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Yield and Growth Parameters of Potato (*Solanum tuberosum* L.) as Influenced by Intra Row Spacing and Time of Earthing Up: In Boneya Degem District, Central Highlands of Ethiopia

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ABSTRACT

Field experiment was conducted to investigate the effect of intra row spacing and time of earthing up on growth and yield of potato (var. Jalene). Four intra row spacing: 10, 20, 30 and 40 cm and four times of earthing up: At 15, 30, 45 days after plant emergence and no earthing were combined in a 4×4 factorial arrangement in randomized complete block design. Data collected on growth and yield parameters were analyzed using SAS version 9.2. Intra row spacing highly significantly affected all the growth parameters: days to 50% flowering and maturity, plant height and spread, stem diameter and leaf area and all yield parameters: Tuber number, total and marketable tuber yield. For majority of growth and yield parameters 40 and 30 cm intra row spacing was preferable, while significantly the highest marketable tuber yield of 23.54 t ha^{-1} was produced at 30 cm intra row spacing. The effect of time of earthing up was found highly significant on all growth parameters studied: days to 50% flowering and maturity, plant height and spread, stem diameter, leaf area and main stem number and all yield parameters studied: Tuber number, total and marketable tuber yield. Earthing up at 15 days after plant emergence showed superior performance in most growth and yield parameters. Therefore, 30 cm intra row spacing and earthing up at 15 days after complete plant emergence can be used at the study area, Boneya in Degem district for better growth and higher marketable yield of potato.

Key words: Earthing up, growth parameters, intra row spacing, marketable potato yield, potato variety Jalene

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the fourth most important food crop in the world following rice, corn and wheat (Horton, 1987; FAO, 2008). It is a staple food crop in some countries and in others it is used as vegetable (Mahmood, 2005; Zamil *et al*., 2010). According to the quantity of production and consumption worldwide, potato is the most important vegetable crop (FAO, 2005; Visker, 2005). In the year 2007 the total volume of world potato production was more than 325.3 million tons that was harvested from the total area of 19.33 million hectare. In the same year in Africa, potato production was 16.71 million tons from 1.54 million hectare (Horton, 1987; FAO, 2008). In the world potato is grown in more than 125 countries (FAO, 2008). It is the second only to Maize in terms of the number of producer countries. Potato was introduced to Ethiopia in 1858

by the German Botanist, Schemper (Pankhurst, 1964). Since then, potato became an important garden crop in many parts of the country. About 70% of the available agricultural land is suitable for potato production which is located at an altitude of 1500 to 3000 m.a.s.l with an annual rainfall between 600 and 1200 mm (Gebremedhin *et al*., 2008). The total area under potato production had reached 73,095 ha and the production was estimated to be more than 5.2 million quintals in the year 2007 (MOARD, 2007). Despite these facts, the national average yield of potato is 7.2 t ha^{-1} which is lower than the world's average 16.8 t ha^{-1}. This is attributed to factors such as poor agronomic practices, lack of sustainable supply of improved planting material, high cost of seed tubers, disease and pest problem and inadequate storage (Bereke, 1994). In the study area, Boneya, Degem District, central highlands of Ethiopia, farmers produce even less than the national average. The most important constraints of potato production in the study area are lack of information on agronomic practices such as intra row spacing and time of earthing up, since no research has so far been conducted for the area to determine the optimum intra-row spacing and time of earthing-up for optimum yield of potato. Any intra row spacing variation could influence biomass accumulation and subsequently tuber number (Santos and Gilreath, 2004). According to Endale and Gebremedhin (2001), the absence of optimal intra row spacing practices could significantly reduce total tuber yield up to 50%. Therefore, optimization of intra row spacing is the one of most important agronomic practices of potato production as it affects the seed cost, plant development and potato tuber yield (Gulluoglu and Arioglu, 2009). Proper earthing-up increases tuber yield by creating favorable conditions for tuber initiation and development and also reduces yield loss (Gebremedhin *et al*., 2008). Therefore, the present study was conducted to determine the effect of intra-row spacing and time of earthing-up on growth and yield of potato.

MATERIALS AND METHODS

Description of the study area: The experiment was conducted at Boneya Degem District, North Showa Zone of Oromia regional state during 2010/11 cropping season. Boneya, Degem district; part of the central highlands of the country is located 124 km away from Addis Ababa. It is located at about 38°29' to 38°44' East longitude and 9°34' to 100°03' North latitude and at an elevation of 2878 m.a.s.l. receiving an annual rainfall of 900 to 1400 mm. The experimental area is with the mean annual minimum and maximum temperature of 15 and 22°C, with sandy loam soil and is one of the major potato producing districts (Anonymous, 2011).

