

# PERFORMANCE OF DIFFERENT MULCHES ON PHYSICAL GROWTH AND YIELD OF POTATO (*SOLANUM TUBEROSUM* L.) IN WESTERN RWANDA

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**ABSTRACT:** The objective of this study was to investigate the effect of various types of mulches on physical growth and yield of potatoes (*Solanum tuberosum* L.). The experiments were conducted in farmer's fields during the agricultural seasons 2022 B (Season B is from March to June) and 2023 A (Season A is from September to February). Experiment was laid out in a Randomized Complete Block Design (RCBD) in two sites with four replications and five treatments: T1 (Control), T2 (Dead mulch), T3 (Living mulch of Mucuna), T4 (Living mulch of Desmodium), and T5 (Living mulch of Lablab). Data were collected on the potato physical growth with an interval of 15 days after planting (DAP) while yield data were collected immediately after harvesting. The Analysis of Variance (ANOVA) was done in Microsoft Excel at  $P < 0.05$ . Results revealed a significant difference in physical growth of plants in all treatments with steady increase up to 90 DAP and decrease at 105 DAP in both Districts. Yield average was 37.67 t/ha and 30.83 t/ha in Rubavu and Nyabihu Districts respectively. It was the highest for dead mulch at 57.6 t/ha in Rubavu and 43.0 t/ha in Nyabihu District. It was followed by Lablab spp at 42.3 t/ha for Rubavu and 37.3 t/ha for Nyabihu District. Yield increment was 42.0 % and 3.8 % in Nyabihu and Rubavu Districts respectively. Dead mulch and Lablab contributed more to the yield increase and can be recommended as farming practice to increase potato yield in both Districts.

**KEYWORDS:** Mulches, Physical growth, Potato, yield increment

## INTRODUCTION

Worldwide, potato (*Solanum tuberosum* L.) is one of the most consumable vegetable crops. At present, potato is grown in more than 160 countries in the world and is considered as one of the four major agronomic crops (Donnelly and Kubow, 2011). Potato originated from the highlands of South America and discovered by Spanish explorers. Thereafter, it spread globally over the last years. Potato was introduced in Europe in the late 16th century (FAO, 2020) and around the turn of the 20th century, the potato arrived in Africa (FAO, 2020). It was introduced

in Rwanda by Germany missionaries and Rwanda is the sixth largest producer of potato in Africa (FAO, 2019). Currently potato is cultivated and consumed all over the world.

Potato is a non-grain crop and has gained much importance around the globe. More than a billion people worldwide eat potatoes, and produced globally over 300 million metric tons (CIP, 2023). In Rwanda, potato covers 3.9 % of total cultivated land per each growing season and shares 10 % of total main crop production (MINAGRI, 2019). Most of the potato producers consists of small family farms that intercrop potatoes

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with beans and maize, and the productivity is still low around 10 t/ha compared to other countries such as Netherlands and German with productivity of 35 t/ha (MINAGRI, 2019; RAB, 2021). National Institute of Statistics of Rwanda (NISR,) indicated that the per capita consumption of potato is 125 kg per year (MINAGRI, 2019). In Rwanda, potato is the third major crop after cassava and sweet potato, in terms of volume of production, and it became an important cash crop in the Northern volcanic areas, highlands of Buberuka, and the Congo/Nile Divide (MINAGRI, 2019). This Northern volcanic region accounts for more than 80% of the national potato production, while the rest is produced on marginal plantations throughout the country (MINAGRI, 2019). In this highland region, potato is the staple food with more than 60% of the production being used directly for home consumption (MINAGRI, 2019). It has high rate of production and it is also considered as a cash crop.

Potato production in Rwanda faces many challenges which hinder its effective productivity. The main challenges causing this low potato productivity include small and fragmented potato production land, poor linkage of potato producers and markets, limited access to credit for agriculture inputs, shortage of appropriate post-harvest handling and processing technologies, inadequate supply of high-quality seeds to farmers, low rate of fertilizer use, irrigation, pests and diseases problems (Rukundo *et al.*, 2019). Availability of improved and high yielding potato varieties adapted to current biotic and abiotic stresses is worsened by the current climate change (RAB, 2021). Productivity of potato is constrained by many factors which can be dealt with to optimize potato production.

