



CIMMY PAK: A high yielding short season white maize open pollinated variety

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Abstract

Breeding for maturity duration is of prime importance to adjust maximum number of crops in crop rotation per unit time. CIMMYT PAK, short duration white maize Open Pollinated Variety (OPV), was introduced in Pakistan through International Maize and Wheat Improvement Center (CIMMYT). The variety was successfully acclimatized and tested for its yield potential as well as maturity duration in Station and National Uniform Maize Yield Trials (NUMYT). It gave 5.9% higher yield than check variety in NUMYT. It matures in 85-90 days while maturity duration of the check variety is 110-115 days. A stable behavior was shown by the variety against stalk rot caused by *Fusarium moniliform* as it was found moderately resistant for both of the seasons. Agronomic investigations revealed that the variety should be planted on ridges with 30" row to row and 8" plant to plant distance to obtain maximum grain yield for both Spring and Kharif seasons. Incorporation of this variety in local see system will not only boost up the provision of certified seed but also will enhance the production of maize crop. Lodging resistance and stay green character in addition to short maturity make the variety highly acceptable to the farming community.

Keywords: introduction, acclimatization, early maturing, Hooker, *Zea mays*, quality

1. Introduction

World population is expanding day by day at ever increasing pace which has put an immense pressure on agriculture sector to fulfill the increasing demands of food. Various agricultural breakthroughs have been a way of tackling this alarming issue. Breeding of high yielding crop varieties is one of these strategies to enhance crop productivity per unit area. This immense pressure caused an increase in cropping intensity to get maximum number of crops from a specific area per unit time (Wu *et al.*, 2018) [7]. Subsequently breeding for changing the life cycle and maturity duration has also been way to adjust the various crops in various cropping patterns and crop rotations (Hussanun *et al.* 2014) [3]. Maize is multi-purpose crop used as food, feed and fodder in addition to its industrial uses. Nutritional value of maize grain is high because it has sufficient amount of protein (9.87%), fat (2.17-4.43), fiber (2.10- 26.70%) and carbohydrates (44.60- 69.60%) and minerals (1.10-2.95%) (Sule Enyisi, 2014) [6]. It plays vital role in food security in various regions of the world. In Pakistan it was grown on an area of 1.318 million hectares of ha and production of 6.309 million tons during 2018-19 (Anonymous 2018-19) [1]. Maize, a versatile crop in its growing habit, is grown all over the world due its higher productivity. In Pakistan maize has become a major field crop with an expanding area of its cultivation. It is grown in various agro-ecological zones of Pakistan ranging from coastal areas to high mountains. Every agro-ecological zone is characterized with its climatic, soil and water characteristics which need specific crop rotations. In potato growing districts of Punjab, there is need of short season that is, early maturing maize variety, which can fit into wheat, maize and potato crop rotation. Similarly in rain fed and hilly areas of the country, short duration maize variety is best suited. Therefore there is dire need for development of maize varieties and hybrids with early maturity and

higher yields (Hussain *et al.*, 2016). Keeping in view the aforementioned need, a short season variety of white maize was developed to facilitate the farming community. It is a high yielding variety with better plant anchor and lodging resistance. Seed of this variety will be provided to the farmers at very reasonable price.

2. Materials and Methods

Maize & Millets Research Institute (MMRI), Yusafwala-Sahiwal is main public research institute of the country working on development of maize OPVs and hybrids along with their production technology. The institute is collaborating partner of the International Maize and Wheat Improvement Center (CIMMYT) and is playing its role in development of maize crop in Pakistan. MMRI is located in maize core area of the country therefore is considered hotspot for screening of maize material against biotic and abiotic stresses. MMRI has been evaluating enormous CIMMYT maize germplasm against biotic and abiotic stresses for many years. The newly developed variety was selected from a number of entries introduced from CIMMYT as trial after a series of evaluations. This variety was allocated to the Institute in autumn 2015 by the CIMMYT through Material Transfer Agreement (MTA). The variety was acclimatized and made uniform through intensive rouging in local climatic conditions. After its successful acclimatization, it was tested in Station Trials against high yielding full season white maize OPV "Pearl". Then the candidate variety was evaluated in National Uniform Maize Yield Trials (NUMYT) where it performed better than the check variety. Best suited plant population and planting geometry for the variety were found out through intensive experimentation. In addition to agronomic trials, the variety was tested against stalk rot following artificial inoculation using the scale given by Hooker (1956) [2].

