



Research Article

VL *Dhan* 158: An early maturing rice variety for rainfed uplands of North-West Himalayas

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Abstract

Early duration rice variety, VL *Dhan* 158 was developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand for cultivation under rainfed upland conditions of Uttarakhand and Himachal Pradesh during *Kharif* season. This variety was notified and released in 2017 by the Central Sub-Committee on Crop Standards Notification and Release of Variety for Agricultural Crops. VL *Dhan* 158 is derived from the cross RCPL 1-45 x VL 3861 with maturity duration of 110-120 days. This has intermediate plant height, semi-erect panicle mostly exerted and plants are non-lodging. This variety has recorded average grain yield of 2,386 kg/ha in comparison to national check, *Vivek Dhan* 154 (1,722 kg/ha); regional check, *Sukradhan* 1 (2,115 kg/ha) and Local check (1,905 kg/ha) with yield advantage of 38.53, 12.78 and 25.26 per cent, respectively, over these checks. It has exhibited high head rice recovery of 66.2%, intermediate ASV (4.0) and amylose content of 24.44%. It has shown resistance to brown spot (*Cochliobolus miyabeanus*) and blast (*Magnaporthe grisea*), the most serious disease of upland rice in Northern hill.

Key words

VL *Dhan* 158, Rainfed upland, hill rice, early duration, high yielding variety

Introduction

Rice (*Oryza sativa*) in North-West Himalayas occupies 0.61 m ha area with production of about 1.34 million tones and productivity 2179 kg/ha of milled rice (DES, 2016). Among this around 60% rice is grown under rainfed upland conditions of Uttarakhand and Himachal Pradesh (Anonymous, 2014). Rice in the upland ecosystem is grown in rainfed banded or unbanded fields, with naturally well-drained soils, without any surface water accumulation. The upland rice ecosystem is characterized by extreme diversity of soils and topography that ranges from sloping, terraced lands to well drained flat lands (Singh and Singh 2000). Rice yields in rainfed ecosystems are low and vary greatly due to the vagaries of the monsoon. In rainfed upland rice growing areas distribution of rainfall is more important than total rainfall received because long spells between two rains greatly reduce productivity of the crop (Serraj *et al.*, 2011) and soils are highly fragile, less fertile, poor physical and chemical properties with less acreage under improved rice varieties. In general rainfed upland ecosystem are drought prone and mostly marginal to small farmers dominate this ecosystem where, rice (*Oryza sativa* L.) serve as nutritional cushion for food

security as well as provides employment for the rural and tribal hill population. Hill farmers are mainly using farm saved seeds of landraces, old and obsolete varieties because lack of awareness on improved varieties and unavailability of the quality seed of improved varieties at right time and place.

Increasing production and productivity of rice in such rainfed upland ecosystem with the in-built tolerance to biotic and abiotic stresses remains always a challenging task for plant breeders. Plant breeders devote constant efforts for development of better varieties in crops to face and adopt the present crop situations. It is necessary to enhance the yield strata and narrow the yield gap for further increase in rice productivity (Kirubakaran *et al.* 2015). Early/short duration varieties of rice have many advantages *viz.*, suitably fit in annual cropping system of the hill farmers, escape terminal drought, fit for contingency planning and have significant impact on rainfed upland rice production and productivity. The expected future demand of rice for increasing population may not be met only by higher yields from irrigated areas. More efforts are needed to enhance the contribution of rainfed rice areas to

overall rice production by identifying, validating, delivering and applying situation-specific, appropriate technologies. The rainfed ecosystems are the high priority ecosystem in Uttarakhand because its 85-90% hill areas are under rainfed. Under this context, efforts were made at ICAR-VPKAS Almora, Uttarakhand to develop high yielding, non-lodging rice variety having non-shattering bold grain type with resistance to major diseases and insect pests.

