

# EVALUATION OF THE GROWTH AND PHYSICO-CHEMICAL COMPOSITION OF DIFFERENT GENOTYPES OF POTATO

Syed Muhammad Aslam<sup>1</sup>, Shujaat Ali<sup>1\*</sup>, Iftikhar Ahmad<sup>1</sup>, Syed Asim Shah<sup>1</sup>, Muhammad Arif Khan<sup>1</sup>, Rahmatullah<sup>1</sup>, Syed Mubarak Shah<sup>1</sup>, Imran Habib Khan<sup>1</sup>

<sup>1</sup>Department of Horticulture, Faculty of Crop Production Sciences, The University of Agriculture Peshawar, Pakistan.

Corresponding Authors: Syed Muhammad Aslam: [aslamhorti2015@gmail.com](mailto:aslamhorti2015@gmail.com), Shujaat Ali: [shujat.swati@gmail.com](mailto:shujat.swati@gmail.com)

**ABSTRACT:** An experiment was conducted to evaluate ten potatoes (*Solanum tuberosum*) genotypes, NARC 2008-A, NARC 2008-B, NARC 2008-C, NARC 2008-D, NARC 2008-E, NARC 2008-F, NARC 2008-G, NARC 2008-H, NARC 2008-I, Desiree. These genotypes were sown in the plastic tunnel, during autumn period in the 1<sup>st</sup> week of October 2015-16. The data were recorded on Physico-chemical composition (SG, DM), physiological weight loss and growth parameters and significant differences ( $P \leq 0.05$ ) were found. Maximum dry matter was recorded in NARC 2008-C. while minimum dry matter content was investigated in NARC 2008-F. Statistically significant differences were found in Specific gravity. The highest SG was recorded in NARC 2008-C. Through the experiment the genotype 'NARC 2008-D' surpassed in all parameters except SG, DM at rest of genotypes. The maximum yield tons ha<sup>-1</sup> was recorded NARC 2008-H (25.23) with lowest disease incidence (0.0%) and minimum tuber yield tons/ha (6.26) with highest disease incidence (16.66%) was observed in potato genotype NARC 2008-I. Similarly 'NARC 2008-E, NARC 2008-F, NARC 2008-D, NARC 2008-C, NARC 2008-A and NARC 2008-G genotypes were showed good results in yield tons ha<sup>-1</sup>. In case of disease incidence, NARC 2008-I was highly susceptible to disease incidence. Whereas genotype NARC 2008-H proved to be disease resistant where a negligible disease incidence was observed, followed by NARC 2008-A and NARC 2008-B.

## INTRODUCTION

Potato (*Solanum tuberosum*) belonging to the family *Solanaceae* [1]. Potato is native to the Andean zones of South America, where it has been a main staple food for 8,000 years [2]. Potato lies fourth in production among food crops after wheat, rice and maize in Pakistan. It is grown-up over a space of 149,00 hectares with a total production of 3,412,000 tones and average national yield per hectare is 22.89 tones/ha in Pakistan [3], while in USA average yield is 46.27 tonnes per hectares [4]. The potato consumption in Pakistan is 14 kg/capita annually with 170 million populations [5].

The dry matter (DM) is an important part of the quality standard for both friend and fresh products, which is affected by some pre-harvest factors i.e potassium fertilizers application cultivars, nitrogen, climate, soil, and maturity [6]. For example Genotypes NARC 1-2006/1, NARC 2002-1, 394021-120, VR 90-217, 393574-61 and 9625 had higher dry matter over 20% and hence are suitable for processing [7]. On a dry weight basis, his protein contented is equal to that of wheat flour [8].

The Specific Gravity (SG) estimation play vital to consider the quality of different potato cultivars during in the storage which is correlated with the starch and dry matter [9, 10]. Therefore, the highest SG indicates the highest DM and the highest Starch content in the tubers and vice versa [11].

Main focus on potato varieties development programme is given to yield, processing quality, tuber appearance and certain heart disease, cancerous and muscular degeneration resistance [12, 13]. In Pakistan, diseases, as bacterial and viral diseases are very dangers for over the country and responsible for economic losses [14]. It is annual cool season crops, which need most favourable temperature ranging from 16°C - 20°C for the excellent growth of tubers [15]. Many potato genotypes cannot build-up their tuber at what time the temperature of the night is above 24°C [16]. Along with good general appearance and quality, varieties, therefore, must have at least a reasonable yield [17]. In the market, consumers select potatoes by visual observation such as shape, colour and skin

brightness [18]. But fresh processing potatoes are available only for short period of time in plain areas of Pakistan. This limiting factor can be eliminated if suitable potato varieties are identified for spring seasons.

