Effect of spacing and fertilizer dose on growth and yield of potato (Solanum tuberosum L) Gudane variety at West Hararghe, Eastern Ethiopia IJHOP Effect of spacing and fertilizer d...

Article · May 2016

CITATIONS
5

READS
1,697

2 authors, including:

Asfaw Zewdu
Oda Bultum University
20 PUBLICATIONS **42** CITATIONS

SEE PROFILE

International Journal of Horticulture and Ornamental Plants
Vol. 2(1), pp. 011-018, May, 2016. © www.premierpublishers.org, ISSN: 2141-502X

IJHOP

Research Article

Effect of spacing and fertilizer dose on growth and yield of potato (*Solanum tuberosum* L) Gudane variety at West Hararghe, Eastern Ethiopia

[1]*Kinde Lamessa, Asfaw Zewdu[2]

[1*,2]Oromia Agricultural Research institute (IQQO), Mechara Agricultural Research Center; Horticulture Research team, Mechara, Ethiopia

The experiment was conducted at two locations, Mechara Agricultural Research Center and Oda Bultum district at Oda Basso Farmers Training Center (FTC) and Gudane variety was used for the study. The treatments were combined factorial arrangement in Randomized Completed Block Design (RCBD) with three replications. Plant height, number of marketable tubers, average number tubers per plant, yield and unmarketable yield was no significant due to main effect of spacing and fertilizer. Location was significantly influence all parameters except yield. However the highest potato yield was obtained at 70cm: 30cm (31.5 ton ha^{-1}), 200 kg ha^{-1} DAP and 100 kg ha^{-1} urea (28.7 ton ha $^{-1}$) and at Mechara (28.4 ton ha $^{-1}$). At Mechara the highest (11 ton ha $^{-1}$) potato yield was recorded at 70cm: 30cm spacing and 200 kg ha^{-1} of DAP and 100 kg ha^{-1} of urea. While at Oda Bultum the highest (23 ton ha^{-1}) potato yield was recorded at 90cm:40cm and 200 kg ha^{-1} of DAP and 100 kg ha^{-1} of urea statistical at par with 50cm:20cm and 200 kg ha^{-1} of DAP and 100 kg ha^{-1}. Therefore, a spacing of 70 cm between row and 30 cm between plants with fertilizer rate of 200 kg ha^{-1} DAP and 100 kg ha^{-1} Urea was recommended for Mechara and Badessa area and similar agro ecologies.

Keywords: *DAP Fertilizer, Spacing, Potato, Urea*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important agricultural crops in the world. In volume of production, it ranks fourth in the world after maize, rice and wheat, with an estimated production area of 18.9 million hectares (Naz *et.al*., 2011). Among root crops, potato ranks first in volume produced and consumed, followed by cassava, sweet potato, and yam (FAO, 2004). Potato production and utilization has been established well than other root and tuber crops. Potato yields on average of more food energy and protein per unit of lands than cereals. The lysine content of potato complement cereal based diets that are deficient in this ammonium acid. It is very important cash and food crops in Ethiopia especially when grain is depleted from the store and contributed to food security. It also gives high yield per unit area, best maturity period are double advantage to be a food security crop. The fact that potatoes mature during the time when there is a food shortage, and its short life cycle to mature enables it to deserve appreciation by farmers (Solomon Yilma, 1985).

***Corresponding author:** Kinde Lamessa, Oromia Agricultural Research institute (IQQO), Mechara Agricultural Research Center; Horticulture Research team, Mechara, Ethiopia. Email: klamessa@gmail.com

Plant density in potato affects some of important plant traits such as total yield, marketable tuber number, unmarketable tuber number and quality. So it might argued that increase in mean tuber weight and increase in the number of tuber and yield per unit area (Marguerite *et.al*., 2006). Georgakis *et. al*. (1997) concluded that by increasing plant density, the tuber yield was increased. Application of inorganic fertilizer are significantly increases the different trait of potato production (Harnet *et.al*., 2012; Zelalem, 2008).

Among the root and tuber crops, the production coverage of potato stands next to enset (*Enset ventircosum* L) in Ethiopia. In Ethiopia, lack of appropriate agronomic techniques is known to be one of the major contributing factor to the existing low tuber yield per unit area (low national average 80 Qut ha^{-1}) despite the existence of highly suitable edaphically and climatic condition for potato productivity (FAOSTAT, 2008). Potato producers in Ethiopia exercise in adequate agronomic practices some of this practice include, in adequate land preparation, sub optimal time of planting, plant population (spacing or stem density), cultivation, fertilization application, seed tuber quality, depth of planting, ridging, pest control and harvesting time and techniques and crop rotation.

