

Evaluation of Released Potato (*Solanum Tuberosum* L.) Varieties in Benishangul Gumuz Region, Western Ethiopia

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Abstract: Potato (*Solanum tuberosum* L.) plays a major role in national food security, poverty alleviation and income generation. The study was designed to evaluate different potato varieties on yield and yield components of potato at Assosa, in Western Ethiopia. The treatments consisted of released potato varieties Belete, Dagim, shonkolla, Gudane, Jallane and Guassa. The treatments were laid out as a Randomized Complete Block Design with three replications. At Assosa condition Shonkolla varieties was recorded highest total tuber yield among six potato varieties which gave 35.06 ton/ha whereas Dagim recorded the lowest total tuber yield 19.12 t/ha. In case of Maokomo sub site the highest total tuber yield (24.23 t/ha) was obtained from Belete variety while the lowest total tuber yield (9.64 t/ha) was recorded by Guassa variety. So, we tentatively recommended that shonkolla variety was best for Assosa area followed by Belete variety. In case of Maokomo we recommended that Belete variety was best for Maokomo area followed by Dagim variety.

Key words: Potato, Varieties, Evaluation and Tuber

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) belongs to the Solanaceae family. It is the fourth most important crop after rice, wheat, and maize, and has historically contributed to food and nutrition security in the world (FAO, 2015). Potato (*Solanum tuberosum* L.) is a leading food and cash crop in Ethiopia, especially in the highlands of the country. It has the potential to supply a cheap and quality food within relatively short period of time. The crop has the greatest potential to produce greater amount of yield per unit land than cereals and is only exceeded nutritionally by fish, sweet potato and rice (EARO, 2000). It is considered to be the source of proteins, vitamin, minerals, energy and amino acids (Pual, 1992). For this reasons, envisaged that potato has a promising potential to make a very significant nutritional and economic benefits of both rural and urban communities of Ethiopia.

On the other hand, ensuring food security is one of the greatest challenges facing the world community including Ethiopia (FAO, 2001). Sustainable food production to feed the ever increasing human population is a critical issue today. The dual challenge of meeting human food requirements and maintaining or even improving the quality of environment is the basic objective of sustainable crop production. Therefore, to continuously generate high yielding potato varieties that can be adapted to major growing areas of the region, the varietal selection activity has to be continuous. The number of farmers growing potato in Benishangul Gumuz region was approximately 3,277 in 2016 and increased to 8,359 farmers in 2017 (CSA, 2017). However, both production as well as productivity has been very low despite the existing favorable climatic conditions, edaphically factors and cheap land resources.

Statement of Problem

The regional average yield of potato, estimated at 6.5 tons Assosa zone and 2.0 tons/ha at Mao-Komo special woreda (Farming System Survey in BGRS, 2006) when compared to national average yield, 13.7 tons per hectare (CSA, 2017). This low yield is attributed mainly due to the potato varieties available at the hands of the farmers in the region are poor yielder and susceptible to diseases particularly, late blight (Assosa Research Strategy Document, 2005). Hence, lack of high yielding potato varieties, which are tolerant/resistant to major diseases and insect pests, is becoming the major problem prevailing in the region.

Significance/ Motivation of the study/

Potato production in Benishangul Gumuz is low as compared to national potato production in ton per ha because the farmers use local potato varieties. The significance of this study is to increase potato production using improved potato varieties in Benishangul Gumuz Region.

Scope and limitation of the study

Some varieties showed the highest yield at Maokomo as compared to Assosa area due to geographical difference. At Assosa area diseases occurred on some varieties as compared to Maokomo area. Late blight limited potato yield if not planted at proper time. It is important to plant early June at Assosa and Maokomo condition.

Objective

To evaluate adaptable and high yielding with good quality potato varieties for users

2. MATERIALS AND METHODS

The experiment was conducted at Assosa Agricultural Research Center in two locations, Assosa on station and Tongo and during 2017/2018 cropping seasons. The center is located at latitude of 10°02' N and longitude of 34°34' E in western Ethiopia. It is characterized by altitude ranging from 1553 m a.s.l. and mean annual rainfall of 1275 mm. The rainy season extends from April to October and maximum rain is received in the months of June to August. It has a warm humid climate with mean maximum and minimum temperatures are 32.0°C and 17.0°C, respectively. The soil of the area is characteristically reddish, brown, Nitosol, which is slightly acidic, pH of 5.5 (EARO, 2004).

Mao-Komo Special *Wereda* is one of the 20 *Weredas* found in Benishangul-Gumuz National Regional State, its capital, Tongo, located 116 km away from Assosa town. It is bordered by Oromia Region in the east, Sudan in the west, Assosa Zone in the north and Gambela Region in the south. The altitude of the area ranges from 950-1800 m.a.s.l. whose 15% and 85% is categorized as mid altitude and lowland, respectively. The temperature of the area ranges from 23-35°C.