The processing industry is getting important and booming day by day in Pakistan, which needs continuous supply of fresh potatoes of appropriate varieties throughout the year. Therefore this experiment was done to find out suitable genotypes for processing purposes industry as well as to improve the farmer's income by introducing new genotypes for fresh market and processing in Pakistan.

## MATERIALS AND METHODS

**Experimental site:** The experiment was conducted during 2015-2016 crop season at the Department of Horticulture Research Farm, National Agricultural Research Centre (NARC) Islamabad, Pakistan.

**Soil preparation:** Deep rotavator was done in the off-season and then levelling the field. Subsequently levelling the trial fields was irrigated as soaking dosage. After that again deep rotavator was done and Overall 60 ridges were ready for the sowing of tubers.

**Planting materials:** The planting materials were also collected from Potato Development Program, (NARC), and Seeds of the ten potato genotypes 2008-A, NARC 2008-B, NARC 2008-C, NARC 2008-D, NARC 2008-E, NARC 2008-F, NARC 2008-G, NARC 2008-H, NARC 2008-I, Desiree were planted in plastic tunnel during the experiment.

**Sowing and cultural practices:** 40-45g of all tubers of genotypes were sown in the plastic tunnel during the autumn period in the 1<sup>st</sup> week of October 2015. Overall 60 ridges were ready for planting. Row to row and plant to plant distance were kept 65cm and 20cm. Each plot size 3.6m<sup>2</sup>. The nitrogen was useful in the formula of NH<sub>2</sub>, phosphate provided in the procedure of (DAP) Di-Ammonium phosphate and potash was applied in the form of sulphate of potash (SOP). When the field was ready, the full amount of "P" and "K" with 1/3<sup>rd</sup> of N was functional at the starting of sowing; while the residual nitrogen was applied in 2 equal splits after 40 and 55 days subsequently spreading of tubers.

All the traditional cultural practices such as irrigation, weeding, hoeing and rouging were applied. Weeding and hoeing were done continuously during the whole growth season of the crop.

**Experimental design:** The design to be used in the experiment was randomized complete block design (RCBD) having ten treatments with three replications. During the experiment, ten genotypes NARC 2008-A, NARC 2008-B, NARC 2008-C, NARC 2008-D, NARC 2008-E, NARC 2008-F, NARC 2008-G, NARC 2008-H, NARC 2008-I, Desiree were planted in the tunnel.

**Collection of Seed:** The seed of all the genotypes were collected from Department of Horticulture Research and Development (DHRD), Potato Program, (NARC) Islamabad. Pakistan.

**Growth and Yield Data collection:** Growth data were collected after harvested such as Emergence (%), Number of stems plot<sup>-1</sup>, Number of small tubers, Weight of small tubers (kg), Number of medium tubers, Weight of medium tubers plot<sup>-1</sup>, Number of big tubers, Weight of big tubers (kg), Yield tones ha<sup>-1</sup>, Marketable yield %, Disease incidence (%).

**PHYSICO-CHEMICAL COMPOSITION:** while Potato hydrometer was used for measuring the specific gravity and percentage dry matter of potatoes (Gould 1999). This Provide an accurate data and simple to use for measuring the solid content or percentage dry matter of potatoes thus indicating their suitability for converting into crisps etc.

**Statistical analysis:** The experiment was laid out according to Randomized Complete Block Design (RCBD) and the statistical analysis were done by subjecting the replication-wise data of each parameter to Analysis of Variance (ANOVA) and differences among ten treatments means (genotypes) were compared by using Least Significant Difference (LSD) Test at 5% probability level [[19].

## RESULTS AND DISCUSSION

The percentage of tuber emergence (Table1) showed a significant increase in genotypes NARC 2008-E followed by NARC 2008. While the lowest seedling emergence was recorded in NARC 2008-I genotype, While the rest of potato genotypes were statistically at par one another.

