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# Evaluation of Potato Varieties for Yield and Yield Components in Myagdi, Nepal

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**Abstract** An experiment was conducted between February and June 2022 in Annapurna Rular Municipality, Myagdi, Nepal with an objective to assess various potato varieties for their yield and yield components. The experiment followed a randomized complete design with five treatments (Desiree, Janakdev, Kufri Jyoti, Mustang local, and Myagdi local) each replicated four times. Growth parameters, including plant height (cm), number of leaves per plant, number of stems per hill, and canopy diameter (cm) at various days after planting, were measured. Yield parameters such as tuber weight per plant (g), tuber number per plant, marketable tuber (kg/m$^2$), Unmarketable tuber (kg/m$^2$) and tuber distribution by grading in terms of number and weight were recorded. Additionally, disease scoring was done for severity and incidence of potato wart on potato varieties. The results indicated that Janakdev exhibited the tallest plant (66.00 cm), while Desiree had the shortest (47.50 cm). Janakdev also displayed the maximum number of leaves per plant (76.90), whereas Desiree had the minimum (50.55). Desiree and Myagdi local recorded the highest (5.53) and lowest (3.50) number of main stems per hill, respectively. Myagdi local demonstrated the maximum canopy diameter (55.15 cm), while Desiree had the minimum (43.91 cm). Janakdev showed the highest tuber weight per plant (512.73 g) and the highest tuber number (8.50). Mustang local produced the highest number of small-sized tubers (25 mm), with Janakdev recording the highest number of large-sized tubers (>50 mm). In terms of yield, Janakdev yielded the highest (37.93 t/ha), whereas Mustang local had the lowest yield (12.27 t/ha). Highest incidence of potato wart was found on Myagdi local (Seto aalu) about 98%. Given its superior performance across various growth and yield traits, Janakdev demonstrated high yield potential (337.93 t/ha) in khibang-06, Myagdi, Nepal. Consequently, Janakdev was recommended as the most suitable variety for farmers in khibang-06, Myagdi.
**Keywords** Potato varieties; Evaluation; Wart; Yield components; Myagdi local

## 1 Introduction

Potato is the world's fourth most staple food crop for the world population and is rich in carbohydrates, providing a primary source of energy. Sustainable production of potato can contribute to all four pillars of food security: availability, access, utilization and stability. In 2020, world production of potatoes was 359 million tons, led by China with 22% of the total. Other major producers were India, Russia, Ukraine and the United State (FAO, 2022).

In terms of area coverage potato ranks fifth (198,788 ha) among main staple crops paddy, maize, wheat, millet and barley; second in total production (3,325,231 t) and first in productivity (16.72 t/ha) in Nepal (MOALD, 2020). Potato has a short cropping period, low water consumption, high protein content, comparatively higher prices, and raw materials of industries with about 90% of the requirement being produced within the country. Its cultivation is common among farmers because of its greater adaptability, high yield capacity, and high demand, contributing 6.57% to AGDP and 2.17% to GDP, respectively (Bajracharya and Sapkota, 2017). It is used as subsidiary food as part of vegetables in Terai region, whereas as staple food in Hill and Mountain Regions of Nepal (Subedi et al., 2019).

Myagdi is one of the districts in Gandaki Province, Nepal, covering an area of 2,297.06 km$^2$. In Myagdi potato is cultivated once a year with productivity of 10.17 t/ha in the year 2016/17, 10.57 t/ha in the year 2017/18, 15.63 t/ha in the year 2018/19, 15.67 t/ha in the year 2019/20 and 15.85 t/ha in the year 2020/21 (MOALD, 2020). The productivity of potato in Myagdi is increasing but not satisfactory. Its productivity is still lower than the national

average. To address this issue, it is essential to evaluate the performance of different potato varieties to identify the most suitable ones for local cultivation. It provides an overview of some recommended potato varieties for mid and high hill region of Nepal, including their maturity days, yield potentials, and specific traits such as disease resistance and adaptability to different climatic conditions (Table 1).