Conventional methods of potato production are facing different challenges in

potato production. It is common to increase production through fertilization and also irrigation system. However, there are other factors which are not given much attention, but which contribution cannot be ignored. It was reported that fluctuation of soil moisture negatively affects seed germination and emergence which in return affects production (Ahmed *et al.*, 2017; Dvořák *et al.*, 2012). Potato production requires moderate temperature, while extremely hot or cold climate affect potato production (Lia *et al.*, 2017). The optimum yield is obtained at temperature range of 15-20°C and the growth reduces at the temperature below 15°C and above 20°C (Lia *et al.*, 2017). Potato production is also affected by growth of weeds which compete with the main crop and reduce production (Ferdous *et al.*, 2017). More importantly, given the relief of potato farms in Rwanda, erosion is commonplace among threatening factors in potato production. Therefore, it is essential to implement productivity-boosting strategies in order to enhance potato production.

Mulching is among improved cultivation practices to increase the yield and productivity of potatoes to its maximum. According to Bharati (2020), mulching has a significant influence on the growth and yield of potatoes. Other scientists reported that mulching promotes soil water infiltration and crop water availability which helps to improve soil biodiversity and environmental benefits (Christianson *et al.*, 2017; Waheed *et al.*, 2023). Mulches function as cover crops to reduce tillage operations that have some ecological advantages over conventional land preparation tasks causing minimum alterations in the soil environment (Christianson *et al.*, 2017). This contributes to higher water use efficiency by plants, higher yields, and greater economic benefits. Mulches were also reported to improve soil structure, control temperature fluctuation,

control weeds and preserve nutrients which contribute to roots growth as well as plant's overall health (Ahmed *et al.*, 2017; Dvořák *et al.*, 2012). Therefore, the aim of this study was to investigate the effect of different types of mulches on physical growth and yield of potato grown in western Rwanda.

## MATERIALS AND METHODS

### Experimental site

The present experiment was conducted in farmer's fields at two different sites of Rurengeri Cell, Mukamira sector in Nyabihu District, and in Muhira cell, Rugerero sector in Rubavu District from September 2022 to January 2023. Nyabihu District is located on a volcanic mountain with relief characterized by 90 % rugged mountains with slopes of more than 55 %, creating a high risk of erosion. Soils comprise sandy and clay, laterite, and volcanic. Precipitation is almost uniform over every month and close to 1400 mm per year. It has a climate with an average temperature of 15°C (Nyabihu District, 2019). Rubavu District is located in a volcanic mountain with a soil characterized by volcanic lava soil. The average temperature range is 15-20°C with the annual rainfall varying from 1200 mm to 1500 mm (Rubavu District, 2019).

### Experimental design and field layout

In both Districts (Nyabihu and Rubavu) the experiment was laid out in Randomized Complete Block Design (RCBD) with four replications and five treatments during the period from September 2022 to January 2023. The field experiment at each site was composed of 20 experimental plots of dimensions 4 m × 3 m with spacing 1m within the blocks and 2 m between the blocks. Five treatments were assigned to each block to study the effect of various types of mulches and cover crops on the physical growth and yield of potato.

The treatment details:

- T1: Control,
- T2: Dead Mulch (straw of beans) (5 t/ha),
- T3: Living Mulch of Mucuna (seeds of 50 kg/ha),
- T4: Living Mulch of Desmodium (seeds of 50 kg/ha), and
- T5: Living Mulch of Lablab (seeds of 50 kg/ha).

The planting density of potato was 80 × 30 cm between and within rows respectively, which gave a total of 50 planting holes per elementary plot, and 41,667 plants/ha. Intercropped with cover crops of Lablab spp, Desmodium spp, Mucuna spp separately in each experimental units and dead mulch of straw of beans was obtained from farmers harvest of the previous agricultural season. The potato seeds of the Kinigi variety and cover crops of Lablab spp, Desmodium spp, and Mucuna spp were obtained from Rwanda Agriculture Board (RAB).