The highest number of stem per plot was produced at NARC 2008-D and "NARC 2008-A" genotypes. Whereas a minimum number of stem per plot was recorded at NARC 2008-B genotype. [20] The variation of plant length and stem internodes in different cultivars of potato may be genetically differences. However, no significant differences were observed in the remaining genotypes.

A number of small tubers plot<sup>-1</sup> showed a significant increase at NARC 2008-D and NARC 2008-A genotypes. The number of potato tubers depends on different Cultivars [21]. While the minimum number of small tubers plot<sup>-1</sup> were produced at

Desiree genotypes. [22] Investigated that when potato plant produced maximum stems then potato tuber will be small in size.

Whereas no significant differences were observed among NARC 2008-B, NARC 2008-C, NARC 2008-E, NARC 2008-F, NARC 2008-G, NARC 2008-H, NARC 2008-I genotypes.

The maximum Weight of medium tubers plot<sup>-1</sup> was recorded in NARC 2008-H potato genotype. [23] Studied the number of potato tubers is effected by stolon's number, number of stems per plot. The minimum Weight of medium tubers plot<sup>-1</sup> was produces in NARC 2008-I genotypes. [24] Determined that, potato gives a better yield when the average day and night temperature is 26 °C. No significant differences were found at the rest of potato genotypes.

The highest No of big tubers plot<sup>-1</sup> was obtained from NARC 2008-E followed by NARC 2008-H. [25] Reported that weight of tubers and number of tubers plant<sup>-1</sup> are a positive relationship with each other. However, the lowest no of big tubers plot<sup>-1</sup> was recorded in NARC 2008-B, NARC 2008-I. the remaining all genotypes at par one another.

The maximum weight of big tubers plot<sup>-1</sup> was recorded with NARC 2008-E, NARC 2008-H potato genotypes. [26] Investigated that large size of potato tubers depends on growth attributes. The rest of all genotypes showed an irrelevant decreasing trend in the (table1).

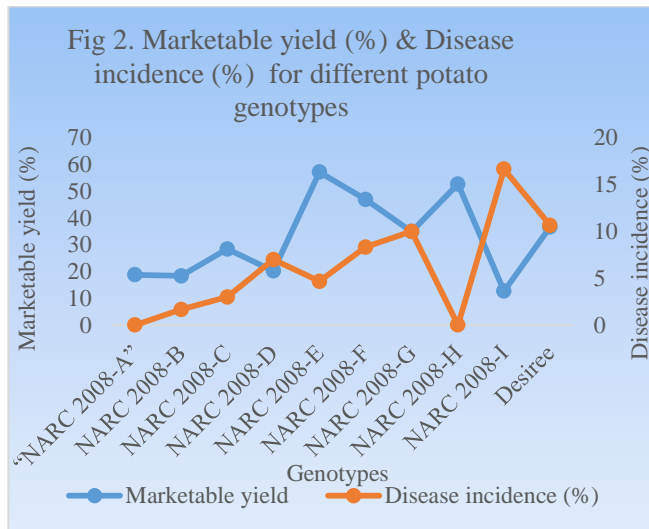
The tuber yield tones ha<sup>-1</sup> was significantly higher in NARC 2008-H, followed by NARC 2008-E genotype. [27] Studied the Cardinal and Diamont cultivars given 28.80 and 27.3 yield tonnes ha<sup>-1</sup>. Whereas the minimum tubers yield ha<sup>-1</sup> (6.26 tonnes) was found in potato genotype NARC 2008-I. no significant differences were found in the rest of genotypes.

[28] Reported that tuber weight, as well as tubers number, is directly affected the potato production.

