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Research Article

Punjab Tar-1: A New Short Duration, High Yielding and Disease Resistance Long Melon Variety (*Cucumis melo*) Released in Pakistan.

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ABSTRACT

The development of new crop varieties with favorable features is a continuing effort. With the passage of time, a cultivated variety becomes subjected to various biotic and abiotic plant stresses. This article describes development of an innovative and imaginative long melon cultivar called "Punjab Tar-1."This article discusses creation of a novel and inventive long melon variety known as "Punjab Tar-1." Current long melon varieties in Pakistan are sensitive to climatic conditions and susceptible to pest and disease attack. A New Short Duration, High Yielding and Disease Resistance Long Melon Variety (*Cucumis melo*) is released in Pakistan to address these current issues of long melon varieties A high yielding and early maturing variety of long melon "Punjab Tar-1" has been developed by Vegetable Research Institute, Faisalabad, Pakistan through mass selection. Plants were selected from an open pollinated indigenous source population with main emphasis on earliness, fruit shape, color and taste and yield. Selection intensity was 15% in 1st three selection cycles and 30% in subsequent four selection cycles whereas yield trials were started from 8th selection cycle. The fruit of this variety has a strong longitudinal rib that makes it difficult for eating by caterpillars. This variety has wide adaptability and exhibits stable yield across multiple environments. Notably, "Punjab Tar-1" contains 10.59 % crude protein and 1.08% crude fat content. Genetic uniformity and distinctiveness of this variety was confirmed through SSR polymorphism. Punjab Tar-1 variety has been approved by Punjab Seed Council in its meeting held on 2021 and was recommended for general cultivation in Punjab, Pakistan. Its certified seed is available for farmers at Vegetable Research Institute, Faisalabad. This newly approved variety will aid to save the precious foreign reserves by reducing vegetable seed import bill. In Pakistan, seed market of long melon is occupied by improved varieties. In multi-location evaluation, one said variety has exhibited high yield and stability than exotic germplasm. This is the first variety developed in Pakistan having good taste, early maturity, long shape, and high yield potential. DNA fingerprinting has further confirmed that it is distinct from local material, having novelty and diversity.

Keywords: *Cucumis melo* L., long melon, mass selection, DNA fingerprinting, genotype × environment

INTRODUCTION

Cucumis melo L. is a polymorphous species with diverse fruit morphology [25, 45]. The species is further divided into two sub-species. *C. melo* L. subsp. *argestis* and subsp. *melo* [33]. Both are differentiated by pubescence on the female hypanthium [24]. Both sub species has 5 and 10 group or varieties respectively and *flexuosus* belongs to ssp. *melo* [13].

Long melon (*Cucumis melo* subsp. *melo* L. var. *flexuosus*) is a traditional crop grown in many parts of the world especially in Middle East, Middle Asia [42] and Mediterranean region. [30]. It is known as long melon, *Kakri* and *Tar* in Pakistan and India, famous in North Africa, *hiti* in turkey and *alficoz* in Spain. [16]. It is also known as Chinese, oriental, serpent cucumber or snake melon [40, 46]. It got the name "Snake melon" due to its long, curved and twisted fruit shape. [47]. Although long melon is a neglected crop, it is still a commodity grown in many regions of the world. [14]. Long melon is cultivated in tropical and

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subtropical summer conditions. [5, 33]. Cultivars of long melon vary in immature fruit color from light to dark green [32] and longitudinal ribs along the length of fruit from very shallow to very deep. The preference of sweet melon as fruit and cucumber as vegetable has reduced the consumption of *flexuosus* type melon [8]. Unlike other melons it's a non-sweet and non-aromatic fruit, harvested immature/unripe to consume as fresh vegetable or pickled. [31, 41]. However, there is a global interest in the revival of this vegetable. Many studies have been conducted on the organic farming of snake melon [14, 34, 39], its health benefits [25] and its genetic diversity [3].