Material and Methods

VL *Dhan* 158 is rainfed upland rice variety developed at ICAR-*Vivekananda Parvatiya Krishi Anusandhan Sansthan* Almora, Uttarakhand from a cross between RCPL 1-45 and VL 3861. High yielding, desirable plant type and disease resistance traits were selected in F₂ and further advanced to subsequent generations. From F₃ to F₆, the progeny rows were evaluated for their sustained performance. Twenty five progenies of this cross were evaluated in observational nursery (fixed advance generation) and progeny namely VR 2654-3 was found significantly superior over the best check. It was named as VL 8657 and tested for two years for yield performance and disease resistance in station trials during 2010 and 2011 and observed that excellent performance of VL 8657 over the best check. VL 8657 was nominated as entry in All India Coordinated Rice Improvement Programme (AICRIP) Trial in 2012 and it was evaluated under multilocation rainfed upland hill trials of all the AICRIP centers of India for yield and other traits. The detailed flow chart of pedigree, breeding programme and evaluation of VL *Dhan* 158 was shown in the Fig.1. The entry, VL 8657 was found superior under AICRIP trials viz., Initial Varietal Trials (IVT), Advanced Varietal Trials (AVT1 & AVT2) and identified as the best entry for grain yield. The reaction of the entry against major diseases and insect pests were also studied in various hot spot centers for three years (2012-2014). The different grain quality parameters were also analyzed for two years (2013 and 2014) at ICAR- Indian Institute of Rice Research, Hyderabad. Agronomical performance of the entry was tested at four different centers in 2014. Finally, the entry VL 8657 was released and notified as VL *Dhan* 158 during 2017.

Results and Discussion

VL *Dhan* 158 has recorded a mean grain yield of 2386 kg/ha in overall hills over 3 years in Multi Location Trials (MLT) conducted under AICRIP at 17 locations during 2012 to 2014 in comparison to national check, *VivekDhan* 154 (1,722 kg/ha); regional check, *Sukradhan*1 (2,115 kg/ha) and local

check (1,905 kg/ha) with yield advantage of 38.53, 12.78 and 25.26 per cent, respectively, over these checks (Table 1). VL *Dhan* 158 gave 39.94%, 10.76% and 23.67% yield advantage over national check, regional check and local check, respectively, under the low elevated hills (Table 2). Whereas, it was superior to *VivekDhan* 154 (national check) by 34.66%, *Sukradhan*1 (regional check) by 19.01% and local check by 30.04% under medium elevation (Table 3). Based on consistent performance under AICRIP coordinated trials for three years, VL *Dhan* 158 was found promising for lower hills of Himachal Pradesh and the medium hills of Uttarakhand.

Reaction to Diseases and Insect pest: Leaf blast, neck blast (*Magnaporthe grisea*) and brown spot (*Cochliobolus miyabeanus*) are the major diseases of hill region and the VL *Dhan* 158 was found to be resistant against these diseases (Table 4). Similarly, there was no major incidence of insect pest infection (Table 5).

Grain quality: VL *Dhan* 158 has recorded high head rice recovery of 66.2%, milling percentage (69.7%) and hulling percentage (77.4%) which are desirable traits for miller's point of view. It has short bold grain type with intermediate gelatinization temperature ASV (4.0), amylose content of 24.44% and medium gel consistency (52mm) which are the desirable traits for good cooking quality (Table 6).

Morphological Characters: VL *Dhan* 158 matures in 110-120 days and attains 50 per cent flowering in 83-94 days after sowing. It has an erect plant habit with 107-124 cm plant height. The panicle types are semi-erect and mostly exerted. The 1000 grain weight is 21.25g (Table 7).

Considering the superior performance of rice variety VL *Dhan* 158 over the national check (*VivekDhan* 154), regional check (*Sukradhan*1) and local check it was released and recommended for large scale cultivation in lower hills of Himachal Pradesh and medium hills of Uttarakhand during 2017.

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Table 1. Overall grain yield (kg/ha) data of Coordinated Varietal Trials

Year of testing	No. of trials	Proposed variety Central Rice VL Dhan 158	Check Var.1 VivekDhan 154 (NC)	Check Var.2 Sukradhan 1 (RC)	Check Var.3 (LC)	Qual. Var.1 IET 22979	C.D.
I Year (2012)	5	2618	1862	2121	2062	1919	234-626
II Year (2013)	7	2065	1263	1867	1581	2041	273
III Year (2014)	5	2602	2225	2457	2200	2411	141
Mean (Weighted)		2386	1722	2115	1905	2114	
I Year (2012)			(+) 40.60	(+) 23.43	(+) 26.96	(+) 36.43	
II Year (2013)			(+) 63.50	(+) 10.61	(+) 30.61	(+) 1.18	
III Year (2014)			(+) 16.94	(+) 5.90	(+) 18.27	(+) 7.92	
Mean (Weighted)			(+) 38.53	(+) 12.78	(+) 25.26	(+) 12.85	

