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Research Article

Elite rice variety ‘VL Dhan 159’ for cultivation under organic condition of Uttarakhand hills

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Abstract
VL Dhan 159 is an early duration rice variety suitable for cultivation under rainfed upland organic condition of Uttarakhand hills. This variety has been developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS) Almora, Uttarakhand for the kharif season and released by the State Varietal Release Committee of Uttarakhand in 2020. Subsequently it was notified by the Central Seed Committee vide notification number S.O.500(E) dated the 29th January, 2021. VL Dhan 159 is derived from the cross VL 66/HPR 2143 with a maturity duration of 110-115 days. Under organic conditions, this variety has recorded an average yield of 2,054 kg/ha and out yielded the check varieties of Vivek Dhan 154 by 42.34 per cent, VL Dhan 221 by 27.34 per cent and VL Dhan 156 by 33.64 per cent. It was found resistant against leaf and neck blast (score 0-3), brown leaf spot (score 3-4), sheath rot (score 1), leaf scald (score 1-3), false smut (score 0), stem borer and leaf folder (score 0-1) under natural condition. It has more number of panicles/m² (229) compared to the checks of Vivek Dhan 154 (200) and VL Dhan 156 (172). This variety has non lodging intermediate plant height, semi-erect with well exerted panicle. It has exhibited a better quality characteristics like high hulling (82.8%) and milling (72.1%), intermediate Alkali Spreading Value (4.0), Gel consistency (50) and amylose content (25.93%). Grain Chalkiness is very occasionally present. It has short bold grain with L/B ratio of 2.00

Key words
VL Dhan 159, organic condition, Rainfed upland, hill rice, early duration, high yielding variety

INTRODUCTION
Rice is the major kharif crop of Uttarakhand cultivated in about 2.56 l. ha area with a production of 6.17 l. t. and productivity of 2,412 kg/ha (DES, 2018). A huge difference in production and productivity of rice between hill and plain region is observed mainly due to the availability of irrigation facilities and improved varieties. Rice grown in plains are almost entirely under irrigated condition whereas about 67 per cent area in hill rice is under rainfed condition, therefore, the development of improved varieties of rice for rainfed upland ecosystem is essential for yield stabilization for hill farmers and fulfill the requirement of rainfed upland rice growers.

Traditionally, upland rice is grown during the spring season locally known as Chaiti or Chetki Dhan or Spring sown rice in English in hill region of Uttarakhand and its cultivation is being practiced under two years of crop rotation i.e., Spring rice (sown in March end/April and harvested by September end/Oct start)-Wheat (October to May)-Finger/Barnyard millet (June to September)-Fallow (October to March) which allows harvesting of only three crops in two years period with a cropping intensity of 150 per cent only. Keeping this point in view, concerted efforts have been made for the development of high yielding, early duration varieties of rice for upland hill regions in order to increase the cropping intensity 200 per cent (i.e., two crops/year) by sowing upland rice in the month of June and harvest in the month of October.

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ELITE RICE VARIETY 'VL DHAN 159' FOR CULTIVATION UNDER RAINEF UPLAND ECOSYSTEM OF UTTARAKHAND HILLS UNDER ORGANIC CONDITION.

This variety was developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand. The variety was released by the State Varietal Release Committee of Uttarakhand in 2020 and recently notified by the Central Seed Committee vide notification number S.O.500(E) dated the 29th January, 2021. The cultivation of this variety not only increases cropping intensity owing to its short duration but also significant impact on production and productivity of rainfed upland rice. This newly developed variety matures in 115-120 days and can be sown after onset of monsoon and harvested before the successive Rabi season crop.

MATERIALS AND METHODS

VL Dhan 159 is derived from a cross between VL 66 and HPR 2143 developed at ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan Almora, Uttarakhand. The cross was made in 2007 and F1 seeds were evaluated in 2008. The F1 seeds were raised in 33 rows in 2009 and ears were selected from the four best plants based on high yielding ability, intermediate plant type, disease resistance and other desirable traits and harvested separately. Each F1 ears were grown in 2 rows in 2010. The pedigree method was followed for generation advancement up to F3 generation. Four progenies of this cross were evaluated in observational nursery in 2013 and the best progeny rows namely; VR 2929-2 found significantly superior to the best check was bulked for further evaluation in station trial. It was named as VL 20083 in station trial and tested in observational nursery in 2013 and the best progeny rows namely; VR 2929-2 found significantly superior to the best check was bulked for further evaluation in station trial. It was named as VL 20083 in station trial and tested in observational nursery in 2013 and the best progeny rows namely; VR 2929-2 found significantly superior to the best check was bulked for further evaluation in station trial. It was named as VL 20083 in station trial and tested in observational nursery in 2013 and the best progeny rows namely; VR 2929-2 found significantly superior to the best check was bulked for further evaluation in station trial. It was named as VL 20083 in station trial and tested in observational nursery in 2013 and the best progeny rows namely; VR 2929-2

RESULTS AND DISCUSSION

VL Dhan 159 is a June sown rainfed upland rice genotype suitable for hills and valleys of Uttarakhand. It has shown overall mean grain yield 2,054 kg/ha over three years (2016-2018) in multilocation testing under SVT and out yielded the checks, Vivek Dhan 154 by 42.34 per cent, VL Dhan 221 by 27.34 per cent and VL Dhan 156 by 33.64 per cent (Table 1).