Long melon varieties in Pakistan are low yielding, susceptible to disease and pest attack. Punjab Tar-1 is early maturing, high yielding, good nutritional value, disease and pest resistant. Mass selection is one of the oldest plant breeding methods and 10,000 years ago, it was used to gradually change weed grasses into cereal crops. Today, mass selection is used to develop improved cultivars, most effective in variable populations of cross-pollinated plants [46]. Improving such populations require effective screening for desirable character, inter-mating methods for selected plants and recurrent cycle to increase the gene frequency of desirable trait.

In Pakistan, long melon was cultivated on an area of 494 hectares which produced 2996 tons with an average yield of 6.6 tons/ha While in Punjab, long melon was cultivated on 282 hectares with a total production of 2245 tons during 2021-22 [15]. It is cultivated from February to March and harvested from May to June in the plains of the Punjab. The seed market of long melon in Pakistan is dominated by imported cultivars which are not well adapted to Pakistan's agro-climatic conditions. Local material of long melon is threatened by severe genetic erosion due to replacement of this material by imported varieties and poor maintenance by farmers [1]. Hence to meet the local demand of long melon seed and ensure its profitability and acceptability among farming community, a variety considering consumer preference along with desirable traits for plant breeders has been developed through mass selection from locally developed source population. Mass selection breeding method was used as it is cross pollinated in nature and broad sense heritability values for the traits like fruit yield, fruit length and number of fruits per plant are high in long melon [2]. Hence, these traits are least effected by environment so phenotypic selection would be useful. Moreover, previous studies have reported positive correlation between fruit length and stem length; fruit thickness with fruit length and fruit color with stem pubescence [47]. Based upon these findings, it was hypothesized that selection for desirable characters in randomly pollinated indigenous population of long melon would be highly effective.

SSR markers have been widely used for genetic fingerprinting of long melon cultivars [41] because of their simplicity, reproducibility and accessibility. Moreover, the SSR polymorphism is in sensitive to extraneous factors and highly genotype specific [28].

MATERIALS AND METHODS

Site of Experiment

The Vegetable Research Institute in Faisalabad, along with other locations (Vegetable Research sub-station, Sahiwal and Vegetable Research sub-station, Bahawalpur) in Pakistan's long melon growing regions, serves as the site for all experiments. Faisalabad is situated in the undulating plains of northeast Punjab, at an elevation of 186 meters above sea level, and lies at a latitude of 31° 02' 00" north and a longitude of 73° 00' 45" east. The city experiences a semi-arid climate, characterized by high evapotranspiration. The average annual rainfall is 13.417 mm, with winter temperatures ranging from 21°C to 28°C and summer temperatures ranging from 30°C to 45°C. The average humidity in Faisalabad is 35.17 g.m-3." February to June average temperature is 1 degree higher than Sahiwal i.e. 76°F, 82°F, 89°F, 96°F and 97°F. The average high temperature in Sheikhupura in month of February, March, April, May and June is 73°F, 77°F, 84°F, 91°F and 92°F respectively, which is lower than both Sahiwal and Bahawalpur.

Soil structure and texture

The soil texture of the field was sandy loam. Bulk Density of the field 1.26 (g/cm^3). Field area previously cultivated with different vegetables. Soil pH is 8.4 having organic matter 0.28 %. Soil and Water testing has been done by soil and water testing laboratory of Agriculture department. Govt. of Punjab. Soil and water sample from farm area were collected and conductivity was measure. Homogenized soil sample was dried at room temperature. Method described by [35] was used to measure soil conductivity. Water conductivity was measured in collected sample using electrical conductivity meter. Soil EC is 0.83 mScm^{-1} and Water EC is 11.29 uScm^{-1}.

Developmental history

Source population: A randomly pollinated population of long melon being cultivated indigenously by Punjab growers was used as source population for selection. This population has been cultivated conventionally by local farmers in this region for decades and achieved the status of landrace, it is characterized by some degree of natural resistance to biotic / abiotic stresses, stable but low yield and natural variation in maturity time.

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Population Size

The parent population in each selection cycle consisted of 3000 plants. During 1st three selection cycles, 15% plants of original population were retained after three tier selection pressure and bulked for next generation. Whereas, in subsequent four generations, selection pressure was reduced to 30% of parent population. After each selection, the rejected plants were roughed out of field to maximize genetic advance.