Experimental treatments and design: Potato variety Jalene was used for the experiment since it is one of the potential potato cultivars for central highlands including Degem district. Four levels of intra row spacing: 10, 20, 30 and 40 cm per row and four times of earthing up: earthing up after 15 days, 30 days and 45 days after emergence of potato plant and no earthing up as a control treatment were laid out in 4×4 factorial arrangements using Randomized Complete Block Design (RCBD) with three replications.

Experimental procedures: For this experiment a plot size of 9 m^2 (3 m length×3 m width) was used. A distance of 0.75 m was maintained between the plots within a block and 1 m distance was maintained between blocks and 75 cm row spacing was uniformly used. Well sprouted uniform tuber seeds of potato variety Jalene were planted at 12 cm depth. Phosphorus was applied in the form of DAP during planting time at the rate of 195 kg ha^{-1} and nitrogen was also applied in a split, first banded at planting and then side dressed after full emergence at a rate of 165 kg ha^{-1}

(EARO, 2004). Earthing up was done uniformly by hilling the soil around the plant up to 20 cm height and 15 cm top width according to the time of earthing up given for each treatment, except the control.

Data collection: To evaluate the effect of intra row spacing and earthing up on potato growth and yield, data were collected for growth parameters such as days to flowering (Shiri-e-Janagrad *et al*., 2009), days to maturity, plant height (Zelalem *et al*., 2009), plant spread, number of main stems (Zelalem *et al*., 2009), stem diameter, leaf area (Sintayehu, 2011) and yield parameters such as number of tubers per plant, marketable tuber yield, unmarketable tuber yield and total tuber yield (Zelalem *et al*., 2009), from ten randomly selected plants of the two middle rows except the yield data which is taken per plot basis.

Data analysis: Data were subjected to analysis of variance (Montgomery, 2005) of the GLM procedure for factorial, Randomized Complete Block Design (RCBD) of SAS Version 9.2 statistical software (SAS Institute Inc., 2002), after the data were checked for meeting the various ANOVA assumptions. Means were compared by using LSD value at 5% significance level (Montgomery, 2005).

RESULTS AND DISCUSSION

Effect of intra row spacing and earthing up on growth parameters: The effect of both intra row spacing and time of earthing up were found highly significant ($p<0.001$) on all the growth parameters studied including days to 50% flowering and maturity, plant height and spread, stem diameter and leaf area except main stem number which is only significantly affected by time of earthing up (Table 1).

Days to 50% flowering: The earliest days to 50% flowering was observed at the closer intra row spacing of 10 cm and 20 cm. Whereas, days to 50% flowering was prolonged in 30 and 40 cm intra row spacing (Table 1). Days to 50% flowering was delayed by about 3 days in the wider intra row spacing as compared to the closest intra row spacing of 10 cm. This could be due to higher

Table 1: Means for days to flowering and maturity, plant height and spread, stem number and diameter and leaf area as affected by intra row spacing and time of earthing up

Treatments	Days to 50% flowering	Days to 50% maturity	Plant height (cm)	Plant spread (cm)	Main stem No.	Stem diameter (cm)	Leaf area (cm^2)
Intra row spacing (cm)							
10	58.66^{b}	106.91^{d}	66.19^{a}	39.28^{c}	4.23^{a}	3.17^{d}	17.67^{d}
20	59.42^{b}	108.58^{c}	65.47^{a}	42.59^{b}	4.22^{a}	4.31^{c}	21.86^{c}
30	60.83^{a}	112.16^{b}	62.35^{b}	47.37^{a}	4.21^{a}	6.18^{b}	27.10^{b}
40	61.66^{a}	113.33^{a}	62.16^{b}	49.68^{a}	4.25^{a}	6.44^{a}	28.79^{a}
Time of earthing up (days)							
No earthing up	59.16^{c}	108.75^{c}	62.03^{c}	42.63^{b}	4.08^{b}	4.64^{d}	21.87^{c}
15	62.08^{a}	112.33^{a}	67.48^{a}	49.01^{a}	4.67^{a}	5.48^{a}	26.81^{a}
30	60.08^{b}	110.30^{b}	64.41^{b}	44.19^{b}	4.12^{b}	5.14^{b}	23.90^{b}
45	59.25^{bc}	109.58^{b}	62.25^{c}	43.10^{b}	4.04^{b}	4.85^{c}	22.85^{cb}
LSD (0.05)	0.86	0.81	1.14	2.42	0.26	0.20	1.02
CV (%)	1.72	0.88	2.15	6.49	7.30	4.81	5.16