Table 2. Grain yield (kg/ha) data of Coordinated Varietal Trials in Northern Lower Hills (ME, MN, HP)

Year of testing	No. of trials	Proposed variety Central Rice VL Dhan 158	Check Var.1 VivekDhan 154 (NC)	Check Var.2 Sukradhan 1 (RC)	Check Var.3 (LC)	Qual. Var.1 IET 22979	C.D.
I Year (2012)	3	3228	2135	2631	2407	2068	234-626
II Year (2013)	5	2439	1516	2286	1854	2493	386
III Year (2014)	3	2711	2487	2591	2592	2570	225
Mean (Weighted)		2728	1950	2463	2206	2398	
I Year (2012)			(+) 51.19	(+) 22.69	(+) 34.11	(+) 56.09	
II Year (2013)			(+) 60.88	(+) 6.69	(+) 31.55	(-) 2.17	
III Year (2014)			(+) 9.01	(+) 4.63	(+) 4.59	(+) 5.49	
Mean (Weighted)			(+) 39.94	(+) 10.76	(+) 23.67	(+) 13.77	

ME= Meghalaya, MN= Manipur, HP= Himachal Pradesh, NC=National Check, RC=Regional Check, LC=Local Check



Table 3. Grain yield (kg/ha) data of Coordinated Varietal Trials in Northern Medium Hills (UT)

Year of testing	No. of trials	Proposed variety Central Rice VL Dhan 158	Check Var.1 Vivek Dhan 154 (NC)	Check Var.2 Sukradhan 1 (RC)	Check Var.3 (LC)	Qual. Var.1 IET 22979	C.D.
I Year (2012)	2	1702	1451	1356	1544	1696	313-443
II Year (2013)	2	1130	632	818	898	910	179-201
III Year (2014)	2	2440	1832	2256	1612	2172	154-186
Mean (Weighted)		1757	1305	1477	1351	1593	
I Year (2012)			(+) 17.30	(+) 25.52	(+) 10.23	(+) 0.35	
II Year (2013)			(+) 78.80	(+) 38.14	(+) 25.84	(+) 24.18	
III Year (2014)			(+) 33.19	(+) 8.16	(+) 51.36	(+) 12.34	
Mean (Weighted)			(+) 34.66	(+) 19.01	(+) 30.04	(+) 10.34	

Table 4. Reaction to major diseases in Northern Hills

Parameter	Year of testing	No. of Location	Proposed variety Central Rice VL Dhan 158	Check Var.1 VivekDhan 154 (NC)	Check Var.2 Sukradhan 1 (RC)	Qual. Var.1 IET 22979
Leaf Blast (SI)	I Year (2012)	11	4.4	5.0	3.9	4.3
	II Year (2013)	11	2.2	3.3	3.0	3.4
	III Year (2014)	13	3.4	3.6	2.9	4.4
	Mean		3.3	4.0	3.3	4.0
Neck Blast (SI)	I Year (2012)	3	4.3	7.0	3.7	5.0
	II Year (2013)	3	4.3	8.0	7.0	7.0
	III Year (2014)	5	3.6	4.2	3.0	3.4
	Mean		4.1	6.4	4.6	5.1
Sheath Blight (SI)	I Year (2012)	4	5.5	6.5	5.5	5.0
	II Year (2013)	5	4.5	3.5	4.0	3.6
	III Year (2014)	3	6.0	4.5	7.0	7.0
	Mean		5.3	4.8	5.5	5.2
Brown Spot (SI)	I Year (2012)	5	4.6	3.4	3.2	3.4
	II Year (2013)	6	5.0	3.8	4.2	4.3
	III Year (2014)	6	4.8	2.8	4.4	5.5
	Mean		4.8	3.3	3.9	4.4