Selection Criteria

Mass Selection was based on the assumption that high variability could be exploited because long melon is highly cross-pollinated crop and quality fruits production is possible under high selection pressure. The selection criteria were based upon five prime parameters i.e., earliness, fruit shape, color, taste and yield.

Selection method

Three tier selection process was adopted to select most desirable plants in each selection cycle. Primary selection was done at appearance of 1st female flower. At this stage, 40-50% earliest female flower bearing plants were selected. Secondary selection for earliness, fruit shape and taste were based upon 1st harvest weight per plant which constituted almost 50% of primary selected plants. The third and final selection was based upon total fruit yield per plant. At this stage, 15% of original population plants having highest total fruit yield were retained for next generation.

Evaluation phase

After 6th selection cycle, the newly developed improved population was put in varietal evaluation process in 2016-17. The commercially grown imported cultivar "MSC-2216" was used as standard in yield trials. This process consisted of two years, i.e., preliminary yield trial and secondary yield trial. The seed samples were also sent to Agronomic Research Institute, Faisalabad, Entomological Research Institute, Faisalabad and Plant Protection Research Institute, Faisalabad for production technology standardization and insect pests' response studies. During 2018 and 2019, the seed samples of new approved population was sent to four different locations i.e., Vegetable Research Sub Station Sahiwal, Vegetable Research Station Sheikhupura, Vegetable Research Station Bahawalpur and Vegetable Research Institute, Faisalabad for multi-locational yield trials. In each of these yield evaluation trials, plot size was kept 32 m^2. Standard agronomic practices were followed in each yield evaluation trial. At same time, the case for registration and DUS (Distinctiveness, Uniformity and Stability) of this new population was submitted to Federal Seed Certification & Registration Department with name "Punjab Tar-1". The spot examination of "Punjab Tar-1" was conducted during 2021 by experts' panels of Punjab Seed Council and case was submitted to Punjab Seed Council for its approval.

Experiment for DNA Fingerprinting

The present research work regarding DNA fingerprinting of long melon variety Punjab Tar-1 was carried out in DNA fingerprinting lab of Agricultural Biotechnology Research Institute (ABRI), Faisalabad Pakistan. The objective of the DNA fingerprinting was to develop DNA profile of Punjab Tar-1 and its comparison to locally grown long melon variety commonly used as (MSC-2216) Tar-local so that genetic variation may be maintained among registered variety. Seeds of both the varieties were sown in green house at 28°C following standard agriculture practices. Five different pots were planted for each genotype (02 seeds per genotype). Five seedlings from each genotype at 4-5 leaf stage were collected for DNA extraction and stored at -40°C. Genomic DNA was isolated using modified CTAB method as described by [18, 19]. This procedure is comprised on four key steps i.e., 1) cell lysis in CTAB solution 2) phase separation and protein denaturation using chloroform: isoamyl alcohol (24:1) and centrifugation 3) Nucleic acid precipitation using 2-propanol and centrifugation 4) RNAs treatment to obtain RNA free DNA pellets. The quality and quantity of the DNA was checked using Nanodrop spectrophotometer (ND 2000, cleaver scientific Pvt. Ltd.). DNA possessing A_{260}/A_{280} 1.8-2.0 was considered of good quality. For further verification of quality, DNA was run on 0.8% agarose gel. Good quality DNA was used for preparation of 20 ng/µl dilutions which were to be used in polymerase chain reaction (PCR) [36].

To obtain a well representative picture of long melon genome, a total of 74 SSR markers [18] evenly distributed across the genome were selected for DNA fingerprinting. The polymerase chain reaction (PCR) was assembled using 2X Green PCR master mix using already described procedure of [23]. Different cycling conditions used in thermal cycler were as follows i.e., initial denaturation at 94°C for 10 min; followed by 35 cycles of denaturation at 94°C for 1 min, annealing for 1 minute at 55°C for each primer, polymerization at 72°C for 1 min, finally, an elongation at 72°C for 7 min [19]. Afterwards, PCR products were run on Polyacrylamide Gel Electrophoresis (PAGE) for product visualization and scoring of the binary data using already described protocol [20, 22]. The binary data obtained after scoring was subjected to statistical analysis to estimate Polymorphic Information Content (PIC) to estimate the usefulness of different SSR markers. Moreover, genetic similarity coefficient was calculated using cluster analysis in NTSYS pc program version 2.0. Jaccard similarity coefficients

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following unweighted pair group method with arithmetic mean (UPGMA) and SAHN clustering [40] were used to construct dendrogram.