### Data collection

Data was collected from randomly selected 5 plants from each plot excluding border plants, and the obtained data was used to measure various growth and yield parameters. The data on vegetative growth, plant biomass (number), plant height (cm), and plant diameter (cm) were collected at the period interval of 15 Days After Planting (DAP) starting from 45 to 105 DAP, while yield data was taken after harvesting at the end of the season both at Nyabihu and Rubavu Districts. Technical data collection sheets, rulers, weighing scales, and pair calipers were availed for that purpose. All data on the physical growth and yield were collected at the same sampled plant from all experimental units.

## Statistical data analysis

Collected data were subjected to analysis of variance (ANOVA) appropriate to the RCBD in Microsoft Excel at  $P < 0.05$  levels of probability test and the treatment means were separated into homogeneous groups using the Least Significant Difference (LSD).

## RESULTS AND DISCUSSION

### Plant leaf development (number)

The results of the ANOVA showed that there was a significant difference in number of leaves in both sites and in all treatments from 45 DAP to 105 DAP at  $P < 0.05$  as depicted in Tables 1 and 2. In both sites and all treatments, the number of leaves increased progressively up to 90 days and it reduced

afterwards. The reduction of leaves after 90 DAP might have been caused by falling of leaves due to maturity with no replacement of new leaves because of approaching maturity stage. Number of leaves was higher for dead mulch and lower for Desmodium and control. The increase in number of leaves for dead mulch might have been caused by their function as fertilizer. In general, number of leaves in Rubavu was higher than in Nyabihu District. Living mulches were reported to provide organic matter to crops and on the other hand can compete with targeted crops (Christianson *et al.*, 2017). Effect of different mulches on increase of number of leaves was also reported by Bharati (2020) where mulches influenced leaves development with steady increase to the maximum up to 75

**Table 1: Plant leaf development (number) from 45 to 105 DAP in Nyabihu District**

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	22.10 <sup>cd</sup>	43.95 <sup>d</sup>	112.80 <sup>cd</sup>	143.60 <sup>bcd</sup>	66.25 <sup>d</sup>
Dead Mulch	32.60 <sup>a</sup>	60.45 <sup>a</sup>	185.51 <sup>a</sup>	219.67 <sup>a</sup>	108.12 <sup>a</sup>
Desmodium spp	22.07 <sup>d</sup>	51.35 <sup>bcd</sup>	109.40 <sup>d</sup>	138.80 <sup>cd</sup>	68.50 <sup>cd</sup>
Lablab spp	27.50 <sup>abcd</sup>	53.30 <sup>abc</sup>	146.00 <sup>abcd</sup>	171.75 <sup>abcd</sup>	86.15 <sup>abcd</sup>
Mucuna spp	23.30 <sup>bcd</sup>	48.20 <sup>cd</sup>	113.45 <sup>bcd</sup>	134.41 <sup>d</sup>	70.95 <sup>bcd</sup>
General Mean	25.51	51.45	133.43	161.64	79.99
CV	14.11	3	13.91	13.32	14.01
LSD (5%)	8.69	8.92	53.24	60.05	29.47

Means followed by the same letter(s) in a column are not significantly different by LSD at 5 % level of significance, CV=Coefficient of variation, LSD=Least Significant Differences, DAP=Days After Planting