Table 5. Reaction to major insect pests in Northern Hills

Parameter	Year of testing	No. of Location	Proposed variety Central Rice VL <i>Dhan 158</i>	Check Var.1 <i>VivekDhan 154</i> (NC)	Check Var.2 <i>Sukradhan 1</i> (RC)	Qual. Var.1 IET 22979
BPH (GR, DS)	I Year (2012)	1	9.0	9.0	7.8	8.2
	II Year (2013)	1	9.0	8.4	7.8	9.0
	III Year (2014)	1	8.2	9.0	8.4	9.0
	Mean		8.7	8.8	8.0	8.7
WBPH (GR, DS)	I Year (2012)	1	6.9	7.5	4.3	9.0
	II Year (2013)	1	9.0	8.4	8.3	9.0
	III Year (2014)	1	9.0	6.5	7.8	8.6
	Mean		8.3	7.5	6.8	8.9
Leaf folder (82 days % DL)	I Year (2012)	1	NA	NA	NA	NA
	II Year (2013)	1	14.7	9.4	29.2	19.3
	III Year (2014)	1	22.7	27.4	27.4	22.9
	Mean		18.7	18.4	28.3	21.1



Table 6. Data on quality characteristics of the variety VL Dhan 158

Grain quality characteristics	Year	Proposed variety Central Rice VL Dhan 158	Check Var.1 VivekDhan 154 (NC)	Check Var.2 Sukradhan 1 (RC)	Qual. Var.1 IET 22979
Hulling (%)	2013	75.5	77.2	80.2	79.2
	2014	79.2	78.0	79.2	79.4
	Mean	77.4	77.6	79.7	79.3
Milling (%)	2013	67.4	69.1	73.3	71.2
	2014	72.0	68.1	71.9	69.2
	Mean	69.7	68.6	72.6	70.2
Head Rice Recovery (%)	2013	64.4	65.2	71.2	66.8
	2014	67.9	53.5	70.2	57.0
	Mean	66.2	59.4	70.7	61.9
Kernel length(mm)	2013	5.90	6.66	6.88	6.65
	2014	5.78	6.29	6.20	6.48
	Mean	5.84	6.48	6.54	6.57
Kernel breadth (mm)	2013	2.48	2.38	2.06	2.75
	2014	2.45	2.41	2.05	2.77
	Mean	2.47	2.40	2.06	2.76
L/B ratio	2013	2.37	2.79	3.34	2.42
	2014	2.35	2.60	3.03	2.33
	Mean	2.36	2.70	3.19	2.38
Grain type	2013	SB	LB	LS	LB
	2014	SB	LB	LS	LB
	Mean	SB	LB	LS	LB
Grain Chalkiness	2013	VOC	VOC	VOC	OC
	2014	VOC	VOC	VOC	OC
	Mean	VOC	VOC	VOC	OC
Alkali Spreading Value	2013	4.0	5.0	4.0	4.0
	2014	4.0	4.0	4.0	4.0
	Mean	4.0	4.5	4.0	4.0
Amylose content (%)	2013	24.71	25.80	24.30	25.38
	2014	24.17	25.31	24.58	25.02
	Mean	24.44	25.56	24.44	25.20
Gel Consistency (mm)	2013	62	43	42	37
	2014	42	41	42	36
	Mean	52	42	42	36.5

Table 7. Descriptive morphological characteristics of VL Dhan 158 as per DUS guidelines

S. No.	Characters and code	Expression and score
1.	Basal Leaf: Sheath colour	Green (1)
2.	Leaf: Pubescence of blade surface	Absent (1)
3.	Leaf: Auricles	Present (9)
4.	Leaf: Anthocyanin colouration of auricles	Colourless (1)
5.	Leaf: Shape of ligule	Split (3)
6.	Leaf: Colour of ligule	Green (1)
7.	Flag leaf: Attitude of blade(early observation)	Erect (1)
8.	Fag Leaf: Attitude of blade (late observation)	Erect (1)
9.	Time of heading (50 % of plant with panicles)	Early (3)
10.	Lemma: Anthocyanin colouration of apex	Absent (1)
11.	Spikelet: Colour of stigma	White (1)
12.	Stem: Length(excluding panicle; excluding floating rice)	Very short (1)
13.	Stem: Anthocyanin colouration of nodes	Absent (1)
14.	Panicle: Length of main axis	Short (3)
15.	Panicle: Length of main axis	Semi-straight (3)
16.	Spikelet: Density of pubescence of lemma	Absent (1)
17.	Spikelet: Colour of tip of lemma	White (1)
18.	Panicle: Awns	Absent (1)
19.	Panicle: Colour of awns(late observation)	Not Applicable
20.	Panicle: Distribution of awns	Not Applicable
21.	Panicle: Attitude of branches	Semi erect (5)
22.	Panicle: Exsertion	Mostly exerted (5)
23.	Sterile lemma: Colour	Straw (1)
24.	Decorticated grain: Length	Medium (5)
25.	Decorticated grain: Width	Medium (5)
26.	Decorticated grain: Shape (in lateral view)	Short bold (2)
27.	Decorticated grain: Colour	White (1)
28.	Endosperm: Content of amylose	Intermediate (5)
29.	Decorticated grain: Aroma	Absent (1)