Table 1 Some recommended varieties of potato for mid hills and high hills of Nepal

| Name of variety | Released date (B.S) | Days to maturity | Yield (t/ha) | Recommended domain | Characteristics |
|---|---|---|---|---|---|
| Kufri Jyoti | 2049 | 110 | 23 | Mid and high hills | Resistance to blight and wart |
| Desiree | 2049 | 110-120 | 23 | Terai, midhills and high hills | Moderately resistance to blight, resistant to wart |
| Janakdev | 2056 | 110 | 39.4 | Terai, midhills and high hills | Moderately resistant to late blight (Shrestha et al., 2019) and wart, hailstone tolerant, wide adaptability |
| Khumal seto-1 | 2056 | 110 | 38.7 | Mid and high hills | Resistance to blight and wart, leaf curl virus, drought, hailstone |
| Khumal laxmi | 2065 | 120-140 | 24-28 | Terai, midhills and high hills | Resistance to blight and wart |
| Khumal ujjwol | 2071 | 100-120 | 25 | Mid and high hills | Less insect problem due to trichome in stem |
| Khumal bikas | 2075 | 100-110 | 25.75 | Mid and high hills | - |

Source: Joshi et al., 2016; Krishi Diary, 2078

## 2 Materials and Methods

### 2.1 Location

The field experiment was conducted in farmer's field at Khibang-06, Myagdi from February to June 2022. It is located at co-ordinates of latitude and longitude 28° 30' 50.3" N to 83° 21' 50.7" E respectively.

### 2.2 Layout

The experiment was laid out in Randomized Complete Block Design (RCBD). There were 5 treatments and each treatment were replicated four times. There were 5 different varieties as treatments namely: Desiree, Janakdev, Kufri Jyoti, Mustang local and Myagdi local (Mixture of White (Seto) and Red (Rato)) as treatments. The plan of layout of the experiment was of plot size 2.5 m×1.5 m i.e. 3.75 $m^2$ (Figure 1). There were altogether 20 plots. Each plot had 4 rows with 7 potatoes in each row with plant-plant spacing of 20 cm and row-row spacing of 60 cm.

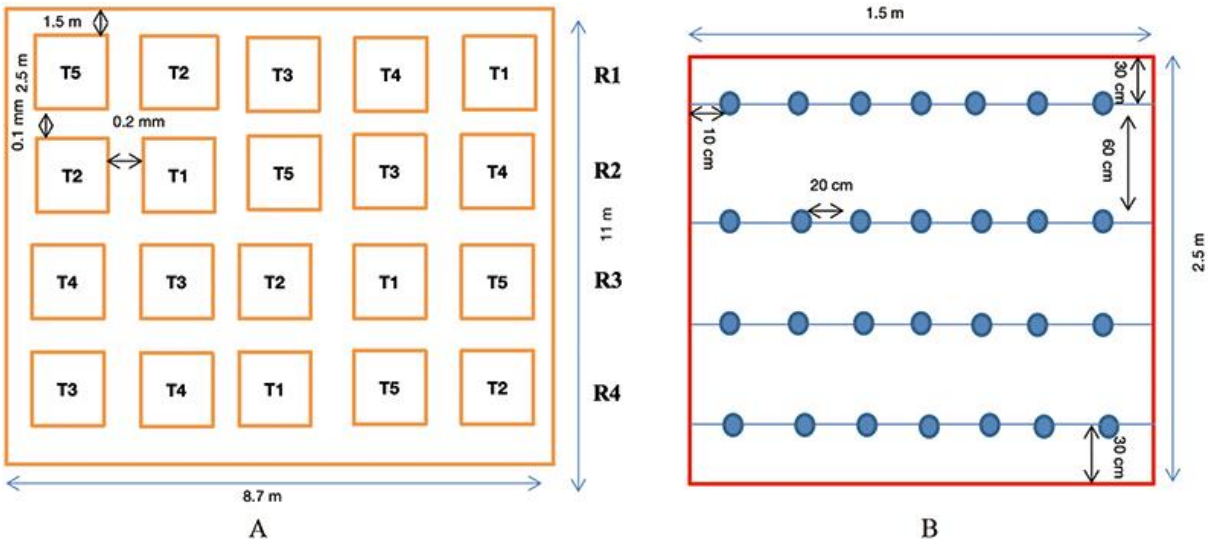


Figure 1 Field layout (A) and Plot layout (B)

### 2.3 Cultivation practices

Fertilizer applied was FYM 30 t/ha, Urea 132.3 kg/ha, DAP 217.4 kg/ha, and MOP 100 kg/ha. Urea was applied in split dose half during planting and other half during first earthing up when plant reaches the height of 15 cm. Total experimental area was 95.7 $m^2$.