Statistical Analysis

Data recorded from yield trials was subjected to Analysis of Variance [43] in split plot design using Agricolae® Package in R software. Microsoft Excel® was used for graphical illustration of data.

RESULTS AND DISCUSSION

Dendrogram of two long melon genotypes constructed based on Jaccords similarity coefficients following Unweighted Pair Group Method of Arithmetic Means (UPGMA) and SAHN clustering

"Punjab Tar-1" gave consistently higher yield in preliminary, secondary and multi-locational yield trials than check variety "MSC-2216". In preliminary and secondary yield trials, "Punjab Tar-1" has higher yield than check variety, but these differences were not significant. However, significant genotype × environment interaction was recorded in pooled analysis of variance of both preliminary and secondary yield trials. The yield of "Punjab Tar-1" in preliminary yield trial was significantly higher than yield of check variety in secondary yield trial. Moreover, genotype × environment interaction effects were non-significant on yield of long melon. Likewise, the yield performance of "Punjab Tar-1" was stable in both preliminary and secondary yield trials. These results not only confirmed the genetic superiority of "Punjab Tar-1" over check variety but also depicted its yield stability across the years (Figure 1). In vegetables breeding, nutritional profile of variety is given prime importance. Hence, nutritional evaluation of a vegetable variety is pre-requisite for its approval and acceptability among farmers and end consumers. Biochemical analysis of "Punjab Tar-1" revealed that it has high moisture contents (84%) which make it highly palatable for raw consumption as salad. Moreover, it has 3.5% crude fiber, 1% crude fat and 10% crude protein, making it economical alternate of cucumber as low caloric food (Fig 3). Crude protein was calculated by Kjeldahl method [10]. Crude fiber by gravimetric procedure. Ash content and moisture was determined according to [9]

Average yield performance of "Punjab Tar-1" along with check variety "MSSC-2216" in Preliminary (2017) and Secondary (2018) Yield Trials at Vegetable Research Institute, Faisalabad. Mean values with different alphabets or asterisk are significantly different from each other at 5% significance level.

Table-1. Performance of Punjab Tar-1 and Check Variety in Stations yield trials

Year	**Name of trial**	**Yield (t/ha)**		
		Check	**PUNJAB TAR-1**	**+/- Over checks (%)**
2017	Preliminary yield trial VRI, Faisalabad	8.30	13.50	38.52
2017	Preliminary yield trial Vegetable sub-station, Sahiwal	9.60	15.74	39
2018	Secondary yield trial Vegetable Station Bahawalpur	7.56	14.71	48.00
2018	Secondary yield trial VRI, Faisalabad	11.01	14.02	21.46
2018	Secondary yield trial Vegetable sub-station, Sahiwal	10.00	12.05	17.01

Significant differences were recorded in location effects on yield of long melon in both multi-locational yield trials. The genotype × location interaction was significant in multi-locational yield trials for both years. During 2019, the highest fruit yield for "Punjab Tar-1" was recorded at Sahiwal followed by Sheikhupura, Bahawalpur and Faisalabad respectively. However, at each location, the yield of "Punjab Tar-1" was recorded significantly higher than the check variety "MSC-2216 (Figure 5). In 2020, same yield trend was recorded for "Punjab Tar-1". The significant effects of genotype × environment interaction suggested relative suitability of different genotypes for different environments (Figure 6). Higher yield recorded for 'Punjab Tar-1" at all locations in both multi-locational yield trials confirmed its wide adaptability and potential to give consistent yield under varying agro-climatic conditions. Moreover, these results also confirmed its broad genetic base making it more climate-resilient which is considered an important parameter for any new variety in today's time.