If these practices have been followed there is high potential to significantly increase tuber yield per unit area even for existing cultivars. Potato like that of other crops is dependent on the supply of nutrient, optimum amounts of all plants nutrients is a prerequisite for best potato growth and high yield, only nitrogen, phosphorus and potassium. Soil fertility decline are noted as the principal cause for crop yield reduction in Western Oromia. Therefore the study was conduct for the following objective; i) To determine optimum intra and inter row spacing for potato tuber production at Mechara and Oda Bultum; ii) To identify optimum rate of DAP and Urea fertilizer for optimum potato tuber production at Mechara and Oda Bultum.

MATERIALS AND METHODS

Location of study area

The field experiment was conducted at Mechara Agricultural Research Center (McARC) on station and Oda Bultum Farmers training center (FTC) during the 2012 cropping season. McARC is found at an Altitude of 1700 m.a.s.l at 40^{o} 19' North latitude and 08^{o} 35' East longitude. The major soil type of the center is sandy clay with reddish color (McARC, 2010). McARC is located at Daro Labu, which is one of the districts of West Hararghe Zone, Oromia Regional State of Ethiopia and 12% of its area lies in the high land, 44% in the mid-high land and 44% in the low land agro ecological zones. The rainfall in this area is usually erratic; there is also rainfall variability in the onset and cessation of the main rainfall. Farming systems of Daro Labu district constitute complex production units involving a diversity of interdependent mixed cropping and livestock activities. The area is predominantly cereal producing with sorghum and maize as staple food crops; the major annual crops grown include sorghum, maize, groundnuts, sweet potato, wheat, common beans and barley. In addition, the major cash crops, like chat and coffee, have a long-standing tradition in the district. Oda Bultum is one district found in West Hararghe zone of Oromia Regional state, in Eastern Ethiopia. it is found at an Altitude of 1,761 M.a.s.l at 8^{0} 54' North latitude and 40^{0} 47' East longitude.

The livelihoods in the Oda Bultum woreda mainly centre on rain fed agriculture , with mixed farming 90% and agro- pastoralist at 10%. Maize , sorghum, tef, wheat and barley are the major cereal and food crops produced in the woreda. Chat, coffee, hot pepper and potato are the most important cash crop in the woreda. The climatic data of at Oda Bultum was not recorded during the study.

Experimental Materials

Potato variety " Gudene" was used for the study. Gudene was released by Holetta Agricultural Research center in 2006. They have specific adaptation from 1600-2800 M.a.s.l. and 291 Qut ha^{-1} yield .

Treatment structures and design

Potato was sown during 2012 season in June 16 and 24 at Mechara on station and Oda Bultum farmers training center respectively. Randomized complete block design with three replication in factorial arrangement was employed for the study. Three level of in organic fertilizer ; 150 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) of and 80 kg ha^{-1} of urea (N: P_{46}:K); 200 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) of and 100 kg ha^{-1} of urea (N: P_{46}:K); 207 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 138 kg ha^{-1} urea (N: P_{46}:K) and three level of combined inter row spacing and intra row spacing; 50cm between row and 20cm between plant; 70cm between row and 30cm between plant and 90cm between row and 40cm between plant were used for the studies. the distance between block and plot 1m and 0.5 cm respectively. The plot size 4.5mX3.3m= 14.85 m^2 was applied for all treatments. Nitrogen fertilizer was applied in two split application 50% during planting and 50% at 45 days after emergence. The treatment were:

T1 (S1F1)= 150 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 80 kg ha^{-1} of urea (N: P_{46}:K) and 50cm between row and 20cm between plant

T2 (S1F2)= 200 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 100 kg ha^{-1} of urea (N: P_{46}:K) and 50cm between row and 20cm between plant