**Table 2: Plant leaf development (number) from 45 to 105 DAP in Rubavu District**

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	21.95 <sup>d</sup>	45.30 <sup>d</sup>	111.50 <sup>cd</sup>	147.61 <sup>bcd</sup>	70.25 <sup>d</sup>
Dead Mulch	39.28 <sup>a</sup>	61.85 <sup>a</sup>	184.26 <sup>a</sup>	223.67 <sup>a</sup>	112.13 <sup>a</sup>
Desmodium spp	22.21 <sup>cd</sup>	49.85 <sup>bcd</sup>	124.40 <sup>bcd</sup>	141.30 <sup>cd</sup>	72.01 <sup>bcd</sup>
Lablab spp	29.35 <sup>abcd</sup>	55.10 <sup>abc</sup>	161.00 <sup>abc</sup>	174.25 <sup>abcd</sup>	89.65 <sup>abcd</sup>
Mucuna spp	23.38 <sup>bcd</sup>	46.70 <sup>cd</sup>	76.15 <sup>d</sup>	134.40 <sup>d</sup>	70.95 <sup>cd</sup>
General Mean	27.23	51.75	131.45	164.24	82.99
CV	0.024	0.03	0.14	0.13	0.14
LSD (5%)	10.5	9.77	65.42	61.16	30.23

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5% level of significance, CV=Coefficient of variation, LSD=Least Significant Differences, DAP=Days After Planting

DAP. Contribution on quality of potatoes due to dead mulch was also reported by Lia *et al.* (2017) where it was also site dependent. Potatoes grow better at the temperature range of 15-20°C and the growth reduces at the temperature below 15°C and above 20°C Lia *et al.* (2017) which might have caused better development of leaves in Rubavu than Nyabihu. Living and dead mulch contribute differently on the increase in number of leaves.

### Plant Height (cm)

The results of the ANOVA showed that there was no significant difference in plant height for 45 DAP and 60 DAP in Nyabihu District and at 60 DAP in Rubavu District. However, the significant difference was

noticed from 75 DAP to 105 DAP in Nyabihu District and in Rubavu District it was from 45 DAP to 105 DAP except for 60 DAP at  $P < 0.05$  as depicted in Tables 3 and 4. There was a steady increase in plant height of potatoes from both sites and all treatments from 45 DAP to 90 DAP followed by reduction in plant height at 105 DAP. Reduction in plant height at 105 DAP may be related to reduction of sap supply due to maturity which causes shrinkage of growth tissues. Dead mulch and Lablab spp contributed more in plant height in Nyabihu District, while in Rubavu District the highest contribution was for dead mulch. The control had the lowest contribution in both sites. Plant height was higher in Rubavu District than Nyabihu District. Increase in height of potatoes due to

Table 3: Plant height (cm) from 45 to 105 DAP in Nyabihu District

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	39.84 <sup>a</sup>	50.31 <sup>a</sup>	70.15 <sup>b</sup>	81.23 <sup>b</sup>	77.93 <sup>b</sup>
Dead Mulch	48.47 <sup>a</sup>	63.63 <sup>a</sup>	85.75 <sup>a</sup>	101.33 <sup>a</sup>	99.09 <sup>a</sup>
Desmodium spp	41.47 <sup>a</sup>	55.52 <sup>a</sup>	78.35 <sup>ab</sup>	91.18 <sup>ab</sup>	87.88 <sup>ab</sup>
Lablab spp	43.47 <sup>a</sup>	62.48 <sup>a</sup>	81.57 <sup>a</sup>	94.25 <sup>a</sup>	91.85 <sup>a</sup>
Mucuna spp	41.63 <sup>a</sup>	61.13 <sup>a</sup>	78.83 <sup>ab</sup>	91.95 <sup>a</sup>	88.65 <sup>a</sup>
General Mean	42.95	58.6	78.92	91.99	89.08
CV	9.8	12.04	6.59	6.72	7.01
LSD (5%)	10.14	13.50	11.22	14.72	15.07

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5 % level of significance, CV=Coefficient of variation, LSD=Least Significant Differences, DAP=Days After Planting