Table-2. Performance of Punjab Tar-1 and Check Variety in multilocation yield trials

Yield (t/ha)				
Year	**Locations**	**Check**	**PUNJAB TAR-1**	**+/- Over Check (%)**
2019	VRI, Faisalabad	10.75	13.03	17.45
	Vegetable Sub Station Sahiwal	12.30	22.60	45.57
	Vegetable Sub Station Sheikhupura	7.61	16.45	53.74
	Vegetable Sub Station Bahawalpur	10.30	15.69	34.35
2019 Coefficient of variation= 19.01% Genotypes(G), Location(L) & GxL interaction are highly significant (P<0.01)				
2020	VRI, Faisalabad	10.00	12.05	17.01
	Vegetable Sub Station Sahiwal	11.71	21.07	44.42
	Vegetable Sub Station Sheikhupura	13.70	18.65	26.54
	Vegetable Sub Station Bahawalpur	12.56	16.36	23.22
2020 Coefficient of variation= 28.09 % Genotypes(G), Location(L) & GxL interaction are highly significant (P<0.01)				

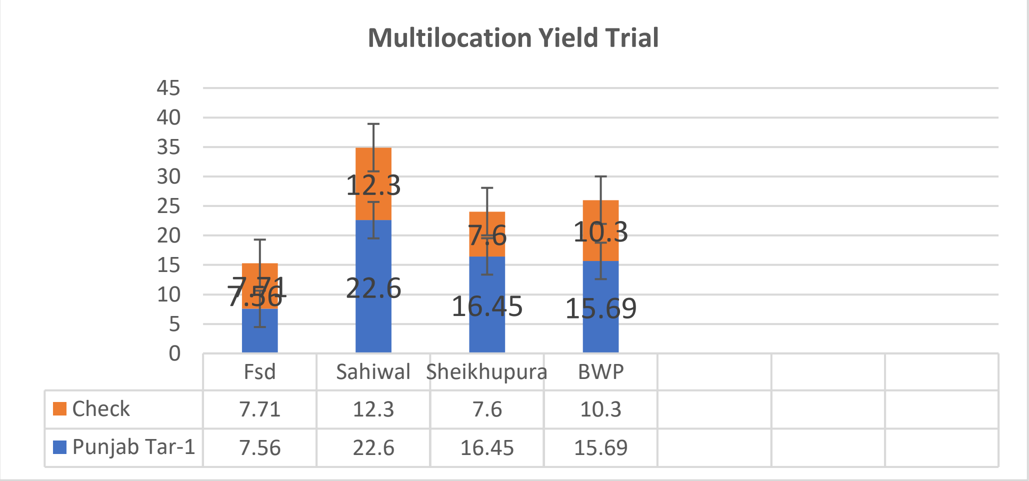

Figure 1. Yield performance of Punjab Tar-1 in comparison with check at different locations of Punjab.

Initially PCR were assembled for all seventy-five (75) SSR markers however, only 48 of these were amplified. Twenty-four of these markers i.e., CM-9, CMBR-104, CMBR-111, CMBR-123, CMBR-140, CMBR-15, CMBR-16, CMCT-134, CMCT-160, CMCT-44, CMCTN-7, CMGA-172, CMGAN-3, CMGT-108, CMMS-004, CMMS1-3, CMMS2-2, CMMS27-1, CMMS30-3, CMMS31-3, CMMS34-10, CMMS35-4, CMTA-170 and TJ-24 were monomorphic for the two varieties i.e., Punjab-Tar-1 and Tar local (MSC-2216). The total numbers of alleles amplified by 48 markers were one hundred fifty-two (152) out of which fifty-nine (59) were polymorphic. On an average 3.2 alleles per locus were amplified which were relatively lower than previous results [15] due to lower number of genotypes in our study. Highest number of alleles i.e., eight (08) and polymorphic alleles seven (07) were amplified by CMCT-144. Polymorphic information content of the markers was also calculated to study the effectiveness of SSR markers which ranged from 0.0 to 0.87. Cluster analysis was carried out to draw dendrogram based similarity/dissimilarity coefficient using UPGMA algorithm which showed 58% the genetic similarity and 48% genetic distances between these two varieties based on these markers data. This dissimilarity %ages show that PunjabTar-1 is distinct variety from Tar-local (MSC-2216) and have diverse genetic background.