Means followed by different letters differ significantly at $p<0.05$

competition of plants for resources in the closer intra row spacing that lead the plants to stress and ultimately the plants flower early instead of prolonged vegetative growth. This result is in agreement with the work of Law-Ogbomo and Egharevba (2009) who reported that, days to 50% flowering was prolonged for plants grown with wider intra row spacing (lower planting density). For earthing up, the earliest days to 50% flowering (59.16 days) was observed at no earthing up (control) treatment and this was not significantly different from potato plant earthed up at 45 days after complete plant emergence. However, flowering was prolonged when potatoes were earthed up at 15 days after complete plant emergence (Table 1). Days to 50% flowering was delayed by about 3 days at 15 days earthing up after the complete plant emergence as compared to the control. This could be due to the fact that absence of earthing up created stress on the plant due to lack of aeration and mechanical barrier of soil colloids during its active growth stage that affected the plant growth and brought early flowering. This result is in conformity with Qadir (1997) and Qadir *et al.* (1999), who confirmed that earthing up at 15 days after complete plant emergence resulted in better potato plant performance in terms of the parameters considered.

Days to 50% maturity: The earliest days to 50% maturity (106.91 days) was observed at the closer intra row spacing of 10 cm but it was extended (113.33 days) at the wider intra row spacing of 40 cm (Table 1). Days to 50% maturity was delayed by 6 days in the wider intra row spacing as compared to the closest intra row spacing of 10 cm. This could be due to the presence of intense inter plant competition at the closer intra row spacing that leads to depletion of the available nutrient and as a result plants stressed and tend to mature earlier. The current finding is in agreement with the work of (Mengistu and Yamoah, 2010) who concluded that closer intra row spacing (increasing planting density) had shortened days to maturity. For earthing up, the earliest days to 50% maturity (108.75 days) was occurred at the control (no earthing up) treatment but it was extended (112.33 days) at earthing up of 15 days after complete plant emergence (Table 1). Days to 50% maturity was delayed by 3 days at 15 days earthing up after the complete plant emergence as compared to the no earthing up treatment. This might be due the reason that earthing up at 15 days after complete plant emergence, matching with the active growth stage of the plant, created favorable soil environment and enhanced further vegetative growth that extended days to maturity. This result is in agreement with the finding of Qadir (1997) who confirmed that earthing up at 15 days after complete plant emergence resulted in better plant performance.

Plant height: The highest plant height (66.1 cm) was obtained at the closer intra row spacing of 10 cm and this is not significantly different from the plant height obtained at 20 cm intra row spacing. On the other hand, the shortest plant height (62 cm) was observed at 30 and 40 cm intra row spacing (Table 1). This might be due to the presence of higher competition for sunlight among plants grown at the closer intra row spacing. This is in agreement with the finding of Zaag *et al.* (1989) who indicated that plant height was initially similar in all treatments but after 72 days the closely spaced plants became taller. Dennis *et al.* (1994) also reported that as intra row spacing increased plant height decreased linearly. Similarly, Ifenkwe and Allen (1978), Law-Ogbomo and Egharevba (2009), Rajadurai (1994) and Zebarth *et al.* (2006) concluded that closer intra row spacing (higher plant density) resulted in the highest plant height. In case of earthing up the highest plant height (67 cm) was obtained at 15 days earthing up after complete plant emergence, whereas the shortest plant height (62 cm) was observed at the control (no earthing up) treatment

which is at par with 45 days earthing up after complete plant emergence (Table 1). This might be due to the reason that early soil cultivation (earthing up) facilitated the nutrient absorption through enhanced microbial processes and increased soil aeration. This result is in conformity with the finding of Qadir *et al.* (1999) and Qadir (1997) who confirmed that plant height was significantly higher in plants earthed up at two weeks after the complete plant emergence.