Table 4: Plant height (cm) from 45 to 105 DAP in Rubavu District

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	41.90 <sup>bcd</sup>	52.61 <sup>b</sup>	72.35 <sup>c</sup>	84.23 <sup>b</sup>	80.83 <sup>b</sup>
Dead Mulch	50.37 <sup>a</sup>	65.93	87.95 <sup>a</sup>	104.33 <sup>a</sup>	101.99 <sup>a</sup>
Desmodium spp	41.80 <sup>cd</sup>	56.32 <sup>ab</sup>	85.95 <sup>ab</sup>	92.38 <sup>ab</sup>	90.28 <sup>ab</sup>
Lablab spp	42.57 <sup>abcd</sup>	63.20 <sup>b</sup>	89.11 <sup>a</sup>	95.45 <sup>ab</sup>	94.25 <sup>ab</sup>
Mucuna spp	38.41 <sup>d</sup>	58.03 <sup>ab</sup>	73.93 <sup>bc</sup>	91.95 <sup>ab</sup>	88.65 <sup>ab</sup>
General Mean	43.01	59.22	81.86	93.67	91.2
CV	0.098	0.12	0.06	0.07	0.07
LSD (5%)	8.39	13.71	13.8	14.76	15.19

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5% level of significance, CV=Coefficient of variation, LSD=Least Significant Differences, DAP=Days After Planting

the influence of mulches was also reported by (Bharati, 2020). Similarly, living mulches were reported to increase plant biomass where leguminous mulches provide more nitrogen to the soil there by contributing to the growth of targeted crop (Christianson *et al.*, 2017). Living and dead mulch have influence on the plant height.

### Plant stem diameter (Cm)

The results from ANOVA revealed that there was no significant difference in plant diameter from Nyabihu District at 45 and 75 DAP while the significant difference was noticed at 60, 90 and 105 DAP and in all treatments of Nyabihu District, while in Rubavu District the difference was significant from 45 to 105 DAP at  $P < 0.05$  as presented

in Tables 5 and 6. There was a steady increase in diameter of plant in all treatments up to 90 DAP. Thereafter, the diameter reduced. The reduction in diameter might have been caused by shortage of sap supply to the plant followed by its shrinkage. Dead mulch contributed more to the increase in plant diameter while the least contribution was for the control. In general plant diameter in Rubavu District was higher than in Nyabihu District. Increase in stem diameter due to mulches was also report by (Bharati, 2020). Living mulch were also reported in reducing leaching of nutrients which in turn can contribute to the growth of the main plant (Christianson *et al.*, 2017). Growth diameter of potato stem was influenced differently by both living and dead mulches.

**Table 5: Plant stem diameter (cm) from 45 to 105 DAP in Nyabihu District**

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	1.26 <sup>a</sup>	1.33 <sup>b</sup>	1.36 <sup>a</sup>	1.33 <sup>b</sup>	0.84 <sup>c</sup>
Dead Mulch	1.39 <sup>a</sup>	1.47 <sup>a</sup>	1.5 <sup>a</sup>	1.53 <sup>a</sup>	0.99 <sup>a</sup>
Desmodium spp	1.33 <sup>a</sup>	1.38 <sup>ab</sup>	1.42 <sup>a</sup>	1.38 <sup>ab</sup>	0.86 <sup>bc</sup>
Lablab spp	1.37 <sup>a</sup>	1.43 <sup>a</sup>	1.5 <sup>a</sup>	1.49 <sup>a</sup>	0.92 <sup>abc</sup>
Mucuna spp	1.33 <sup>a</sup>	1.39 <sup>ab</sup>	1.44 <sup>a</sup>	1.41 <sup>ab</sup>	0.91 <sup>abc</sup>
General Mean	1.33	1.4	1.45	1.42	0.9
CV	4.85	2.46	4.63	3.86	4.8
LSD (5%)	0.14	0.11	0.15	0.13	0.11

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5 % level of significance, CV=Coefficient of variation, LSD = Least Significant Differences, DAP = Days After Planting