Snake cucumber plants have an outcrossing habit, so in this case landraces and local cultivars are populations of random mating individuals [44]. Mass selection has been a method of cultivar development in underdeveloped countries. A high yielding and early maturing pea variety was developed through mass selection. Pea is highly self-pollinated crop. Homogenous and homozygous progenies were bulked for preliminary yield trial. [12]. Radish is a cross-pollinated crop. Mass selection has been used to develop Hisar selection-1 [11]. In maize, modified mass selection method has been used to improve yield of synthetic variety [7]. Mass selection method has been applied in long melon to develop high yielding variety. Which is the first one to develop locally here in Pakistan. India has developed some varieties including Punjab longmelon-1. It was released in 1995. It is an early maturing variety with thin and long fruits. Another variety akra sheetal gets 90-110 days to mature [27]. Fruit length of Punjab Tar-1 is 25-29 cm. Fruit width is 18-20 cm. Usually fruit length of long melon genotypes can be 50 cm long. [4].

Four types of snake melon in the region of turkey, have different fruit length i.e., round (14.5 cm), light furrowed (46 cm), hairy (22 cm) and furrowed (52 cm) [8]. Punjab Tar-1 has fruit length 25cm and furrowed fruit surface [29].

A total of 31 QTLs have been identified and their study further suggested that fruit morphology can be manipulated without affecting fruit sweetness significantly [35]. Long melon has been cultivated in India [38]. In Pakistan, it has been cultivated in Faisalabad (103 acre), Sahiwal (112 acre) and Multan (120 acre). Highest production areas are Sahiwal (267 tons), Khanewal (300 tons) and RYK (358 tons). Narowal has highest average yield kg/ha i.e., 9500. Sheikhupura has second highest average yield in all over Punjab i.e., 9250 kg/ha. [23].

Long melon seed has 16.19% carbohydrate, 15.57% protein and 5.69% ash. Seed is composed of 22.33 % oil. [26]. In our cultivar, analysis showed similar result. High water content is desirable and low fat is also similar with the previous studies [37].

DUS evaluation was carried by FSC & RD, which involves two years trails. Candidate variety was evaluated by spot examination committee on 22-04-2021. On the recommendation line was further submitted to expert sub-committee. They approved it for general cultivation and forwarded for its approval in Punjab Seed Council. Punjab Seed Council approved it for cultivation in Punjab.

In the recent past varieties has been distinguished from each other based on DUS testing which rely on characterization of distinct morphological, phenological and physiological traits [44,]. Although this method has been used for a long time and proved effective for testing of distinctiveness, uniformity and stability of the genotypes since long but these traits are influenced by environment and may give birth to misleading output [17]. Therefore, it is now replaced with more accurate and genetic material-based DNA fingerprinting of crops which help to characterize the small difference among the varieties and also not affected by the environmental factors. [35]. Different DNA markers i.e., RFLPs, RAPD, AFLPs, SCARs, SNPs and simple sequence repeat (SSR) markers are available for DNA fingerprinting of crops but among these SSR markers are most reproducible, cost effective and user friendly [21]. Therefore, keeping in view of significance of SSR markers, the present study was based on seventy-five (75) markers to characterize the genetic difference among the locally marketed long melon variety with candidate variety Punjab-Tar-1. Different genetic diversity parameters i.e., alleles per locus (3.2), maximum number of alleles (08), maximum polymorphic alleles (07) were higher in our studies as compared to previously reported results [15]. Both varieties showed genetic difference at 48% of amplified loci which provide sufficient evidence to register Punjab-Tar-1 as a new variety [22].

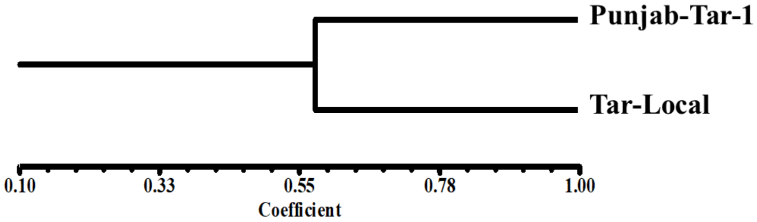

Figure-2. Dendrogram of two long melon genotypes constructed based on Jaccords similarity coefficients following Unweighted Pair Group Method of Arithmetic Means (UPGMA) and SAHN clustering

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The nutritional value of the candidate variety and check variety was studied by the soil biochemistry section at Ayub Agricultural Research Institute, Faisalabad and the provided results are presented in Figure 3 and Fig 4, respectively.