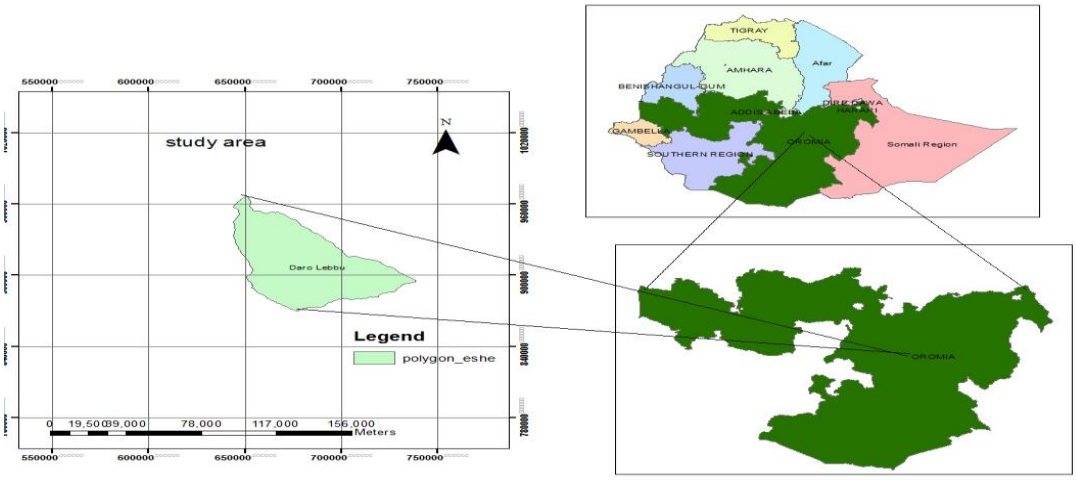

Figure 1. Map of the study area (Mechara Agricultural research center)

T3 (S1F3)= 207 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 138 kg ha^{-1}(N: P_{46}:K) and 50cm between row and 20cm between plant
T4 (S2F1)= 150 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 80 kg ha^{-1} of urea (N: P_{46}:K) and 70cm between row and 30cm between plant
T5 (S2F2)= 200 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 100 kg ha^{-1} of urea (N: P_{46}:K) and 70cm between row and 30cm between plant
T6 (S2F3)= 207 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 138 kg ha^{-1}(N: P_{46}:K) and 70cm between row and 30cm between plant
T7 (S3F1)= 150 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 80 kg ha^{-1} of urea (N: P_{46}:K) and 90cm between row and 40cm between plant
T8 (S3F2)= 200 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 100 kg ha^{-1} of urea (N: P_{46}:K) and 90cm between row and 40cm between plant
T9 (S3F3= 207 kg ha^{-1} of DAP (N_{18}: P_{46}:K_0) and 138 kg ha^{-1}(N: P_{46}:K) and 90cm between row and 40cm between plant

Data collected

Germination date, plant height (cm), stand count at flowering, number of main stem, 50% flowering date, stand count at harvest, average number of tubers per plant, marketable tubers ton ha^{-1}, unmarketable tubers ton ha^{-1} and total tubers yield ton ha^{-1}.

Data analysis

The analysis of variance (ANOVA) was carried out using statistical packages and procedures out lined by Gomez and Gomez (1984) appropriate to Randomized Complete Block Deign using GenStat Computer Software version 13.3. Mean separations was carried out using least significant difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

Plant height: The analysis of variance revealed that plant height potato were non- significant (P> 0.05) due to main effect of spacing and fertilizer. The highest plant height was obtained at 50cm:20cm spacing (87cm) but statistical non-significant with 70cm:30cm and 90cm:40cm spacing. This might be due to population density and competition effect for recourse like sun light, nutrient and water. Location was highly significant influence potato plant height (P< 0.001) (Table 2). The highest was obtained at Oda Bultum (96 cm) and the lowest was recorded at Mechara location (76cm). This may be due to amount rainfall in the location and soil type. Location with fertilizer shows significant effect on potato plant height. The highest (98cm) was obtained at Oda Bultum with the 207:137 fertilizer applications and the lowest (70cm) at Mechara with the 100:85 fertilizer applications (Table 2). All interaction effect revealed that their significant difference in potato plant height (Table 4). Similarly, finding was reported by Shaaba and Kisetu (2014) application of NPK fertilizer did not give significantly difference on plant height of potato.

Stand count at flowering: The analysis of variance revealed that stand count at flowering was significant due to spacing and non- significant due to fertilizer application. Location was highly significant (P< 0.001) influence stand count at flowering. The highest stand count at flowering was recorded at Oda Bultum (32) and the lowest was recorded at Mechara location (19) (Table 3). This might be due to amount of rainfall and agro climatic condition of the area and population density. The highest stand counts at flowering were obtained at lower intra and inter row spacing in combination with all fertilizer application; except statistical at par with the application of 70cm: 30cm with 200:100 application of fertilizer. The lower stand counts at flowering were

Table 1. Climatic data of the long term average (2009-2012) at Mechara location, Ethiopia.