**Table 6: Plant stem diameter (cm) from 45 to 105 DAP in Rubavu District**

Treatments	45 DAP	60 DAP	75 DAP	90 DAP	105 DAP
Control	1.29 <sup>bc</sup>	1.39 <sup>bc</sup>	1.46 <sup>a</sup>	1.64 <sup>bc</sup>	0.84 <sup>e</sup>
Dead Mulch	1.58 <sup>a</sup>	1.53 <sup>a</sup>	1.60 <sup>a</sup>	1.81 <sup>ab</sup>	1.19 <sup>a</sup>
Desmodium spp	1.36 <sup>ab</sup>	1.35 <sup>c</sup>	1.55 <sup>a</sup>	1.91 <sup>ab</sup>	0.89 <sup>de</sup>
Lablab spp	1.43 <sup>ab</sup>	1.40 <sup>abc</sup>	1.57 <sup>a</sup>	2.02 <sup>a</sup>	0.95 <sup>bcde</sup>
Mucuna spp	1.08 <sup>c</sup>	1.45 <sup>ab</sup>	1.13 <sup>b</sup>	1.41 <sup>c</sup>	0.91 <sup>cde</sup>
General Mean	1.35	1.42	1.45	1.76	0.96
CV	4.8	2.4	4.6	3.1	4.5
LSD (5%)	0.28	0.13	0.28	0.35	0.20

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5% level of significance, CV=Coefficient of variation, LSD=Least Significant Differences, DAP=Days After Planting

## Influence of mulches potato yield

The results of the ANOVA showed a comparative response of different mulches and cover crops on the yield per plant and yield per hectare in Rubavu and Nyabihu Districts as depicted in Tables 7 and 8. There was a significant difference in plant yield for all treatments in all sites at  $P < 0.05$ . The highest plant yield in both sites was for dead mulch with more than 1 kg per plant followed by Lablab spp, control was the least in Nyabihu District while Mucuna was the least in Rubavu District. In general plant

**Table 7: Comparison of the yield per plant (kg) in Nyabihu and Rubavu Districts**

Treatment	Yield /Plant (kg) Nyabihu District	Yield /Plant (kg) Rubavu District
Control	0.52 <sup>d</sup>	0.87 <sup>bcd</sup>
Dead Mulch	1.03 <sup>a</sup>	1.38 <sup>a</sup>
Desmodium spp	0.59 <sup>cd</sup>	0.72 <sup>cd</sup>
Lablab spp	0.89 <sup>abc</sup>	1.02 <sup>abc</sup>
Mucuna spp	0.65 <sup>bcd</sup>	0.53 <sup>d</sup>
General Mean	0.74	0.90
CV	10.72	8.8
LSD (5%)	0.33	0.47

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5 % level of significance, CV=Coefficient of variation, LSD=Least Significant Differences

**Table 8: Comparison of the yield (t/ha) from various mulches and cover crops in Rubavu and Nyabihu District**

Treatments	Yield (t/ha) Rubavu District	Yield (t/ha) Nyabihu District
Dead Mulch	57.63 <sup>a</sup>	43.05 <sup>a</sup>
Lablab spp	42.34 <sup>b</sup>	37.34 <sup>b</sup>
Control	36.30 <sup>c</sup>	21.72 <sup>d</sup>
Desmodium spp	29.79 <sup>d</sup>	24.79 <sup>c</sup>
Mucuna spp	22.29 <sup>e</sup>	27.29 <sup>c</sup>
General Mean	37.67	30.84
CV	4.77	5.08
LSD	2.53	2.71

Means followed by the same letter(s) in a column are not significantly different by LSD at a 5% level of significance, CV=Coefficient of variation, LSD=Least Significant Differences

yield was higher in Rubavu than in Nyabihu District.

Yield per hectare in all treatments was evaluated. There was a significant difference in yield of all treatments at  $P < 0.05$  in both Districts as depicted by Tables 7 and 8. Dead mulch and Lablab spp showed the highest yield in both Districts and the yield was higher than the control. In Rubavu District, control was higher than Desmodium spp and Mucuna spp where Mucuna spp showed the lowest yield in this District. Moreover, in Nyabihu District, the lowest yield was for the control and the control in Nyabihu District had the lowest yield in both Districts followed by Mucuna spp in Rubavu District. Overall, the highest yield was in Rubavu with yield of 37.67 t/ha and 30.84 t/ha for Nyabihu District. These results are very high comparing to the existing national yield target of potato which is 14 t/ha in comparison with the current yield of 8.6 t/ha obtained from existing farming techniques as stated by Rukundo (2019) and MINAGRI (2019). Therefore, the technique of mulching can be adopted to increase potato productivity. Special consideration should be given to dead mulch and Lablab which were found to increase productivity to the highest level.