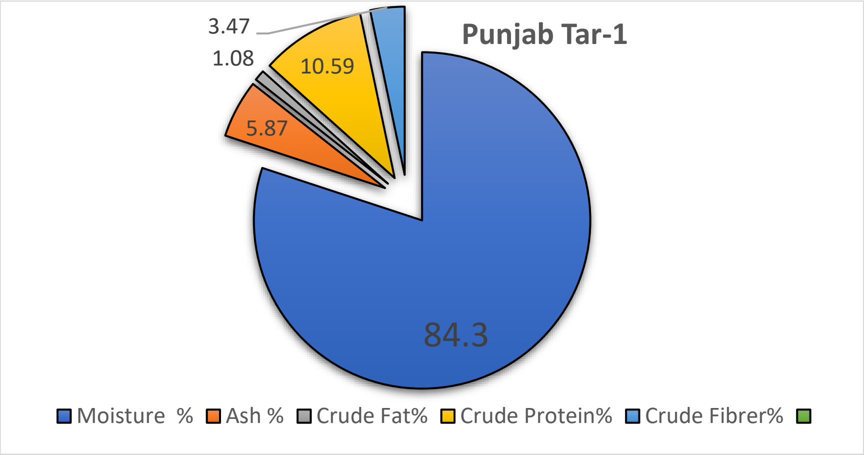

Figure 3. Nutritional profile of Punjab Tar-1

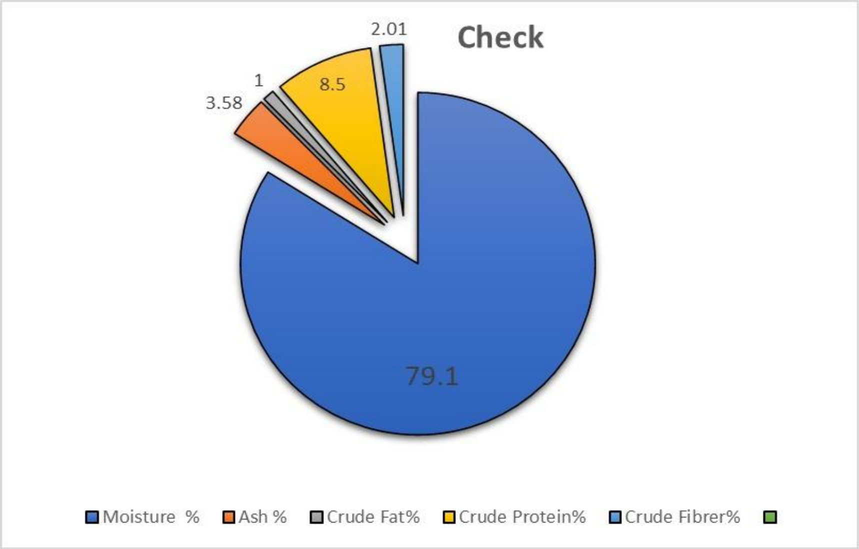

Figure 4. Nutritional profile of Check (MSC-2216)

Vegetables are more sensitive to insect pests and disease and resistance to biotic stresses, and it is an important breeding objective of any vegetable breeding program. During variety development process of “Punjab Tar-1”, selection of disease-free plants was an integral component of selection criteria. After completion of developmental phase, the newly developed population was tested for susceptibility to various insect pests and diseases. No serious pathological disease was recorded on this advanced population. Some symptoms of alternaria leaf spot were observed but no economic losses were recorded due to disease. Likewise, no serious insect pest attack was observed on “Punjab Tar-1”. Only 1.52 % lepidopterous pest was recorded during the growing season with no significant economic losses.