### 2.4 Parameters recorded

Growth parameters, including plant height (cm), number of leaves per plant, number of stems per hill, and canopy diameter (cm) at various days after planting, were measured. Additionally, yield parameters such as tuber weight per plant (g), tuber number per plant, marketable tuber (kg/$m^2$), Unmarketable tuber (kg/$m^2$) and tuber distribution by grading in terms of number and weight were recorded. Data analysis was done using MS-Excel and R-Studio.

### 2.5 Disease scoring of potato wart

Potato tubers were harvested manually, and the disease severity was evaluated based on the EPPO Diagnostic Protocol (EPPO, 2004), which classifies symptoms into nine distinct classes depending on the extent of wart proliferation observed on the tubers (Table 2).

Table 2 Classification of disease severity in potato cultivars based on wart proliferation

| Class | Reaction of potato cultivar |
|---|---|
| 1 | Tubers not affected |
| 2 | Single Proliferation (<5 mm) |
| 3 | 2 or 3 proliferations (<5 mm) or a single large proliferation (5-10 mm) |
| 4 | Several large warts (5-10 mm) |
| 5 | Several medium-sized warts (>10 mm) |
| 6 | Several large warts, at least one of these being>10 mm, and beginning deformation of the tuber |
| 7 | Large warts with a diameter of >10 mm and disruption of tuber formation |
| 8 | Very large warts, but individual tubers still recognizable |
| 9 | Very large warts, no normal tubers present |

The disease severity was evaluated for each individual plant separately, according to the size and number of the warts. The final score was considered to be the category / class which predominated among the plants with symptoms. For example, if from 10 plants, five plants were not affected (class 1); two were in class 4; and three in class 5, then the final score was written down as '5' (Table 2).

## 3 Results and Analysis

### 3.1 Potato plant height (cm)

The effect of different varieties on plant height was significant (Table 3). At 45 DAS maximum plant height was obtained in Janakdev (27.95 cm) and minimum height was recorded from Myagdi local (23.18 cm) which was at par with Kufri Jyoti (Figure 2). Similarly, at 60 DAS maximum height was recorded from Janakdev (47.61 cm) and minimum height was recorded from Desiree (32.24 cm). Similarly at 75 DAS maximum height was recorded from Janakdev (59.79 cm) which was at par with Myagdi local and minimum height was recorded from Desiree (42.19 cm). Similarly at 90 DAS highest plant height was recorded from Janakdev (66.00 cm) which was at par with Myagdi local and lowest plant height was recorded from Desiree (47.50 cm). The CV shows highest variability of plant height at 75 DAS and lowest at 45 DAS.

### 3.2 Number of stems per hill

The effect of varieties on number of main stems per hill was significant (Table 4). At 45 DAS maximum number of stem per hill was recorded in Desiree (3.80) which was at par with Janakdev. Similarly at 60 DAS maximum number of stem per hill was recorded in Desiree which was at par with Janakdev and Kufri Jyoti and minimum number of stem per hill was recorded in Myagdi local (2.73) which was at par with Mustang local. At 75 DAS maximum number of stems per hill was recorded on Desiree (5.53) and minimum number of stem per hill was recorded on Myagdi local (3.50) which was at par with Mustang local and Kufri Jyoti. The CV shows higher variability of stem numbers per hill at 45 DAS and lowest variability at 60 DAS.

Table 3 Plant height (cm) of potato varieties at Myagdi, Nepal (2022)

| Treatments | 45 DAS | 60 DAS | 75 DAS | 90 DAS |
|---|---|---|---|---|
| T1 (Desiree) | 27.63$^{ab}$ | 32.24$^{c}$ | 42.19$^{c}$ | 47.50$^{c}$ |
| T2 (Janakdev) | 27.95$^{a}$ | 47.62$^{a}$ | 59.79$^{a}$ | 66.00$^{a}$ |
| T3 (Kufri Jyoti) | 22.93$^{c}$ | 42.46$^{ab}$ | 56.67$^{ab}$ | 62.57$^{ab}$ |
| T4 (Mustang local) | 23.68$^{bc}$ | 35.24$^{bc}$ | 45.95$^{bc}$ | 50.72$^{bc}$ |
| T5 (Khibang local) | 23.18$^{c}$ | 44.39$^{ab}$ | 59.45$^{a}$ | 64.96$^{a}$ |
| LSD(=0.05) | 4.15 | 9.21 | 12.62 | 12.05 |
| SEm(±) | 0.67 | 1.50 | 2.05 | 1.96 |
| CV% | 10.75 | 14.80 | 15.50 | 13.40 |
| F probability | 3.44$^{*}$ | 4.63$^{*}$ | 3.99$^{*}$ | 4.84$^{*}$ |
| Grand mean | 25.07 | 40.39 | 52.80 | 58.35 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±) d; Standard Error of mean difference, CV: Coefficient of Variation