The experimental design was RCBD with three replications. Six recently released potato varieties, Dagim(v1), Shonkola (v2), Guasa (CIP-384321-9(v3)), Belete (CIP-393371-58(v4)), Jalane(v5), and Gudane(v6) were tested as treatments. The total numbers of plots were 18 and each plot had a size of 9 m² areas with five rows and 10 plants per row with a total population of 40 plants per plot at spacing of 0.75 m and 0.30 m between rows and plants, respectively. All crop cultural practices were followed as per the recommended packages. Data were collected for plant height (cm), main stem number per hill, average tuber weight per hill, marketable tuber yield, unmarketable tuber yield and total tuber yield.

Data Analysis

Data were analyzed using analysis of variance procedures on the appropriate statistical analysis software (SAS, 2010) version 9.0. Whenever the treatment differences show significance, mean differences were tested by LSD at 5% level of significance.

3. RESULTS AND DISCUSSION

Growth Performance and Yield Components

Plant height and number of main stems per hole: The results showed that no significant difference ($P>0.05$) among varieties in terms of plant height and number of main stems both at Assosa and Maokomo.

Average of fresh weight per plant: the result revealed that not significantly influenced by different varieties at Assosa area, but average fresh fruit per plant was highly significantly influenced by different potato varieties at Maokomo site. The highest average fresh tuber per plant (696.80 g) was observed from Belete variety.

Average of dry weight per plant: the result showed that average of dry weight per plant was not significantly affected by different varieties at Assosa, but it was highly significantly ($P<0.01$) affected by different varieties at Maokomo.

Total tuber number per plant: the result showed that not significantly ($P>0.05$) affected by different varieties at Assosa, but it was highly significantly affected ($P<0.01$) by different varieties at Maokomo. The highest total tuber number per plant at Maokomo was observed from Guassa and Jalane varieties (7.87) whereas the lowest total tuber number per plant (5.6) Dagim variety.

Table1. Mean of growth performance potato varieties at Assosa and Maokomo in 2017/18

Trts	PH(cm)		NSPH		AFWPP(g)		ADWPP(g)		TNPP	
	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo
Dagim	52.93	55.45	3.43	3.73	337.9	493.20b	88.03	116.33b	8.20	5.60
Shonkolla	61.53	49.25	3.47	4.1	476.6	400.10bc	107.24	73.90c	9.33	6.20
Guasa	61.87	51.23	4.53	3.6	469.3	378.80c	146.95	80.33c	12.07	7.87
Belete	62.67	59.67	3.33	4.27	442.1	696.80a	134.16	181.73a	6.40	6.27
Jalane	56.40	40.53	3.00	2.8	605.3	368.20c	131.98	81.79c	11.33	7.87
Gudane	50.40	47.83	2.87	3.27	384.4	433.40cb	84.19	110.51b	8.27	7.4
CV	9.63	11.46	21.67	17.15	39.47	13.22	38.24	12.61	23.98	10.32
LSD	10.09				324.99	111.08	80.29	24.64	4.04	1.29
Sign Level	Ns	Ns	Ns	Ns	Ns	**	Ns	**	Ns	**

Ns= Non significance, **= highly significant, *= significant, LSD= Least Significant Difference, CV= Coefficient of Variation, PH= plant Height, NSPH= Number of Stem per hole, AFWPP= Average Fresh Weight Per plant, ADWPP= Average dry weight per plant, TNPP= Total number of tuber per plant.

Yield Attribute Parameters

Marketable tuber yield: highly significantly ($P<0.01$) affected by different potato varieties both at Assosa and Maokomo. The highest marketable tuber yield (20.49 t/ha) was obtained from Shonkolla at Assosa whereas the lowest marketable tuber yield (11.09 t/ha) was recorded from Gudane variety at Assosa. The highest marketable tuber yield observed from Belete variety (23.86 t/ha) at Maokomo whereas the lowest marketable tuber yield (8.08 t/ha) at Maokomo was recorded from Guassa variety. This variation might be due to inherit potential of varieties. These results were in line with other researchers who reported that marketable tuber yield was significantly varied by variety (Elfinesh, 2008; Kumar *et al.*, 2007).

Unmarketable tuber yield:- the results showed that no significant difference ($P>0.05$) among varieties at Assosa while it was significantly ($P<0.05$) affected by varieties at Maokomo.

Total tuber number per plot: the result revealed that there was significance difference ($P>0.05$) among varieties at Assosa whereas total tuber number per plot was highly significantly ($P<0.01$) affected by varieties at Maokomo.

Total tuber yield per ha

The results showed that total tuber yield was significantly ($P<0.05$) affected by varieties at Assosa whereas it was highly significantly ($P<0.01$) affected by different varieties at Maokomo. It might be due to inherit potential of varieties. At Assosa conditions the highest total tuber yield was recorded from the Shonkolla (35.06 ton/ha) followed by Belete (29.69 ton/ha). In case of Maokomo condition the highest tuber yield of potato was observed from Belete variety (24.23 ton/ha) followed by Dagim variety (21.99 ton/ha). This variation might be due to inherit potential of varieties. This results were in line with other researchers who reported that total tuber yield was significantly varied by variety (Elfinesh, 2008; Kumar *et al.*, 2007).