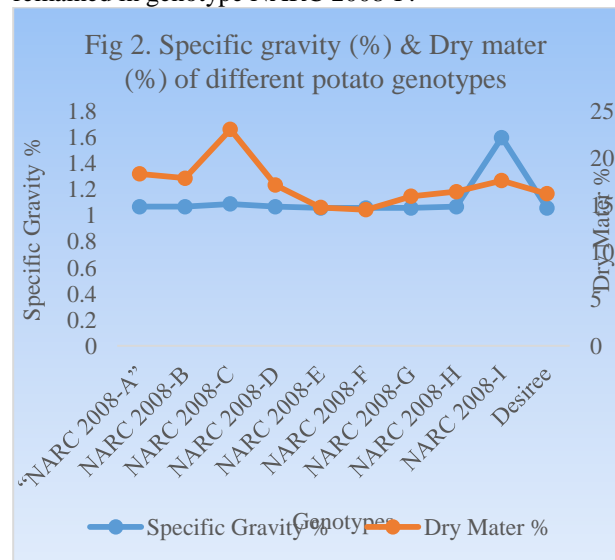
The Marketable yield (%) and Disease incidence (%) presented are in (Fig 1). the maximum marketable yield percentage was noted in potato genotypes 'NARC 2008-E, NARC 2008-H, NARC 2008-F. [29] Concluded during the experimental trail that MS/92-1090 genotypes are given maximum marketable yield. Whereas the lowest marketable yield was recorded in potato genotypes NARC 2008-I.

The maximum disease incidence was found in potato genotype NARC 2008-I. while the lowest disease incidence was occurred in "NARC 2008-A", NARC 2008-H genotypes. [30] The maximum rotten (33.61 %) was reported in Desiree CVs, whereas (3.62 %) was recorded in Kruda Cultivar.

Specific Gravity, Dry matter content is presented in ((Fig 2). Means values of Specific Gravity remained statistically significant. SG showed a significant increase in NARC 2008-C. [31] investigated that specific gravity is a sign of the amount of dry mater in potato tubers. While the minimum specific gravity was recorded (1.061). The rest of the SG values were statistically at par with one another. The Specific Gravity (SG) estimation play vital to consider the quality of different potato cultivars during in the storage, which is correlated with the starch and dry matter [32].



90-217, and 9625, which are bitter for processing product. Whereas the lowest dry matter content percentage (14.53 %) remained in genotype NARC 2008-F.



Dry matter content showed a significant increase in NARC 2008-C potato genotypes. i.e. [33] Investigated the DM content up to 24-26 % in La Molina Cultivars.

[34] studied the DM over 20 % in various Genotypes i.e., 394021-120, NARC 1-2006/1, 393574-61, NARC 2002-1VR

Table1. Vegetative Growth and Yield Components.

Genotypes	Seedling emergence (%)	Number of stems plot <sup>1</sup>	Number of small tubers	Number of medium tubers	Weight of medium tubers plot <sup>-1</sup>	Number of big tubers	Weight of big tubers (kg)	Yield tones ha <sup>-1</sup>
"NARC 2008-A"	86.00 bcd	118.33 a	118.33 ab	103.33 ab	5.37 a	2.33 c	0.37 c	19.90ab
NARC 2008-B	81.66 cd	61.00 e	80.67 abc	68.33 cd	3.23 c	2.00 c	0.33 c	12.93c
NARC 2008-C	91.33 ab	107.7 abc	76.67 bc	125.33 a	5.83 a	4.66 c	0.60 c	20.70 a
NARC 2008-D	96.00 a	124.00 a	120.00 a	114.67ab	5.56 a	3.00 c	0.40 c	20.96 a
NARC 2008-E	97.00 a	110.33 ab	105.00 ab	85.67 bcd	5.20 ab	13.33 a	2.30 a	24.63 a
NARC 2008-F	92.66 ab	89.00 bcd	53.00 cd	88.00 bcd	5.67 a	10.66 ab	1.76 ab	22.33 a
NARC 2008-G	89.00 abc	83.33 cde	87.67 abc	86.00 bcd	5.16 ab	6.33 bc	0.90 c	19.90
NARC 2008-H	92.33 ab	109.67 ab	78.33 abc	98.67 abc	6.13 a	12.33 a	1.93 a	25.23 a
NARC 2008-I	78.00 d	70.67 de	105.67 ab	25.00 e	0.90 d	2.00 c	0.20 c	6.26
Desiree	80.00 cd	66.00 de	28.33 d	56.67 de	3.80 bc	5.66 bc	0.96 bc	14.33

**CONCLUSIONS AND RECOMMENDATIONS**

It was concluded from the present research work that NARC 2008-E produced significant yield and showed its dominance over rest of the all genotypes with lowest disease incidence. While "NARC 2008-C" proved to be ideal for processing due to its high dry matter (23.100%). Genotype "NARC 2008-E" is recommended for cultivation due to its high yielding and disease resistant. While "NARC 2008-C" is recommended for processing due to containing maximum dry matter content.

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