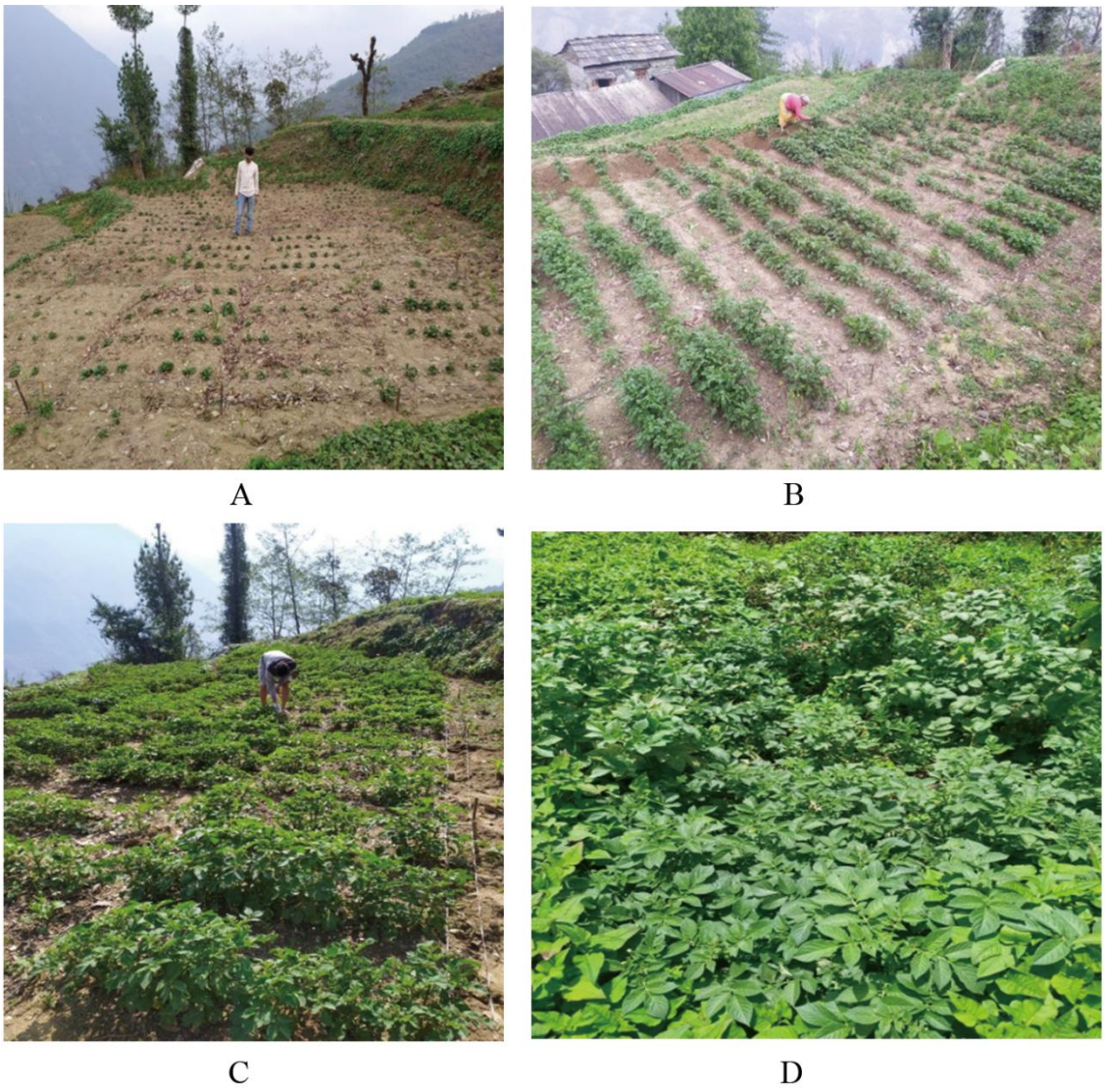


Figure 2 Potato plant height at 35 d (A), 45 d (B), 75 d (C) and 90 d (D)