Month	Max(^{o}C)	Min(^{o}C)	TRF(mm)	RH (%)
January	21.72	9.71	36.2	29.56
February	22.84	11.27	8.6	21.89
March	22.72	11.88	472.7	28.28
April	27.57	15.25	548.5	35.48
May	27.71	14.98	694.3	51.19
June	25.45	14.63	423.2	52.1
July	25.36	14.26	846.7	58.89
August	25.79	14.22	873.4	75.12
September	26.08	13.2	916.7	56.79
October	26.02	13.52	315.23	59.97
November	25.66	13.27	221.8	46.1
December	27.51	14.33	149.9	43.4
Total	-	-	5507.23	-
Mean	25.37	13.78	-	46.56

RH = Relative Humidity, TRF= Total Rainfall. "Source Mechara weather station

Table 2. Mean effect of plant height of potato as affected by the interaction effect of fertilizer and location at West Hararghe.

	Location	
Fertilizer	Mechara	Oda Bultum
100:85	70	97
200:100	81	92
207:137	76	98
LSD	7.5.0	
CV (%)	11.20	

Means followed by the same letter(s) within columns and rows are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

obtained at higher intra and inter row spacing in combination with all fertilizer application. This might be due to population density, highest population density give highest stand count at flowering (Table 5).

Stand count at harvest: The analysis of variance revealed that stand count at harvest was significant due to spacing and non- significant due to fertilizer application. Location was highly significant (P< 0.001) influence stand count at harvest. The highest stand count at harvest was recorded at Oda Bultum (31) and the lowest was recorded at Mechara location (19) (Table 3).

Number marketable tuber

The analysis of variance revealed that number of marketable tuber was non- significant due to main effect of spacing, fertilizer and location. This in agreement with the findings of Harnet *et.al*. (2009) who found out that availability space had no effect on number marketable tuber. This result in agreement the findings of Harnet *et.al.* (2013) they reported that the combination of inter and intra spacing had none significant effect on number of marketable yield. In a related study Burton (1989) reported that wider spacing produced few tubers as it gave rise to few stems that could lead to high number and possibly tubers, but closer spacing improved quality and saleable yield. All interaction effect revealed that no significant difference due to number marketable tuber. This result in agreement the findings of Somanin *et.al*. (2010) they reported that increasing plant density increases the tuber per plant. Divergence with the findings of Rahemi *et.al*.(2003) intra-row spacing and Nitrogen fertilizer affected yield significantly.

Number unmarketable tuber

The analysis revealed that number of unmarketable tuber was highly significant due to spacing and location. The highest number unmarketable tuber (150.4 ton ha-^{1}) was

Table 3. Main effect of fertilizer, spacing and location on yield and yield components of potato at West Hararghe

Treatments		Plant height	Stand count at flowering	Stand count at harvest	Number marketable tuber	Number unmarketable tuber	Average number tuber per plant	Yield ton ha^{-1}	Unmarketable tuber yield to ha^{-1}
Spacing	50cm:20cm	87.00	29.67	29.28	165.50	150.40	13.39	26.80	9.50
	70cm:30cm	86.00	24.72b	24.33	171.90	87.30	12.06	31.50	7.10
	90cm:40cm	84.00	19.28c	19.39	140.20	100.20	13.67	24.50	7.60
P-value		0.889	0.006	0.001	0.299	0.0029	0.655	0.08	0.081
LSD		NS	4.108	2.650	NS	41.950	NS	NS	NS
Fertilizer	150:85	83.00	24.06	23.61	145.80	110.20	12.50	26.00	7.50
	200:100	87.00	24.94	24.33	163.60	122.30	14.67	28.40	9.00
	207:138	87.00	24.67	25.06	168.20	105.40	11.94	28.40	7.60
P-value		0.115	3.722	0.624	0.153	0.367	0.124	0.179	0.187
LSD		NS	NS	NS	NS	NS	NS	NS	NS
location	Bultum	96.00	31.22	30.78	157.60	91.10	8.81	26.50	6.30
	Mechara	76.00	17.89	17.89	160.90	134.10	17.26	28.70	9.80
LSD		5.50	1.525	1.762	19.390	17.420	2.239	NS	1.64
P-value		<0.001	<0.001	<0.001	0.722	<0.001	<0.001	0.076	<.001
CV (%)		11.2	10.90	12.70	21.30	27.100	30.00	15.90	35.10

Means followed by the same letter(s) within columns are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

Table 4. Means for potato plant height (cm) as affected by all interaction effect at West Hararghe

	150:85		200:100		207:138	
Spacing	Mechara	Oda Bultum	Mechara	Oda Bultum	Mechara	Oda Bultum
50cm:20cm	69	108	72	90	68	98
70cm:30cm	66	91	97	94	78	90
90cm:40cm	73	93	74	93	83	105
LSD			15.90			
CV (%)			11.20			

Means followed by the same letter(s) within columns and rows are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

Table 5. Means for stand count at flowering as affected by interaction effect of spacing with location and spacing with fertilizer at West Hararghe.

