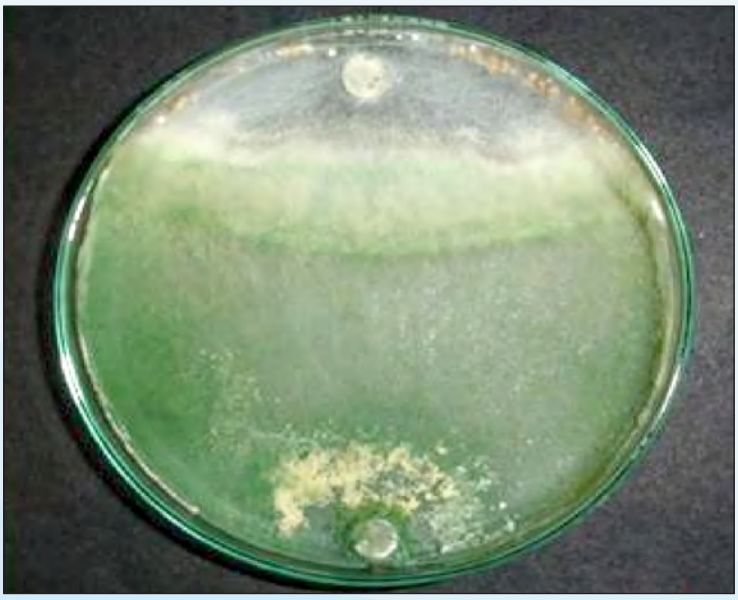
Bacterial Entomo-pathogen: *Bacillus cereus* WGPSB2 for White Grubs

Application/ Use	:	The bio-agent, *Bacillus cereus* strain WGPSB2 is effective for the management of white grubs.
Description/ Features of the product developed		*Bacillus cereus* WGPSB2 is a gram +ve bacteria isolated from diseased white grubs, formulated in talc for field applications. It cause disease to the grubs when ingested by the early stage of grub and kills them. It is found effective to the grubs but safer to other native microbes in soil and not hazardous to other living organisms as tested by IITR, Lucknow. It is an effective alternative for chemical pesticides, which are used for the management of white grubs in the region.
Input	:	For producing 1 kg powder, mother culture of the bacteria, nutrient broth (6.5 g) and talc (1 kg) is required besides equipment and labour for the production. The whole process takes three days from inoculation to packing.
Output capacity	:	A batch of 4 kg talc based formulation can be prepared using incubant shaker in 3 days time. Fermentors can be used for bigger batch. One kg of the formulation is used for 0.1 ha of crop area for the management of white grubs. It is found to reduce the pest population to 67% in three years.
Specific benefits and impact	:	*Bacillus cereus* WGPSB-2 caused >80% mortality of second instar larvae of *Anomala dimidiata* in lab and micro plot conditions at ICAR-VPKAS and found effective in fields also. It is an effective alternative for chemical pesticides used for the management of white grubs. Talc based application is easy when applied with FYM to the crop. It can be used as seed coating or drenching also.
Unit cost	:	Rs. 120 per kg of talc formulation
Developed by	:	Drs. SN Sushil, G Selvakumar, M Mohan, J Stanley, JC Bhatt and HS Gupta



Bio-pesticide for Soil-borne Fungal Pathogens: *Trichoderma harzianum* strain 28 (Tr-28)

Application/ Use	:	The isolate *Trichoderma harzianum* Tr-28 possesses broad-spectrum activity against diverse soil-borne plant pathogens
Description/ Features of the product developed	:	The isolate Tr-28 showed high antagonistic activity in vitro against six major soil borne plant pathogens *viz.*, *Rhizoctonia solani, Sclerotium rolfsii, Sclerotinia sclerotiorum, Fusarium solani, Fusarium oxysporum* f. sp. *lentis* and *Fusarium oxysporum* f. sp. *pisi.* Under field studies, it was found promising in reducing many soil borne diseases *viz.* wilt and root rot of garden pea and lentil, root rot of french bean, damping off of tomato, capsicum and cauliflower. The isolate additionally possess plant growth promoting activity and also tolerant to cold.
Input	:	Inputs required for production of this bioagents are mother culture, PDA media and broth, sorghum grains and talc besides labour and equipments for the production process.
Output capacity	:	It is recommended as 8-10 kg per ha fortified with farmyard manure.
Specific benefits and impact	:	The isolate Tr-28 is a bioagent for the management of soil borne diseases like wilt and root rot of garden pea and lentil, root rot of french bean, damping off of tomato, capsicum and cauliflower. The isolate additionally possess plant growth promoting activity and induces host plant resistance.
Unit cost	:	Rs. 100 per kg
Developed by	:	Drs. Deeksha Joshi, KS Hooda and JC Bhatt



28 Insect Trap

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White Grub Beetle Trap

Application/ Use	:	The white grub beetle trap is a light based insect trapping device used to attract and capture white grub beetles
Description/ Features of the product developed		White grub beetle trap is efficient, cost effective, light weight and user friendly light based insect trap specific for capturing white grub beetles (Patented: IN 290170). It consists of a CFL assembly, hitting fins, funnel and collection pot designed to attract and capture white grub beetles or scarab. It is found very effective for monitoring and mass trapping of white grub beetles. It is suitable to be used in all cropping systems wherever white grub infestations are found. The traps can be used in community basis on a village level for better results.
Input	:	Input required for manufacturing one light trap are tin sheets (0.5 mm thickness = 24 gauge; 1.6 kg), CFL, electric wire and electricity besides skilled labour for making it.
Output capacity	:	One light trap can cover an area of about 1 ha normally but two may be required depending on the topography of the hills.
Specific benefits and impact	:	Light trap can be used for the management of white grubs by mass trapping adult beetles. It is found specific to white grubs and eco-friendly by not trapping beneficial species. The impact of light trap can be seen by reduction in beetle catches upto 58% in three years and grub reduction of 67% in different villages tested.
Unit cost	:	Rs. 850 per light trap
Developed by	:	Drs. SN Sushil, JC Bhatt, M Mohan, KP Singh and J Stanley