Table 4 Number of stems per hill of potato varieties at Myagdi, Nepal (2022)

| Treatments | 45 DAS | 60 DAS | 75 DAS |
|---|---|---|---|
| T1 (Desiree) | 3.80$^{a}$ | 4.25$^{a}$ | 5.53$^{a}$ |
| T2 (Janakdev) | 3.68$^{a}$ | 4.10$^{a}$ | 4.55$^{ab}$ |
| T3 (Kufri Jyoti) | 3.08$^{ab}$ | 4.08$^{a}$ | 4.15$^{b}$ |
| T4 (Mustang local) | 3.08$^{ab}$ | 3.38$^{b}$ | 3.95$^{b}$ |
| T5 (Myagdi local) | 2.40$^{b}$ | 2.73$^{b}$ | 3.50$^{b}$ |
| LSD(=0.05) | 0.85 | 0.69 | 1.06 |
| SEm(±) | 0.14 | 0.11 | 0.17 |
| CV% | 17.28 | 12.05 | 15.88 |
| F probability | 4.10$^{*}$ | 8.33$^{**}$ | 4.94$^{*}$ |
| Grand mean | 3.21 | 3.71 | 4.34 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±) d; Standard Error of mean difference, CV: Coefficient of Variation

### 3.3 Canopy diameter

The effect of varieties on canopy diameter was significant (Table 5). At 45 DAS maximum canopy diameter was recorded in Myagdi local (29.98 cm) and minimum was recorded in Mustang local (25.60 cm) which was at par with Kufri Jyoti. Similarly at 60 DAS maximum canopy diameter was recorded in Myagdi local (46.39 cm) and minimum canopy diameter was recorded in Mustang local (31.01 cm). At 75 DAS maximum canopy diameter was recorded on Myagdi local (55.15 cm) which was at par with Janakdev and minimum canopy diameter was recorded on Desiree (44.00 cm). The CV shows higher variability of canopy diameter at 60 DAS and lowest at 45 DAS.

Table 5 Plant canopy diameter (cm) of potato varieties at Myagdi, Nepal (2022)

| Treatments | 45 DAS | 60 DAS | 75 DAS |
|---|---|---|---|
| T1 (Desiree) | 27.98$^{ab}$ | 37.73$^{bc}$ | 44.00$^{c}$ |
| T2 (Janakdev) | 27.40$^{ab}$ | 41.28$^{ab}$ | 51.66$^{a}$ |
| T3 (Kufri Jyoti) | 26.48$^{b}$ | 41.54$^{ab}$ | 50.28$^{ab}$ |
| T4 (Mustang local) | 25.60$^{b}$ | 31.01$^{c}$ | 44.86$^{bc}$ |
| T5 (Myagdi local) | 29.98$^{a}$ | 46.39$^{a}$ | 55.15$^{a}$ |
| LSD(=0.05) | 2.67 | 8.51 | 5.55 |
| SEm(±) | 0.43 | 0.87 | 0.90 |
| CV% | 6.30 | 8.75 | 7.33 |
| F probability | 3.68$^{*}$ | 4.26$^{*}$ | 6.82$^{**}$ |
| Grand mean | 27.49 | 39.59 | 49.19 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±) d; Standard Error of mean difference, CV: Coefficient of Variation

### 3.4 Number of leaves per potato plant

The effect of varieties on number of leaves per plant was significant (Table 6). At 45DAS maximum number of leaves per plant was recorded in Desiree (53.65) and minimum from Myagdi local (36.80). Similarly at 60 DAS maximum number of leaves per plant was recorded in Janakdev (66.05) and minimum number of leaves per plant was recorded on Myagdi local (46.60). At 75 DAS maximum number of leaves per plant was recorded on Janakdev (70.60) which was at par with Kufri Jyoti and minimum number of leaves per plant was recorded on Mustang local (44.15). Similarly at 90 DAS maximum number of leaves per plant was recorded on Janakdev (76.90) and minimum numbers of leaves per plant was recorded on Desiree (50.55). The CV shows highest variability of leaves number at 75 DAS and lowest at 60 DAS.