Plant spread: The widest plant spread (49.68 cm) was obtained at the wider intra row spacing of 40 cm but the narrowest plant spread (39.28 cm) was recorded at the closer intra row spacing of 10 cm (Table 1). This could be due to the positive effect of wider intra row spacing, where there is minimum competition for resources between plants compared to the closer intra row spacing, in that the photosynthetic efficiency of plants increased and the plants utilize the sufficiently available resources. This result is in conformity with the finding of Ahmed *et al.* (2000) who reported that closer intra row spacing resulted in poor vegetative growth such as plant spread compared to the wider intra row spacing. Entz and LaCroix (1984) also stated that branching increased in the wider intra row spacing. In similar manner, Zaag *et al.* (1989) reported that branching was similar in all treatments up to 50 days but later the wider intra row spacing gave the highest plant spread and in similar experiment Zebarth *et al.* (2006) also indicated that closer intra row spacing resulted in reduced number of branches resulting in the narrowest plant spread. Significantly the widest plant spread (49.01 cm) was observed at 15 days earthing up after complete plant emergence but the narrowest plant spread (42.63 cm) was obtained at the control (no earthing up) treatment which is similar to the effect of earthing up at 30 and 45 days after complete plant emergence (Table 1). This could be due to the reason that earthing up at 15 days after complete plant emergence, early in the growing season of the potato plant coincided with the proper time of soil workability and optimum soil moister level. This made the soil porous and aerated and the plants received the advantage of proper growth and development than the plants on the control and lately managed plots. Similar opinion was reported by Qadir (1997) and Qadir *et al.* (1999) in that plant spread was significantly higher when plants were earthed up 15 days after the complete plant emergence.

Main stem number: Significantly the highest main stem number (4.67) was recorded at 15 days earthing up after complete plant emergence but the lowest main stem number (4.04) was obtained at 45 days earthing up after complete plant emergence which was at par with no earthing up (control treatment) and earthing up at 30 days after complete plant emergence (Table 1). This might be due to the fact that earthing up, a cultural practice, given to the plant during its active growth stage, enhanced the growth and development of more number of stems. The result of this current investigation is in agreement with the work of Qadir (1997) who found that number of stems per plant (4.44) was significantly higher when plants were earthed up two weeks after complete plant emergence. Similarly, Qadir *et al.* (1999) also concluded that the number of stems per plant was significantly higher for plants earthed up at two weeks after complete plant emergence.

Stem diameter: The largest stem diameter (6.44 cm) was observed at the wider intra row spacing of 40 cm whereas the smallest stem diameter (3.17 cm) was found at the narrowest intra row spacing of 10 cm (Table 1). Wider intra row spacing resulted in less competition among plants, availability of resources; high light interception and large quantity of photo assimilate production as well as assimilation and thus increased plant growth and development ultimately increased stem

diameter. In line with the current finding, Dennis *et al.* (1994) also confirmed that increased intra row spacing resulted in increased stem diameter. The largest stem diameter (5.48 cm) was obtained at 15 days earthing up whereas the smallest stem diameter (4.64 cm) was obtained at no earthing up (Table 1). In no earthing up, there could be lower soil aeration and soil colloids also restricted plant roots growth but earthing up controlled the weeds and enabled the plants to absorb more nutrients and increased their stem diameter. Gebremedhin *et al.* (2008) also indicated that one time earthing up compared to no earthing up increased yield components of potato. Qadir *et al.* (1999) and Qadir (1997) also stated that higher stem diameter was recorded at earthing up of two weeks after plant emergence.

Leaf area: The largest leaf area (28.79 cm^2) was obtained at the wider intra row spacing of 40 cm while the smallest leaf area (17.67 cm^2) was recorded at the closer intra row spacing of 10 cm (Table 1). At the wider intra row spacing due the presence of minimum competition, plants absorbed the sufficiently available resources and more light and increased their photosynthetic efficiency that further increased the vegetative growth and ultimately resulted in increased leaf area. Oliveira (2000) also confirmed that leaf area decreased in the closer intra row spacing compared to the wider intra row spacing that resulted in lager leaf area. In similar manner (Nkambule and Ossom, 2010) stated that the largest mean leaf area was obtained in the wider intra row spacing. The largest leaf area (26.81 cm^2) was observed at 15 days earthing up after complete plant emergence while the smallest leaf area (21.87 cm^2) was recorded at no earthing up, the control treatment (Table 1). Earthing up at 15 days after plant emergence coincided with the active growth stage of the plant improved the soil porosity and aeration, better root growth and penetration for nutrient absorption increased plant growth and development that ultimately increased leaf area. Qadir (1997) also concluded that better yield and yield components of potato including leaf area was recorded at earthing up two weeks after complete plant emergence.