	Fertilizer			Location	
Spacing	**150:85**	**200:100**	**207:138**	**Mechara**	**Oda Bultum**
50cm:20cm	30	30	29	42.00	17.33
70cm:30cm	23	27	25	30.56	18.89
90cm:40cm	20	18	20	21.11	17.44
LSD		4.610		4.058	
CV (%)		10.90		10.90	

Means followed by the same letter(s) within columns and rows are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

Table 6. Means for stand count at harvest as affected by interaction effect of spacing with location and spacing with fertilizer at West Hararghe.

	Fertilizer			Location	
Spacing	**150:85**	**200:100**	**207:138**	**Mechara**	**Oda Bultum**
50cm:20cm	28.17	30.5	29.17	41.22	17.33
70cm:30cm	22.5	25	25.5	29.78	18.89
90cm:40cm	20.17	17.5	20.5	21.33	17.44
LSD	4.831			3.003	
CV (%)	12.7			12.70	

Means followed by the same letter(s) within columns and rows are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

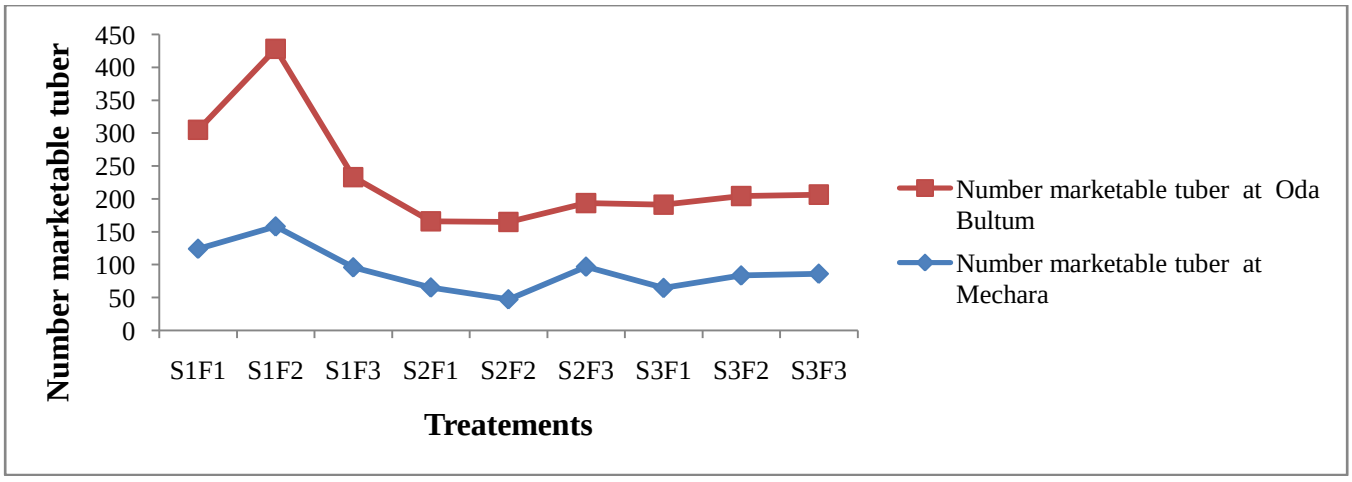

Figure 1. Effect of location on the number of marketable tuber

recorded at narrow intra and inter row spacing (50cm: 20cm) the lowest (87.3 ton ha^{-1}) was recorded at standard check (70cm: 30cm) but statistical at par with (90cm: 40cm). The lowest (91.1) and the highest (134.1) number unmarketable tuber were obtained at Mechara and Oda Bultum respectively. This might be due to the occurrence of potato weevil at Mechara or the climate condition of the areas (Table 3).