Table 6 Average number of leaves of potato varieties at Myagdi, Nepal (2022)

| Treatments | 45 DAS | 60 DAS | 75 DAS | 90 DAS |
|---|---|---|---|---|
| T1 (Desiree) | 53.65$^{a}$ | 58.20$^{a}$ | 62.85$^{ab}$ | 50.55$^{c}$ |
| T2 (Janakdev) | 48.85$^{ab}$ | 66.05$^{ab}$ | 70.60$^{a}$ | 76.90$^{a}$ |
| T3 (Kufri Jyoti) | 43.55$^{bc}$ | 57.45$^{ab}$ | 68.00$^{a}$ | 67.73$^{ab}$ |
| T4 (Mustang local) | 41.05$^{bc}$ | 49.88$^{bc}$ | 44.15$^{c}$ | 56.45$^{bc}$ |
| T5 (Khibang local) | 36.80$^{c}$ | 46.60$^{c}$ | 53.23$^{bc}$ | 60.58$^{bc}$ |
| LSD(=0.05) | 8.55 | 9.61 | 13.84 | 13.44 |
| SEm(±) | 1.39 | 1.56 | 2.25 | 2.18 |
| CV% | 12.39 | 11.21 | 15.03 | 13.97 |
| F probability | 5.66$^{**}$ | 5.99$^{**}$ | 5.97$^{**}$ | 5.49$^{**}$ |
| Grand mean | 44.78 | 55.64 | 59.77 | 62.44 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±) d; Standard Error of mean difference, CV: Coefficient of Variation

### 3.5 Tuber yield per plant (g) and tuber number per plant

There was significant effect of varieties on number and weight of tubers per plant (Table 7). The highest tuber weight per plant (512.73 g) was recorded from Janakdev and lowest tuber weight per plant (322.00 g) was recorded from Mustang local which was statistically similar with Desiree and Kufri Jyoti. Similarly, the highest number of tubers per plant was observed on Kufri Jyoti (9.95) and lowest number of tubers per plant was observed on Myagdi local (6.45) which was statistically similar with Mustang local.

### 3.6 Marketable and non-marketable weight per meter square (kg)

The effect of different varieties on marketable and unmarketable tuber weight was significant (Table 7). Maximum weight of Marketable size tuber (3.65 kg/m$^2$) was recorded from Janakdev and minimum weight was recorded from Mustang local (1.08 kg/m$^2$) and highest weight of unmarketable size tuber (0.68 kg/m$^2$) was recorded from Myagdi local due to wart susceptible variety (Figure 3) and minimum was recorded from Janakdev (0.14 kg/m$^2$). The CV shows highest variability in marketable yield and lowest in unmarketable yield.

### 3.7 Yield (t/ha)

The effect of different potato varieties on tuber yield (t/ha) was significant (Table 7). The highest tuber yield was recorded from Janakdev (37.93 t/ha) and lowest tuber yield was recorded from Mustang local (12.27 t/ha). Many biotic and abiotic factors such as light intensity, soil type, disease, pest etc. affects the yield of different crops (Thomson, 2001). Besides varieties adaptive responses to experimental sites, quality of planting materials and plant genetics also might be the factors for significant differences in yield (Eaton et al., 2017).

Table 7 Average yield (t/ha) of potato varieties at Myagdi, Nepal (2020)

| Treatments | Average no of tubers per hill | Yield per hill (g) | Marketable yield (kg/m$^2$) | Unmarketable yield (kg/m$^2$) | Total yield (t/ha) |
|---|---|---|---|---|---|
| T1 (Desiree) | 8.20$^{ab}$ | 390.38$^{b}$ | 1.81$^{bc}$ | 0.14$^{b}$ | 19.53$^{bc}$ |
| T2 (Janakdev) | 8.50$^{ab}$ | 512.73$^{a}$ | 3.65$^{a}$ | 0.14$^{b}$ | 37.93$^{a}$ |
| T3 (Kufri Jyoti) | 9.95$^{a}$ | 410.27$^{ab}$ | 2.27$^{b}$ | 0.14$^{b}$ | 24.08$^{b}$ |
| T4 (Mustang local) | 7.60$^{b}$ | 321.91$^{b}$ | 1.08$^{c}$ | 0.15$^{b}$ | 12.27$^{c}$ |
| T5 (Khibang local) | 7.00$^{b}$ | 418.28$^{ab}$ | 2.25$^{b}$ | 0.68$^{a}$ | 29.28$^{ab}$ |
| LSD(=0.05) | 1.73 | 101.06 | 1.02 | 0.02 | 10.30 |
| SEm(±) | 0.28 | 16.4 | 0.17 | 0.004 | 0.87 |
| CV% | 13.60 | 15.97 | 30.05 | 6.01 | 14.07 |
| F probability | 3.92$^{*}$ | 4.36$^{*}$ | 7.96$^{**}$ | 1012.00$^{***}$ | 8.44$^{**}$ |
| Grand mean | 8.25 | 410.73 | 2.21 | 0.25 | 44.7 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±)d; Standard Error of mean difference, CV: Coefficient of Variation