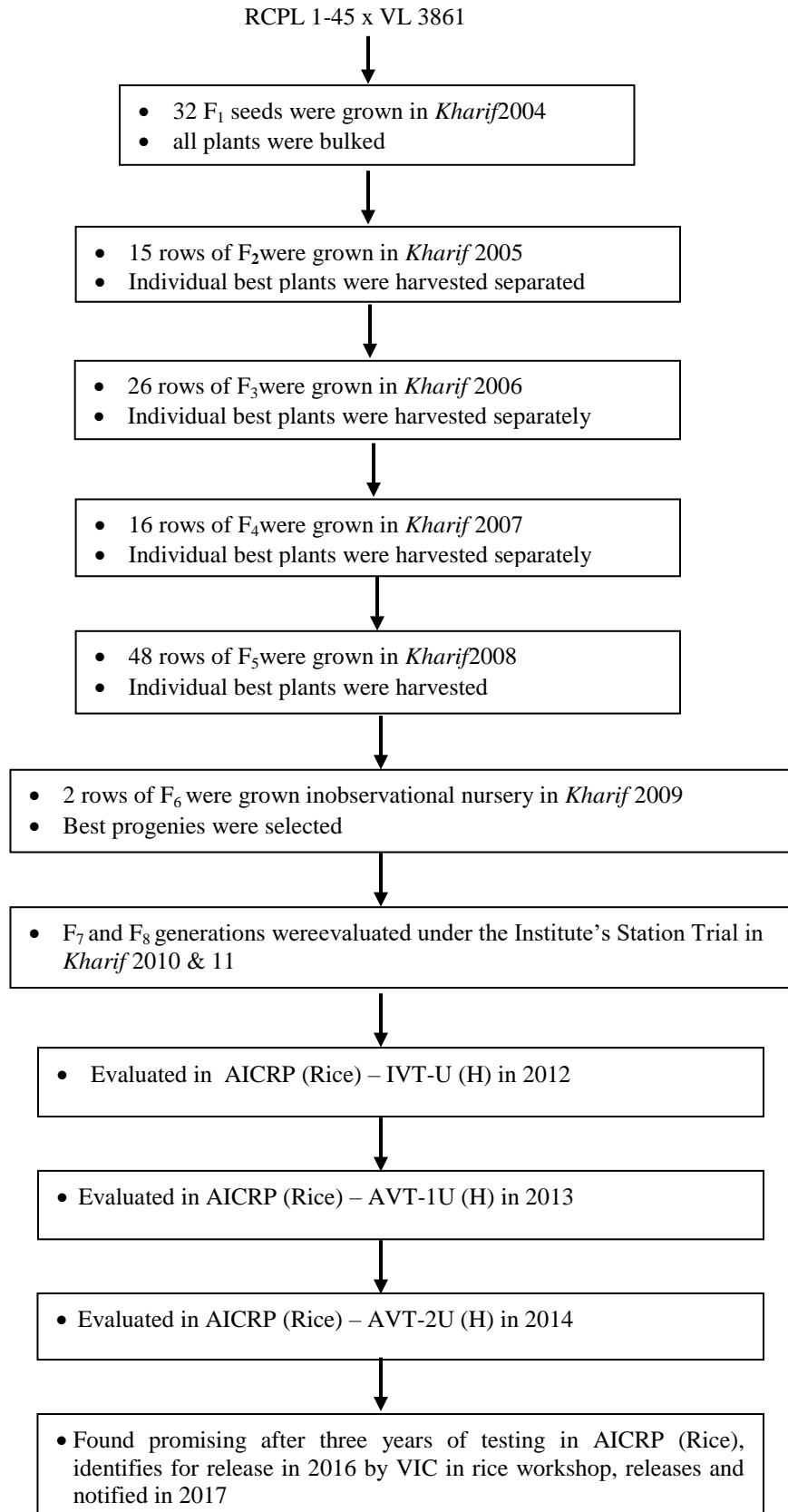


Fig.1. Flow Chart of pedigree of VL Dhan 158