Table2. Mean of yield parameters of potato at Assosa and Maokomo in 2017/18.

Trts	MYLD (kg/plot)		UNMYLD (kg/plot)		TTN per plot		TTY (t/ha)	
	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo
Dagim	11.52c	21.48ab	1.39	0.82b	133.67	122.00b	19.12c	21.99ab
Shonkola	20.49a	15.37bc	3.10	1.82a	198	179.00a	35.06a	17.19bc
Guasa	15.2bc	8.08d	2.87	0.82b	156.33	77.33c	26.78bc	9.64d
Belete	18.58ab	23.86a	1.46	0.37b	106	96.00cb	29.69ab	24.23a
Jalane	12.52c	10.94cd	2.34	0.97b	122	115.00cb	22.01bc	11.91cd
Gudane	11.09c	14.38cd	2.33	0.84b	148.33	117.33b	19.89c	15.23cd
CV	15.68	21.25	47.46	40.84	20.18	17.70	17.10	20.07
LSD	4.25	6.61	1.95	0.66	52.88	37.93	12.82	14.63
Sign Lev	**	**	NS	*	NS	**	*	**

Ns= Non significance, **= highly significant, *= significant, LSD= Least Significant Difference, CV= Coefficient of Variation. MTW=Mean tuber weight, MYLD= Marketable tuber Yield, UNMYLD= Unmarketable tuber yield, TTN= Total tuber number per plot, TYPH= Total tuber yield per ha.

Tuber Size Distribution

Mean tuber weight (g): mean tuber weight was not significantly ($P>0.05$) affected by varieties at Assosa, it was highly significantly ($P<0.01$) affected by varieties at Maokomo. The highest mean tuber weight (110.88 g) was observed from Belete variety at Maokomo whereas the lowest mean tuber weight (43.20 g) was recorded from Shonkolla variety. The variation may be attributed to an inherit potential of the genotypes. Patel *et al.* (2008) and Kumar *et al.* (2007) also reported that maximum yield of small size tubers may be due to higher number of tubers as well as varietal character and adaptability or establishment effect of other growth attributes.

Number of small tuber size per plot: it was not significantly ($P>0.05$) affected by varieties at Assosa whereas it was highly significantly ($P<0.01$) affected by varieties at Maokomo.

Number of medium tuber size per plot: it was not significantly ($P>0.05$) affected by varieties both at Assosa and Maokomo areas.

Number of large tuber size per plot: Large tuber size of potato in number was not significantly ($P>0.05$) affected by varieties at Assosa whereas it was highly significantly ($P<0.01$) affected by varieties at Maokomo.

Table3. Mean of number of size distribution per plot and mean tuber weight of potato at Assosa and Maokomo site in 2017/18 cropping season.

Trts	MTW (g)		STSD		MTSD		LTSD	
	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo	Assosa	Maokomo
Dagim	41.23	88.317b	50.33	23.33d	51.67	55	24.33	44.000a
Shonkola	54.46	43.203d	92	90.00a	55.33	66	49.67	23.500cb
Guasa	39.12	48.147dc	99.33	35.67cd	57.67	31	34.67	10.333d
Belete	69.69	110.880a	22	34.33cd	38.67	38.67	47.67	32.333b
Jalane	52.99	46.687dc	64.33	64.00b	33.33	27	17.67	16.667cd
Gudane	45.42	58.490c	74.67	49.33cb	51	37.33	16.33	19.667c
CV	27.73	10.89	38.79	26.49	37.18	42.04	50.39	20.89
LSD	25.47	13.08	47.37	23.83	32.43	33.57	29.08	9.28
Sign Level	Ns	**	Ns	**	Ns	Ns	Ns	**

** = highly significantly difference, Ns= Non significant, MTW=Mean tuber weight, STSD= Small tuber size distribution, MTSD= Medium tuber size distribution, LTSD= Large tuber size distribution. LSD= Least Significance difference, CV= Coefficient of Variation.

4. CONCLUSION AND RECOMMENDATION

Six recently released potato varieties are Dagim, Shonkola, Guasa (CIP-384321-9), Belete (CIP-393371-58), Jalane, and Gudane were tested as a treatments in 2017/18 cropping season both at Assosa and Maokomo. Among those Belete, Shonkola and Dagim were the best performing varieties.

From those, two varieties Shonkola and Belete were best performed at Assosa whereas Belete and Dagim varieties were well performed at Mao-Komo sub site. This showed that Belete variety was widely adaptable on both locations while Shonkola was well performed at Assosa whereas Dagim was well performed at Mao-komo area. We tentatively recommended that Shonkola variety was best for Assosa area followed by Belete variety whereas Belete variety was well performed in case of Maokomo area followed by Dagim variety.

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