A B

Figure 3 Potato wart in Kufri Jyoti (A) and Myagdi local (Seto aalu) (B)

### 3.8 Grading on the basis of size

The effect of different potato varieties on tuber size was found to be significant (Table 8). The maximum number of small sized tubers (<25 mm) per $m^2$ were in Mustang local (8.00) and minimum number were recorded in Desiree (5.75) which was at par with Janakdev, Kufri Jyoti and Myagdi local. Maximum number of medium sized tubers (25-50 mm) per $m^2$ was recorded in Kufri Jyoti (41.25) and minimum numbers were recorded in Myagdi local (28.50) which was at par with Desiree and Mustang local. Maximum number of large sized tubers (>50 mm) per $m^2$ was recorded in Janakdev (42.00) and minimum numbers were recorded in Mustang local (26.00). The CV shows highest variability of large size tubers while lower variability at small size tubers.

Table 8 Grading tubers of potato varieties on size basis at Myagdi, Nepal (2022)

| Treatments | Less than 25 mm | Between 25 to 50 mm | Greater than 50 mm |
|---|---|---|---|
| T1 (Desiree) | $5.75^{b}$ | $32.50^{bc}$ | $30.75^{bc}$ |
| T2 (Janakdev) | $6.25^{b}$ | $36.00^{ab}$ | $42.00^{a}$ |
| T3 (Kufri Jyoti) | $6.25^{b}$ | $41.25^{a}$ | $30.25^{bc}$ |
| T4 (Mustang local) | $8.00^{a}$ | $29.25^{bc}$ | $26.00^{c}$ |
| T5 (Khibang local) | $6.00^{b}$ | $28.50^{c}$ | $36.25^{ab}$ |
| LSD(=0.05) | 0.99 | 7.20 | 8.98 |
| SEm(±) | 0.16 | 1.17 | 1.46 |
| CV% | 9.91 | 13.95 | 17.63 |
| F probability | $7.78^{**}$ | $5.05^{*}$ | $4.51^{*}$ |
| Grand mean | 6.45 | 33.5 | 33.05 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±)d; Standard Error of mean difference, CV: Coefficient of Variation

### 3.9 Grading on the basis of weight

The effect of different potato varieties on tuber weight was found to be significant (Table 9). The maximum Underweight tubers per (<25 g) was recorded in Mustang local (22.92 g) and minimum underweight tubers (<25 g) were recorded in Myagdi local (15.81 g). Maximum medium weight tubers per plant were recorded in Kufri Jyoti (194.03 g) and minimum medium weight tubers per plant were recorded in Mustang local (147.08 g). Maximum large weight tubers per plant were recorded in Janakdev (311.60 g) and minimum large weight tubers per plant were recorded in Mustang local (152.43 g). The CV shows highest variability of large weight tubers while lower variability at underweight tubers.

Table 9 Grading tubers of potato varieties on weight basis at Myagdi, Nepal (2022)

| Treatments | Less than 25 g | Between 25 g and 50 g | Greater than 50 g |
|---|---|---|---|
| T1 (Desiree) | 16.84$^{bc}$ | 170.84 | 202.70$^{bc}$ |
| T2 (Janakdev) | 20.94$^{ab}$ | 180.19 | 311.60$^{a}$ |
| T3 (Kufri Jyoti) | 16.76$^{bc}$ | 194.03 | 205.30$^{bc}$ |
| T4 (Mustang local) | 22.92$^{a}$ | 147.08 | 152.43$^{c}$ |
| T5 (Khibang local) | 15.81$^{c}$ | 158.03 | 246.44$^{ab}$ |
| LSD(=0.05) | 4.57 | 49.58 | 78.91 |
| SEm(±) | 0.74 | 8.05 | 12.81 |
| CV% | 15.90 | 18.92 | 22.90 |
| F probability | 4.36$^{*}$ | ns | 5.38$^{*}$ |
| Grand mean | 18.65 | 170.08 | 223.69 |

Note: Mean followed by common letter(s) within columns are non-significantly different based on LSD test *P*=0.05, *Significant at 0.05 *P* level, SEm(±)d; Standard Error of mean difference, CV: Coefficient of Variation