Effect of intra row spacing and earthing up on yield parameters: The effect of both intra row spacing and time of earthing up were found highly significant ($p<0.001$) on all yield

Table 2: Means for tuber number, total yield, marketable yield and unmarketable yield as affected by intra row spacing and earthing up

Treatments	Tuber No. (count $hill^{-1}$)	Total tuber yield (t ha^{-1})	Marketable tuber yield (t ha^{-1})	Unmarketable tuber yield (t ha^{-1})
Intra row spacing (cm)				
10	6.70^{d}	34.43^{a}	18.27^{c}	16.16^{a}
20	8.43^{c}	31.49^{b}	21.71^{ab}	9.74^{b}
30	10.55^{b}	30.00^{b}	23.54^{a}	6.46^{c}
40	10.93^{a}	26.09^{c}	21.19^{b}	4.89^{d}
Time of earthing up (days)				
No earthing up	8.33^{c}	26.49^{c}	17.03^{c}	5.25^{a}
15	10.30^{a}	36.44^{a}	27.48^{a}	4.59^{a}
30	9.46^{b}	31.61^{b}	22.38^{b}	4.82^{a}
45	8.51^{c}	27.48^{c}	17.82^{c}	5.25^{a}
LSD (%)	0.36	2.76	2.27	1.21
CV (%)	4.82	10.85	12.86	15.69

Means followed by different letters differ significantly at $p<0.05$

parameters studied including tuber number, total tuber yield and marketable tuber yield except unmarketable tuber yield which is only significantly affected by intra row spacing (Table 2).

Tuber number: Significantly the highest number of tubers per plant (10.93) was recorded at the wider intra row spacing of 40 cm whereas the lowest number of tubers per plant (6.7) was obtained at the closer intra row spacing of 10 cm (Table 2). In the wider intra row spacing there could be minimum competition among plants for space and resources and also better plant exposure for high radiation interception that increased the photosynthetic efficiency of the plant and finally resulting in increased number of tubers per plant. Similar to the result of the current investigation Mahmood (2005) also reported that maximum numbers of tubers per plant was obtained in the wider intra row spacing. In similar manner (Zamil *et al*., 2010) also indicated that the wider intra row spacing gave the highest number of tuber per hill. In similar experiment (Gulluoglu and Arioglu, 2009), Thornton *et al*. (2007) and Zaag *et al*. (1989) also reported that number of tubers per plant increased at the wider intra row spacing. In case of earthing up, the highest tuber number (10.30) was recorded at 15 days earthing up after complete plant emergence whereas the lowest tuber number (8.33) was obtained at no earthing up, the control treatment which is at par with earthing up at 45 days after complete plant emergence (Table 2). Earthing up at 15 days after complete plant emergence, during the active growth period of the plant created favorable soil conditions for more number of tubers initiation and development that increased tuber number. Similarly, Qadir (1997) and Qadir *et al*. (1999) also reported that number of tubers per plant was significantly higher at 15 days earthing up after complete plant emergence. Tafi *et al*. (2010) also concluded that earthing up of potatoes at 10 cm plant height increased the length of underground stems that ultimately increased tuber number per plant.

Total tuber yield: The highest tuber yield per hectare (34.43 t ha^{-1}) was obtained at the closer intra row spacing of 10 cm whereas the lowest (26.09 t ha^{-1}) was obtained at the wider intra row spacing of 40 cm (Table 2). This is due to the compensation effect of closer intra row spaced plants per hectare than the wider intra row spacing which resulted in higher yield of tubers per plant. In a similar manner Burton (1989) also investigated the effect of intra row spacing on the yield of potato and finally concluded that in a wider intra row spacing yield per hectare was reduced due to the insufficient number of plants grown per hectare compared to plants grown at closer intra row spacing per hectare. Similarly, Mahmood (2005) also confirmed that closer intra row spacing gave the highest yield per hectare than the wider intra row spacing. Different scientists (Ahmed *et al*., 2000; Gulluoglu and Arioglu, 2009; Mahmoodabad *et al*., 2011; Midmore, 2003; Nelson, 1976; Rajadurai, 1994; Rahemi *et al*., 2005; Zamil *et al*., 2010) at different times investigated the effect of intra row spacing on potato yield and ultimately confirmed that potato tuber yield per hectare was decreased in the wider intra row spacing but increased in the closer intra row spacing due to more tubers being harvested in the closer intra row spacing. The highest tuber yield (36.44 t ha^{-1}) was recorded at 15 days earthing up after complete plant emergence whereas the lowest tuber yield (26.49 t ha^{-1}) was recorded at the control (no earthing up) treatment which is at par with tuber yield recorded at 45 days earthing up after complete plant emergence (27.48) (Table 2). Earthing up at 15 days after plant emergence coincided with the active growth stage of the plant improved the soil conditions for efficient nutrient absorption resulted in increased plant growth and development that ultimately resulted in the highest tuber yield per hectare. Qadir (1997) and Qadir *et al*. (1999) also reported the highest potato tuber yield per hectare at 15 days earthing up after complete plant emergence.