Average number of tuber per plant

The analysis of variance revealed that average number tuber per plant was no significant due to main effect of spacing and fertilizer application. Significant difference was recorded due to location. The highest was recorded at Mechara (17.26) and the lowest (8.81) was recorded at Oda Bultum. All interaction effect revealed that no

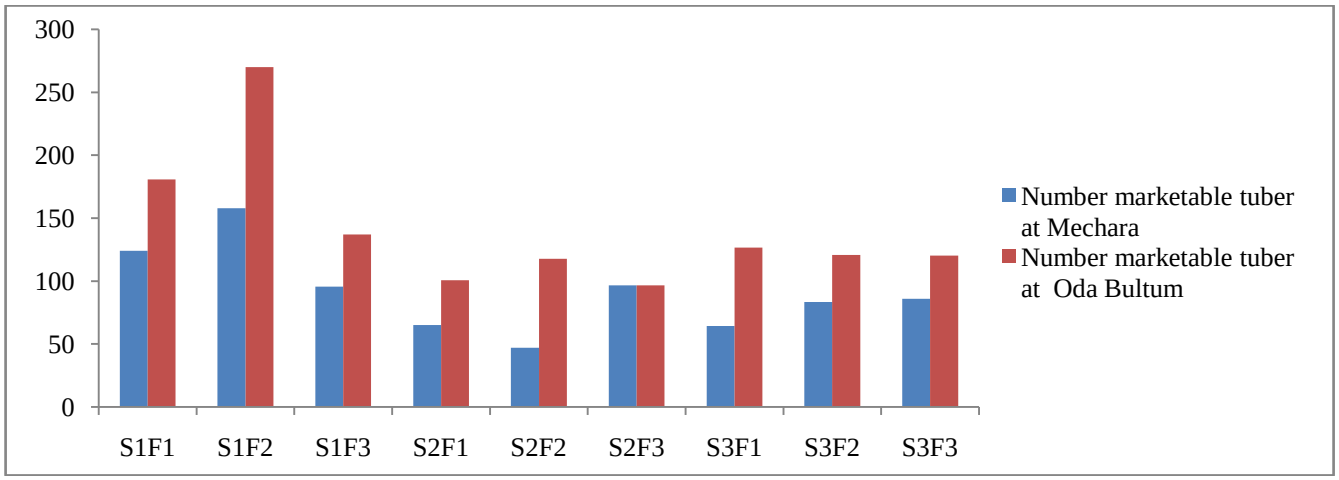

Figure 2. Treatments effect on the number of marketable tuber at Mechara and Oda Bultum location.

Table 7. Means for number of unmarketable tuber as affected by all interaction effect

	100:85		200:100		207:138	
Spacing	**Mechara**	**Oda Bultum**	**Mechara**	**Oda Bultum**	**Mechara**	**Oda Bultum**
50cm:20cm	124.0	180.7	158.0	207.0	95.7	137.0
70cm:30cm	65.0	100.7	47.0	117.7	96.7	96.7
90cm:40cm	64.3	126.7	83.3	120.7	86.0	120.3
LSD			58.6			
CV (%)			27.1			

Means followed by the same letter(s) within columns and rows are not significantly different at P ≤ 0.05 level of significance, LSD= Least significant difference, CV= Coefficient of variation.

Table 8. Means for number of unmarketable tuber as affected by all interaction effect

	100:85		200:100		207:138	
Spacing	**Mechara**	**Oda Bultum**	**Mechara**	**Oda Bultum**	**Mechara**	**Oda Bultum**
50cm:20cm	8.00	21.0	7.67	21.0	6.33	16.33
70cm:30cm	7.33	16.3	11.00	14.7	9.33	13.67
90cm:40cm	8.33	14.0	10.67	23.0	10.67	15.33
LSD			6.97			
CV (%)			30			

significant difference due to average number tuber per plant.

Yield ton ha^{-1}:

No significant difference recorded due to main effect of spacing and fertilizer and location. Population density and fertilizer application are major factor that affect production and productivity of potato. Even though, statistical no significant difference recorded due to spacing the highest yield was reordered at 70cm: 30cm inter and intra row spacing (Somanin *et.al*., 2010). This in agreement with the findings of Harnet *et. al*. (2013) the highest tuber yield was recorded at 65 cm inter row spacing and the lower was recorded at 80cm inter row spacing.