The data regarding performance of the variety in agronomic trial is presented in Table 2. This variety was found responsive at both lower and normal fertility level and overall recorded significantly higher grain yield (2,353 kg/ha) over the best check VL Dhan 156 (2,117 kg/ha).

This variety has shown resistance against major diseases viz., leaf and neck blast (score 0-3), brown leaf spot (score 3-4), sheath rot (score 1), leaf scald (score 1-3) false smut (score 0) (Tables 3-4) and insect pests viz., stem borer and leaf folder (score 0-1) evaluated under natural as well as artificial conditions (Tables 5-6).

Table 1. Summary of grain yield data of State Varietal Trials

| Year of testing | Name of trial (location) | Proposed variety (VL 20083) | Check Var. 1 (Vivek Dhan 154) | Check Var. 2 (VL Dhan 221) | Check Var. 3 (VL Dhan 156) |
|-----------------|--------------------------|-----------------------------|-------------------------------|---------------------------|-----------------------------|
| Mean yield (kg/ha) | 2016 SVT(4) | 2,555 | 1,780 | 1,613 | - |
|                  | 2017 SVT(4) | 2,187 | 1,605 | - | 1,942 |
|                  | 2018 SVT(4) | 1,420 | 943 | - | 1,131 |
| Weighted Mean | 2,054 | 1,443 | 1,613 | 1,537 |
| Percentage increase over the checks | 2016 SVT | (-) 43.54 | (-) 58.40 | - |
|                  | 2017 SVT | (+) 36.26 | - | (+) 12.62 |
|                  | 2018 SVT | (-) 50.58 | - | (+) 25.55 |
| Mean percentage increase | (+) 42.34 | (+) 27.34 | (+) 33.64 |
| Frequency in the top group (pooled for 3 years) | 6/12 | 1/12 | 0/12 | 2/12 |
Table 2. Adaptability to changes in agronomic conditions in Uttarakhand Hills, Almora during Kharif, 2020

| Experiment                      | Year of testing | Item          | Proposed variety | Check Var.1 (Vivek Dhan 154) | Check Var.2 (VL Dhan 156) |
|---------------------------------|-----------------|---------------|------------------|------------------------------|----------------------------|
| Fertilizer Experiment response to NPK (Recommended dose of fertilizer 60:30:20 kg/ha) | 2020            | F1: 50 % RDF  | 2030             | 1692                         | 1969                       |
|                                 |                 | F2: 100 % RDF | 2676             | 2126                         | 2264                       |
|                                 |                 | Mean          | 2353             | 1909                         | 2117                       |

Table 3. Reaction to major diseases under natural condition in SVT during Kharif, 2016-18 (Maximum Score on scale 0-9)

| Disease              | Year | Proposed variety (VL 20083) | Check Var. 1 (Vivek Dhan 154) | Check Var. 2 (VL Dhan 221) | Check Var. 3 (VL Dhan 156) |
|----------------------|------|-----------------------------|-------------------------------|----------------------------|----------------------------|
| Leaf Blast           | 2016 | 3                           | 1                             | 3                          | -                          |
|                      | 2017 | 3                           | 1                             | -                          | 1                          |
|                      | 2018 | 3                           | 3                             | -                          | 3                          |
| Mean                 |      | 3.0                         | 1.7                           | 3.0                        | 2.0                        |
| Neck Blast           | 2016 | 0                           | 5                             | 3                          | -                          |
|                      | 2017 | 3                           | 5                             | -                          | 3                          |
|                      | 2018 | 1                           | 1                             | -                          | 1                          |
| Mean                 |      | 1.3                         | 3.7                           | 3.0                        | 2.0                        |
| Sheath Rot           | 2016 | 1                           | 1                             | -                          | -                          |
|                      | 2017 | 1                           | 1                             | -                          | 1                          |
|                      | 2018 | 1                           | 1                             | -                          | 1                          |
| Mean                 |      | 1.0                         | 1.0                           | 1.0                        | 1.0                        |
| Brown Leaf Spot      | 2016 | 3                           | 1                             | 3                          | -                          |
|                      | 2017 | 4                           | 3                             | -                          | 3                          |
|                      | 2018 | 4                           | 4                             | -                          | 4                          |
| Mean                 |      | 3.7                         | 2.7                           | 3.0                        | 3.5                        |
| Leaf Scald           | 2016 | 1                           | 3                             | 3                          | -                          |
|                      | 2017 | 3                           | 5                             | -                          | 3                          |
|                      | 2018 | 1                           | 5                             | -                          | 5                          |
| Mean                 |      | 1.7                         | 4.3                           | 3.0                        | 4.0                        |
| False Smut           | 2016 | 0                           | 1                             | 0                          | -                          |
|                      | 2017 | 0                           | 0                             | -                          | 0                          |
|                      | 2018 | 0                           | 0                             | -                          | 0                          |
| Mean                 |      | 0.0                         | 0.3                           | 0.0                        | 0.0                        |
| Grain Discolouration | 2016 | 3                           | 3                             | 1                          | -                          |
|                      | 2017 | 1                           | 1                             | -                          | 1                          |
|                      | 2018 | 1                           | 1                             | -                          | 1                          |
| Mean                 |      | 1.7                         | 1.7                           | 1.0                        | 1.0                        |