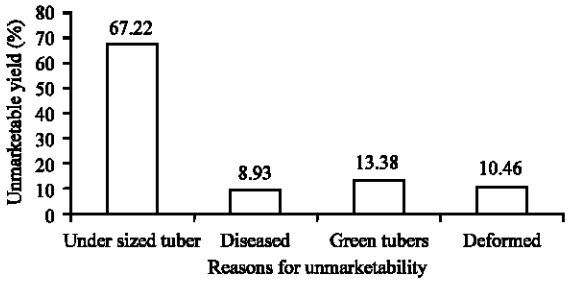

Fig. 1: Means for reasons for the percentage of unmarketable yield of potato as affected by intra row spacing and time of earthing up

Marketable tuber yield: The highest marketable tuber yield (23.54 t ha^{-1}) was obtained at the wider intra row spacing of 30 cm whereas the lowest (18.27 t ha^{-1}) was obtained at the closer intra row spacing of 10 cm (Table 2). At the wider intra row spacing due the presence of minimum competition, plants absorbed the sufficiently available resources and intercepted more light. This increased their photosynthetic efficiency for higher photo assimilate production and ultimately resulted in increased more marketable tuber yield. The result of the current investigation is in line with the finding of Dwelle and Love (1993) who concluded that in closer intra row spacing bulking rate of individual tubers decrease and this resulted in smaller tubers and lower marketable tuber yield. Similarly, Zaag *et al.* (1989) also reported that marketable tuber yield increased in the wider intra row spacing. The highest marketable tuber yield (27.48 t ha^{-1}) was obtained at the 15 days earthing up whereas the lowest (17.03 t ha^{-1}) was obtained at the closer intra row spacing of 10 cm which is at par with 45 days earthing up (17.82) (Table 2). This could be due to earthing up at 15 days after complete plant emergence, during the active growth period of the plant improved the soil conditions for proper root growth and nutrient absorption that facilitate the above ground part for better growth and development ultimately resulted for the better marketable tuber yield. The current result is in line with the work of Qadir (1997) and Qadir *et al.* (1999) who confirmed that earthing up at 15 days after complete plant emergence resulted in better potato plant performance and yield.

Unmarketable tuber yield: The highest unmarketable tuber yield (16.16 t ha^{-1}) was obtained at the closer intra row spacing of 10 cm. However the lowest unmarketable tuber yield (4.89 t ha^{-1}) was obtained at the wider intra row spacing of 40 cm (Table 2). This could be due to the existence of higher computation between plants in closer intra row spaced plants that results more number of under sized tubers that leads to the less quality product. Similarly, Zaag *et al.* (1989) reported that marketable tuber yield increased in the wider intra row spacing. In this experiment unmarketable tuber yield was assessed by identifying under sized, diseased, deformed and green potato tubers and the most important reason for unmarketability is under sized potato tuber (Fig. 1).

CONCLUSION

The current investigation showed that both intra row spacing and time of earthing up significantly affected days to 50% flowering and maturity, plant height, plant spread, stem diameter, leaf area, tuber number, total tuber yield and marketable tuber yield. It can be concluded from this study that for the majority of the growth parameters 40 cm intra row spacing and

earthing up after 15 days of complete plant emergence are preferable. Similarly, the highest total tuber yield (34.43 t ha^{-1}) and unmarketable tuber yield (16.16 t ha^{-1}) was produced at the closest intra row spacing of 10 cm. But from the total tuber yield produced in the closest intra row spacing of 10 cm 46.93% was unmarketable and hence, significantly the highest marketable tuber yield (23.54 t ha^{-1}) was obtained at the wider intra row spacing of 30 cm. Similarly the highest total tuber yield (36.44 t ha^{-1}) and marketable tuber yield (27. 48 t ha^{-1}) was produced at the time of earthing up of 15 days after complete plant emergence. This study verified that growth and yield of potato is influenced by intra row spacing and time earthing up and accordingly 30 cm intra row spacing in combination with earthing up at 15 days after complete plant emergence can be used for optimum growth and the highest marketable tuber yield of Jalene potato variety on the sandy loam soil of the study area, in Boneya Degem district the central highlands of Ethiopia, under the rain fed condition.

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