Morphological and yield parameters of “Punjab Tar 1” and check variety “MSC-2216”

Characteristics	**Punjab Tar-1**	**MSC-2216(check)**
Sowing Time	February-March	February-March

Maturity days (Fruit)	58	74
Maturity Time (Fruit)	Early	Medium-late
Av. Plant length	176 cm	158 cm
Av. Nodes per plant	7	5
Fruit Skin Color	Light Green	Green
Fruit Surface	Rough/ un-even longitudinal ribs	Smooth
Fruit length	25-29 cm	18-20 cm
Fruit Diameter	3.0 cm	2.5 cm
Fruit Flesh Color	Greenish White	Greenish White
Fruit Shape	Long	Long
Fruit Weight	0.180 gm	0.155
Fruit Taste	Lemon sweet	Sweet
Average Fruit Yield	7000-8000 Kg/acre	4500-5500 Kg/Acre
Yield Potential	9150 Kg/acre	5580 Kg/acre
Seed Yield Kg/acre	60-80 Kg/acre	30-40 Kg/acre

Botanical Description of Punjab Tar-1 in comparison to Check

Punjab Tar-1 is Long Green Fruits, early fruit development, Lemon Sweet Taste, heat tolerant, resistant to different types of Insect pests and diseases. Well-adapted to Irrigated areas of Punjab. Whereas the check variety is Medium Green Fruits, late fruit development, Sweet Taste, susceptible to heat, different types of Insect pest and diseases. Disease resistance evaluation of Punjab Tar-1 was done by Plant Pathology Research Institute, Faisalabad. There was no serious pathological disease recorded. Some minor leaf infections were observed due to Alternaria leaf spot disease. Insect pest resistance was evaluated by Entomological Research Institute, Faisalabad. There was no hazardous pest attack observed. Only 1.52% lepidopterous pest was recorded during growing season. At maturity level, the crop was healthy.

Production Technology

In Punjab Best time of sowing For Punjab Tar- is February and March. The ideal temperature for its growth is 25-35oC. Recommended seed rate for sowing is 1 kg/acre. Its recommended dose of Nitrogen in form of Urea, Phosphorous in the form of SSP and potash in the form of SOP, kg/acre is 90:35:100 respectively. Plant*plant distance should be 18cm on both sides of a bed of 8*4 m2. Plant population should be 12000 plants per acre.

CONCLUSION

Three tier selection pressure was proved very effective in developing early maturing long melon variety coupled with good yield and wide adaptability through mass selection. This newly approved variety “Punjab Tar-1” will help to increase its profitability and lead to revival of this neglected vegetable in Pakistan. The approved variety “Punjab Tar-1” is a short duration and high yielding long melon variety first commercial variety approved for general cultivation in Pakistan. It has moderate tolerance against diseases of long melon. It proved its significance in station yield trials and multilocation yield trials. It surpassed check varieties appreciably. It is expected that “Punjab Tar-1” owing to its attractive characters will attain recognition among the agricultural society. Its adoption in terms of seed multiplication, purification and promotion at farmer’s field will definitely add to stabilizing production. It is dropping ever-increasing vegetables import bill of Pakistan. The ideotype of “Punjab Tar-1”, it is perfect for promotion and cultivation in all areas of Punjab. It is suitable for early sowing as well. The Punjab Seed Council (PSC), Lahore Punjab approved this new variety “Punjab Tar-1” under label for commercial cultivation all over Punjab, Pakistan. It is really a blessing in disguise for long melon growers in Punjab Pakistan.

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Punjab Tar-1 is a result of continuous hectic and concerted efforts of the researcher's team of Vegetable Research Institute, Faisalabad. The facilitation and support supplied by Punjab Agriculture Department is appreciated to achieve this milestone in the form of Punjab Tar-1. The facilities and cooperation of Punjab agriculture research wing sector and scientists of its all-allied directorates (Agronomy, Plant Pathology & Entomology, Sheikhupura, Sahiwal & Bahawalpur and FSC&RD, is significantly respected in evaluating the strain and making it worth approval. Vegetable Research Institute, Faisalabad worked wholeheartedly for its planning, selection, screening, and evaluation process.

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