Unmarketable tuber yield ton ha^{-1}:

No- significant difference was recorded due spacing and fertilizer. The highest unmarketable tuber yield (9.8 t ha-

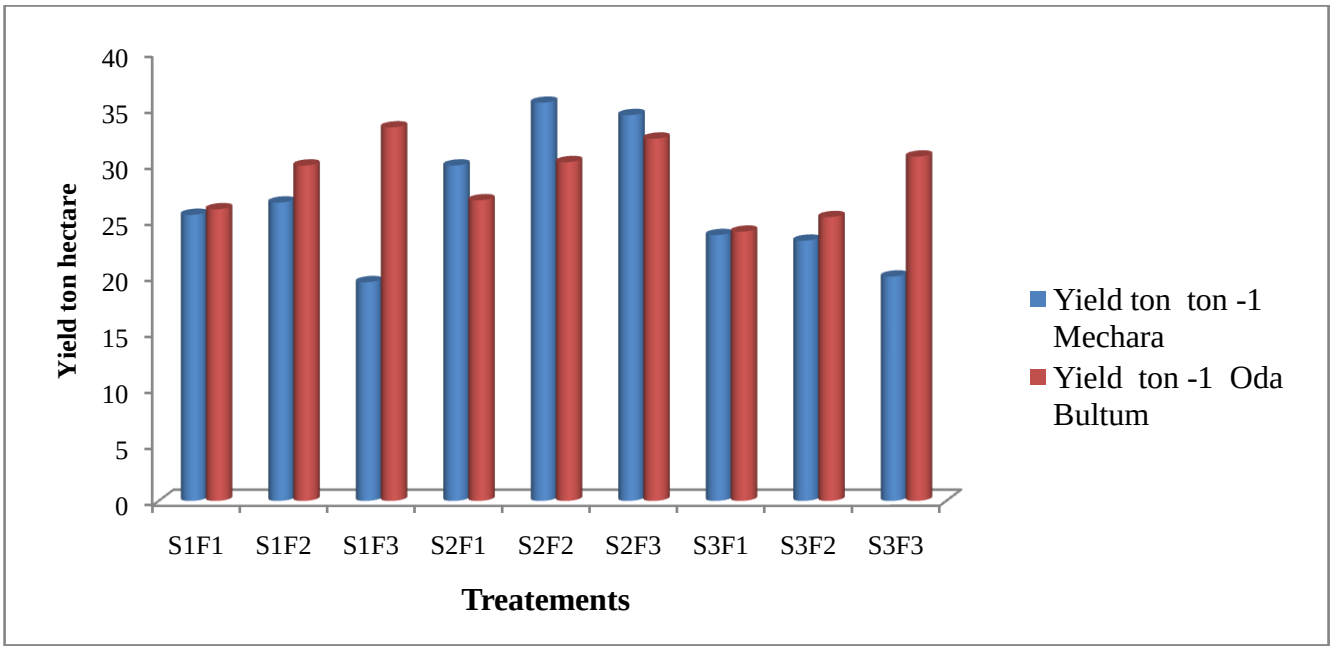

Figure 2. Treatments effect on the potato yield ton ha^{-1} at Mechara and Oda Bultum location.

1) was obtained at Mechara and the lowest unmarketable tuber yield (6.3 t ha-1) was obtained at Oda Bultum (Table 3). This might me due to climate condition and the occurrence of insect pest at that location. The highest potato weevil was recorded at Mechara than Oda Bultum location. This agreement with the findings of Harnet *et al*. (2013) reported that unmarketable tuber was no-significant from 20cm to 40cm intra row spacing. In addition, Zelalem (2008) reported that application nitrogen fertilization did not affect unmarketable tuber yield. Non-significant difference was observed due to all interaction (Somanin *et.al*., 2010).

CONCLUSION

From the current investigation plant height, number marketable tuber, average number tuber per plant, yield and unmarketable yield was no significant due to main effect of spacing and fertilizer. However, significant difference recorded due to main effect of location. At Mechara the highest potato yield was recorded at 70cm: 30cm spacing and 200 kg ha^{-1} of DAP and 100 kg ha^{-1} of urea. While at Oda Bultum the highest potato yield was recorded at 50cm: 20cm and 207 kg ha^{-1} of DAP and 138 kg ha^{-1} of urea. The highest marketable tuber was recorded at Oda Bultum while the lowest was recorded at Mechara. From the result, it can be concluded that spacing of 70cm between row and 30cm between plants with fertilizer rate of 200 kg ha^{-1} DAP and 100 kg ha^{-1} Urea gave better marketable tuber yield, average number of tubers per plant, total tuber yield and other parameters at Mechara locations. For Oda Bultum location spacing of 50cm between rows and 20cm between plants with fertilizer rate of 207 kg ha^{-1} of DAP and 138 kg ha^{-1} of urea gave better yield at Oda Bultum locations. Therefore, a spacing of 70 cm between row and 30 cm between plants with fertilizer rate of 200 kg ha^{-1} DAP and 100 kg ha^{-1} Urea was recommended for Mechara and Badessa area and similar agro ecologies

ACKNOWLEDGMENTS

I would like to thank the Oromia Agricultural Research Institute (OARI) for financial support and Mechara Agricultural Research Center (MeARC) is acknowledged for facilitating this work. My sincere thanks also go to my wife Birtukan Mulugeta for their support during the work. Finally I thanks my son Labsi and Kayo I love so much and God bless you forever.