This variety has very good and acceptable grain qualities viz., hulling 82 per cent; milling 72 per cent; kernel length 5.27mm; kernel breadth 2.63mm; L/B ratio 2.00mm short bold grain. It has exhibited an intermediate alkali spread value (4.0), gel consistency (50mm) and amylose (25.93%) content (Table 7). It has short bold grain with plant height of 95-105 cm
Table 4. Reaction to major diseases in All India Coordinated Trials during *Kharif*, 2017 & 2018

| Parameter                | Year of testing | No. of Location | Proposed variety VL Dhan 159 | Check Var.1 Sukradhan 1 (NC) | Check Var.2 Vivek Dhan 154 (RC) |
|--------------------------|-----------------|-----------------|-------------------------------|-------------------------------|---------------------------------|
| Leaf Blast (SI)          | I Year (2017)   | 8               | 6.1                           | 5.4                           | 6.0                             |
|                          | II Year (2018)  | 10              | 5.6                           | 5.1                           | 4.9                             |
|                          | Mean            |                 | 5.9                           | 5.3                           | 5.5                             |
| Neck Blast (SI)          | I Year (2017)   | 9               | 4.2                           | 5.4                           | 6.2                             |
|                          | II Year (2018)  | 9               | 4.6                           | 5.0                           | 6.2                             |
|                          | Mean            |                 | 4.4                           | 5.2                           | 6.2                             |
| Brown Spot (SI)          | I Year (2017)   | 5               | 5.4                           | 4.8                           | 6.6                             |
|                          | II Year (2018)  | 5               | 5.6                           | 5.4                           | 5.6                             |
|                          | Mean            |                 | 5.5                           | 5.1                           | 6.1                             |
| Rice Tungro Disease (SI) | I Year (2017)   | 1               | 3.0                           | 5.0                           | 5.0                             |
|                          | II Year (2018)  | 2               | 4.0                           | 6.0                           | 7.0                             |
|                          | Mean            |                 | 3.5                           | 5.5                           | 6.0                             |

Table 5. Reaction to major insect pests under natural condition in SVT during *Kharif*, 2016-18 (Maximum Score on scale 0-9)

| Insects                 | Year | Proposed variety (VL 20083) | Check Var. 1 (Vivek Dhan 154) | Check Var. 2 (VL Dhan 221) | Check Var. 3 (VL Dhan 156) |
|-------------------------|------|-----------------------------|-------------------------------|-----------------------------|----------------------------|
| Stem borer              | 2016 | 0                           | 0                             | 0                           | -                          |
|                        | 2017 | 1                           | 0                             | -                           | 0                          |
|                        | 2018 | 0                           | 0                             | -                           | 0                          |
|                        | Mean | 0.3                         | 0.0                           | 0.0                         | 0.0                        |
| Leaf folder             | 2016 | 1                           | 1                             | 1                           | -                          |
|                        | 2017 | 0                           | 0                             | -                           | 1                          |
|                        | 2018 | 1                           | 0                             | -                           | 1                          |
|                        | Mean | 0.7                         | 0.3                           | 1.0                         | 1.0                        |