### 3.10 Disease severity and incidence

In evaluating the resistance of potato varieties to wart disease caused by *Synchytrium endobioticum*, the EPPO diagnostic standard (EPPO, 2004) was employed, and field trials were conducted on five different varieties. The results showed significant differences in disease severity and incidence among the varieties (Table 10). Among them, Janakdev and Desiree demonstrated strong resistance, with a disease severity rating of 1 and no observed disease occurrence (0% incidence). In contrast, the Seto aalu variety from the Myagdi region exhibited extremely high susceptibility, with a disease severity rating of 9 and an incidence rate of 98%, indicating that nearly all tubers were affected. The Rato aalu (Figure 4) and Mustang local varieties showed moderate resistance, with incidence rates of 3% and 20%, respectively. These results indicate that Seto aalu is highly susceptible to wart disease, while Janakdev and Desiree show strong resistance under field conditions.

Table 10 Wart formation in potato tubers (Type I-X, Spieckermann Scale) in *Synchytrium endobioticum*-infested fields, Myagdi, Nepal

| Treatments | Disease rating in the field test (Scale 1-9) | Disease incidence |
|---|---|---|
| T1 (Janakdev) | 1 | 0% |
| T2 (Desiree) | 1 | 0% |
| T3 (Kufri Jyoti) | 2 | 2% |
| T4 (Myagdi local (Seto aalu)) | 9 | 98% |
| T4 (Myagdi local (Rato aalu)) | 2 | 3% |
| T5 (Mustang local) | 3 | 20% |

Note: Scale as described in EPPO Diagnostic protocol (EPPO, 2004). 1: tubers not affected; 9: very large warts, no normal tubers present (see 'Materials and Methods')

Figure 4 Potato wart free Myagdi local (Rato aalu)

## 4 Discussion and Progress

The differences in plant height might be due to quality of planting materials and plant genetics (Eaton et al., 2017; Banjade et al., 2019). Slower growth in earlier days may be due to lower temperature (Banjade et al., 2019). Number of eyes is one of the factor to determine the number of stems per seed tuber (Struik, 2007). The difference in canopy diameter among the varieties might be due to genetic and environmental factors. Temperature and light intensity may interact to influence the number of leaves that grow. The significant differences in number of leaves that grow per plant is due to plant genetic differences among the varieties. The rate of energy and material between atmosphere and plant canopy is determined by Leaf area index (LAI) of the plants (Vose et al., 1994). The variation was due to varietal characteristics and number of branches and stem per hill. These differences in the numbers of tubers of different grades among varieties could be related to the variety's tolerance to the trial site's climatic circumstances, its genetics, or the quality of the potato seed (Eaton et al., 2017). The numbers of tubers per plant are the most important components of yield (Poudel and Karkee, 2016). Highest ummarketable tuber yield in Myagdi local was due to wart infestation in Myagdi local (white type /seto aalu) but red type (rato aalu) was wart resistant. Also in Mustang local unmarketable tuber was high due to wart susceptibility and small tubers. Besides small size warts were seen in some tubers of Kufri Jyoti too which contradicts with (Sharma and Chakrabarti, 2020; Luthara and Kumar, 2024) but in favour with (Bhaardawj et al., 2020; Sood 2021).

Although this study revealed the growth and yield differences of various potato varieties in the Myagdi region there are still some limitations. Weather conditions and soil properties during the experimental period may have influenced the results, but due to limitations in the study design, these factors could not be precisely controlled. The study only assessed the performance of the varieties in one growing season, and the differences between varieties may vary across multiple seasons and years. Therefore, future research should consider conducting multi-location trials across different growing seasons and climate conditions to verify the stability of these varieties in diverse environments. Additionally, modern breeding techniques, such as genomic selection and marker-assisted selection should be integrated to further improve the superior varieties, enhancing their disease resistance and yield stability.

The study shows that the Janakdev variety has high yield potential and broad adaptability in Myagdi region making it suitable primary choice for local farmers. However, to achieve large-scale adoption, further verification of its performance under different altitudes and climate conditions is necessary. Moreover, technical training for farmers should be strengthened, along with promotion of appropriate cultivation techniques and pest management measures to fully realize the yield potential of this variety and enhance local productions levels.

### Authors' contributions

The research idea, planting material collection, layout, data analysis, article writing was done by BD. TNB was major supervisor during research period and aid in manuscript draft too. SA aid in data collection and manuscript draft. DB aid on manuscript draft. All authors read and approved the final manuscript.

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### Conflict of Interest Disclosure

The authors affirm that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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