REFERENCE

Burton, W.G. (1989). The Potato. Longman Scientific and Technical, Essex, UK. 470-504pp. Chiipanthenga, M., Maliro, M., Demo, P.,and Njoloma, J. 2012. Potential of aeroponics system in the production of quality potato (Solanum tuberosumL.) seedin developing countries. *Africa. Journal of Biotechnology*. Vol. 11(17) 3993-3999.

FAO (Food and Agriculture Organization of the United Nations) (2004). Agricultural Data. Provisional 2003 production and Production Indices Data. Crop primary. (*http: // apps. Fao.Org/default. jsp)*

Georgakis , D.N., D.I . Karafyllidis, N.I. Stavropoulos, E.X. Nianiou and I.A. Vezyrogolu, (1997). Effect of Planting Denisty and Size of Potato Seed - Minitubers on the size of the produced potato seed tubers. Acta Hort . (ISHS), 462: 935-942

Gomez, K.A. and A.A. Gomez, (1984). Statistical Procedures for Agricultural Research. 2nd Edition. John Wiley and Sons Inc. Inter-Science Publications .New York. pp. 180-225.

FAOSTAT (2008). Country Profile on Potato Production and utilization: Ethiopia. In Gebremedhin ,W., Endale, G., and Kiflu , B. 2001. National potato research program report. Ethiopia Agricultural Research Organization, Holetta Agricultural Research Center

Harnet Abrha, Derbew Belew and Gebremedhin Woldegiorgis (2013). Effect of Inter- and Intra Row Spacing on Seed Tuber Yield and Yield Components of Potato at Ofla Woreda. In: Seed potato tuber production and dissemination experience challenge and prospects proceedings of the national workshop on seed potato tuber production and dissemination. 12-14 March 2012 Bahirdar, Ethiopia

Marguerite, O., G. Jean-pierre and Jean-Francois (2006). Threshold Value for Chlorophyll Meter as Decision Tool for Nitrogen Management of Potato. Agron.J ., 98: 496- 506.

Naz F, Ali A, Iqbal Z, Akhtar N, Asghar S, and Ahmad B. (2011). Effect of different levels of NPK fertilizers on the proximate composition of Potato at Abbottabad . *Sarhad Journal Agricultural science . 27(3):* 353-356.

Rahemi.A., Hasanpour.A., Mansoori.B., Zakerin.A., and Taghavi.J.S. (2013). The Effects of Intra-Rowspacing and N-fertilizer on the Yield of Two Foreign Potato Cultivars in Iran. International Journal of Agriculture and biology. 1560-8530/2005/07-5-705-707.http://www.Ijab.org

Shaaban Husna and EliakiraKisetu (2014). Resonse of Irish Potato to NPK Fertilizer Application and its Economic Return when Grown on an Ultisol of Morogoro, Tanzaina. Journal of Agricultural and crop science. Vol 2(9) , pp. 188-196. ISSN: 2384-731X

Solomon Yilma, (1985). Review of potato research in Ethiopia. pp. 294-307. In: Proceedings of the 1st Ethiopian Horticultural Workshop. 20-22 February 1985, Addis Ababa, Ethiopia

Somanin, S.J., Mahmoodabad , R.Z, Yari Asgar.(2010). Response of agronomical , physiologically , apparent recovery nitrogen use efficiency and yield of potato tuber (Solanum tuberosum L.) to nitrogen and plant density . American -Eurasian Journal Agricultural and Environmental science 9(1): 16:21.

Zelalem Ayichew, (2008). Response of Potato (*Solanum tuberosum* L.) to Different Rates of Nitrogen and Phosphorus Fertilization on Vertisols at Debre Berhan in the Highlands of Central Ethiopia. M.Sc. Thesis, Haramaya University.

Accepted 19 March, 2016.

Citation: Lamessa K, Zewdu A (2016). Effect of spacing and fertilizer dose on growth and yield of potato (*Solanum tuberosum L*) Gudane variety at West Hararghe, Eastern Ethiopia. International Journal of Horticulture and Ornamental Plants 2(1): 011-018.