Table 6. Reaction to major insect pests in All India Coordinated Trials during *Kharif*, 2017 & 2018

| Parameter               | Year of testing | No. of Location | Proposed variety VL Dhan 159 | Check Var.1 Sukradhan 1 (NC) | Check Var.2 Vivek Dhan 154 (RC) |
|-------------------------|-----------------|-----------------|-------------------------------|-------------------------------|---------------------------------|
| BPH (GR, DS)            | I Year (2017)   | 4               | 8.8                           | 7.5                           | 7.1                             |
|                        | II Year (2018)  | 4               | 7.7                           | 7.1                           | 8.3                             |
|                        | Mean            |                 | 8.3                           | 7.3                           | 7.7                             |
| WBPH (GR, DS)           | I Year (2017)   | 2               | 8.0                           | 7.0                           | 6.4                             |
|                        | II Year (2018)  | 2               | 7.8                           | 7.8                           | 7.4                             |
|                        | Mean            |                 | 7.9                           | 7.4                           | 6.9                             |
| Stem Borer White Ear (% WE) | I Year (2017)   | 2               | 12.6                          | 7.1                           | 25.6                            |
|                        | II Year (2018)  | 1               | 26.1                          | 19.7                          | 14.6                            |
|                        | Mean            |                 | 19.3                          | 13.4                          | 20.1                            |
| Leaf Folder (% DL)      | I Year (2017)   | 0               | NA                            | NA                           | NA                             |
|                        | II Year (2018)  | 2               | 15.2                          | 28.6                          | 23.3                            |
|                        | Mean            |                 | 15.2                          | 28.6                          | 23.3                            |
| Grass Hopper (% DL)     | I Year (2017)   | 1               | 13.5                          | 11.2                          | 12.9                            |
|                        | II Year (2018)  | 1               | 12.5                          | 14.3                          | 12.9                            |
|                        | Mean            |                 | 13.0                          | 12.8                          | 12.9                            |
Table 7. Data on grain quality characteristics of the variety VL Dhan 159

| Grain quality characteristics | Proposed variety VL Dhan 159 | Check Var.1 Sukradhan 1 (NC) | Check Var.2 Vivek Dhan 154 (RC) | Check Var.3 (LC) |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------|
| Hulling (%)                   | 82.8                         | 80.2                         | 76.6                         | 73.5            |
| Milling (%)                   | 72.1                         | 71.4                         | 61.0                         | 46.2            |
| Kernel length (mm)            | 5.27                         | 6.94                         | 6.54                         | 6.88            |
| Kernel breadth (mm)           | 2.63                         | 2.03                         | 2.35                         | 2.18            |
| L/B ratio                     | 2.00                         | 3.41                         | 2.78                         | 3.06            |
| Grain type                    | SB                           | LS                           | LB                           | LS              |
| Grain Chalkiness              | VOC                          | VOC                          | VOC                          | VOC             |
| Alkali Spreading Value        | 4                            | 4                            | 4                            | 4               |
| Amylose content (%)           | 25.93                        | 24.46                        | 26.75                        | 28.04           |
| Gel Consistency (mm)          | 50                           | 49                           | 25                           | 22              |

Table 8. Morphological Description of VL Dhan 159 (VL 20083) 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                                  | White (1)            |
| 7.     | Flag leaf: Attitude of blade (early observation)       | Erect (1)            |
| 8.     | Flag 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                            | Medium (5)           |
| 15.    | Panicle: Curvature 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: Exertion                                       | Well exerted (7)     |
| 23.    | Sterile lemma: Colour                                   | Straw (1)            |
| 24.    | Decorticated grain: Length                              | Short (1)            |
| 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                           | Medium (5)           |
| 29.    | Decorticated grain: Aroma                               | Absent (1)           |
and panicle length of 20-23 cm. It has more number of panicles/m² (229) in comparison to checks Vivek Dhan 154 (200) and VL Dhan 156 (172). It possesses semi-erect, intermediate and non-lodging plant type, green coloured leaf blade and leaf sheath, and a erect flag leaf compact and well exerted panicle, awless grains and straw apiculus colour (Table 8).

The seed production of this variety is normal in hill region as per standard procedure and doesn’t require any specific attention. However, if locations in plains are selected, care should be taken for the soil and climatic conditions for potential production.

This new variety fulfills the requirement of rainfed upland rice growers and has potential to increase the production and productivity of upland rice in hill regions of Uttarakhand.

REFERENCES

Anonymous. *Kharif* Progress Report 2016, 2017 & 2018 published by Uttarakhand Government, Agriculture Department, RAT&DC Haldwani.

Anonymous. Annual Report of AICRIP 2016, 2017, 2018 Varietal Improvement, Screening Nurseries of Plant Pathology, Entomology published by ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad – 500 030, T.S, India.

Anonymous. Release proposal of rice variety VL Dhan 159 submitted to the SVRC, Uttarakhand in 2020.

Anonymous. Draft Proceedings 13th State Variety Release Committee, Uttarakhand meetings held on 19, May 2020.

DES, 2018. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare. https://eands.dacnet.nic.in/APY_96_To_06.htm