## Potato yield increment

Yield increment was calculated based on the control as a reference and reported in percentage as shown in Figure 1 below. In Nyabihu District there was yield increment of 98.20 % for dead mulch, 71.90 % for Lablab, 25.70 % for Mucuna and 14.10 % for Desmodium with the average yield increment of 42.00 %. On the other hand, yield increment in Rubavu District was 58.80 % for Dead mulch, 16.60 % for Lablab, negative 38.60 % for Mucuna, and negative 17.90 % for Desodium where general increment was 3.80 %. Yield increment in Rubavu was lower than the

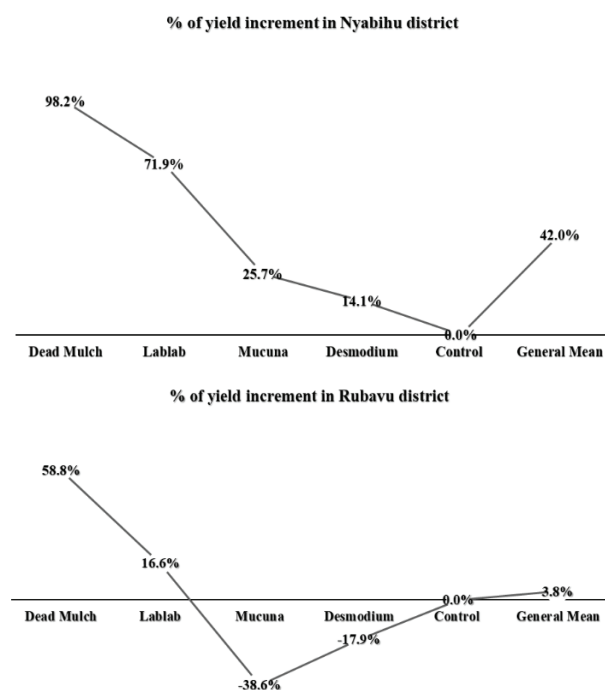


Fig.1. Effect of mulch and cover crops on yield increment (t/ha) of Irish potatoes in Nyabihu and Rubavu Districts

one of Nyabihu District where general yield increment was 42.00 % in Nyabihu District compared to 3.80 % of Rubavu District. Low yield increment in Rubavu was due to that the control in that District performed better than the control of Nyabihu even more than some other treatments. In Rubavu District Mucuna and Desmodium affected negatively the yield of potato where their yield was less than the control. Yield increment using different mulches was also reported by (Bharati, 2020) where they influenced yield differently. Negative increment in potato yield for Desmodium and Mucuna in Rubavu District might have been caused by their competition with the main plant. Negative impact of living mulches on crop yield was also reported by Lia *et al* (2018). Variation in yield may also be influenced by other factor like soil characteristics, rainfall and temperature. Therefore, dead mulch and Lablab can be recommended as suitable mulches in both Districts.

## CONCLUSION

Potato is very sensitive to various mulch and cover crops in terms of physical growth and yield. The results revealed that from 45 to 105 DAP, there was a significant difference and a steady increase among treatment means in Nyabihu and Rubavu Districts in physical growth. Among all treatments, dead mulch and Lablab spp, showed the highest potentiality and suitability in mulching potatoes by comparing to others like Mucuna, Desmodium spp and untreated plots in increasing potato yield. Mucuna and Desmodium affected negatively the yield of potato in Rubavu District. Living mulch might have competed with potatoes on the nutrients. Soil characteristics and climatic conditions might have influenced growth in addition to mulches. Therefore, dead mulch and Lablab spp can be recommended for mulching in both Districts. Furthermore, it is recommended to investigate the effect of different types of mulches on soil properties to reveal the suitable mulch for each type of soil and climate. Cost-benefit analysis should also be conducted to investigate whether implementing these techniques will provide enough income for farmers to change their livelihood.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

## ETHICAL STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors

## LITERATURE CITED

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