3. Results and Discussion

3.1 Station Trials

After successful introduction and acclimatization, station trials were conducted to evaluate the yield potential of CIMMYT PAK against the local check variety during

Kharif 2016 and spring 2017. The results presented in Table-1 revealed that 15.5% and 34.0% higher yield was given by CIMMYT PAK over the check respectively during Kharif 2016 and Spring 2017.

Table 1: Yield Performance in Micro Plot Maize OPVs Yield Trial

Year of Evaluation	Entries	Grain Yield (Kg/ha)	% Increase/decrease over the check
Kharif 2016	CIMMYT Pak	7842	15.5
	Pearl (check)	6788	
	CV	12	
	LSD	1364	
Spring 2017	CIMMYT Pak	7381	34.0
	Pearl (check)	5477	
	CV	12.7	
	LSD	2354	

3.2 National Uniform Maize Yield Trials (NUMYT)

The variety was evaluated at various agro-ecological zones in NUMYT during spring 2017 and spring 2018 coordinated by The National Coordinator (Maize, Sorghum, Fodder & Other Cereals), Pakistan Agricultural Research Council (PARC), Islamabad. The results (Table 2) revealed that

mean CIMMYT PAK showed higher average grain yield than the check variety over the locations. It gave 2.7% and 9.1% higher yield than check variety during spring 2017 and spring 2019. It implies that CIMMYT PAK will be helpful in increasing profit margins of the farmers due to its higher grain yield potential.

Table 2: Yield Performance in National Uniform Maize (OPVs) Yield Trial

Year of Evaluation	Entries	MMRI (Yusafwala)	AARI (Faisalabad)	NARC (Islamabad)	CCRI (Pirsabak, Noshehra)	Shergarh	Average (Kg/ha)	% Increase/decrease over the check
Spring 2017	CIMMYT Pak	8213	1754	3123	-	-	4363	2.7
	Pearl (check)	5867	2338	4535.3	-	-	4247	
	CV	23.3	64.8	44.3	-	-	-	
	LSD	4865	NS	NS	-	-	-	
Spring 2018	CIMMYT Pak	9256	7843	5449	6438	8132	7424	9.1
	Pearl (check)	7497	7489	3856	7303	7858	6801	
	CV	1898	2021	3342	1624	1968		
	LSD	15.4	23.8	42.0	15.3	16.5		

3.3 Agronomic Studies

The variety was evaluated under four different planting geometries to find out better planting method/geometry to obtain better grain yield during kharif 2016 and spring 2017. It is evident from results (Table) ridge sowing with 30" ridge to ridge distance and 8" plant to plant distance gave maximum yield (5870 kg/h) of newly developed variety that yield was maximum (6364 kg/ha) when the variety was

sown on one side of ridges having 30" ridge to ridge distance and 8" plant to plant distance. Same planting method and plant geometry was found to be best for the variety as it produced maximum grain yield of 8087 kg/ha during spring 2017. It is evident from the results that planting geometry affects the grain yield of maize and the results are in line with previous studies (Khan et al., 2018) [5].

Table 3: Yield Performance of CIMMYT Pak under Various Planting Geometries

Sr. No	Planting method	Plant spacing	Grain Yield (kg/h)
Kharif 2016	Ridge sowing	RxR=30" PxP=8"	5870
	Bed sowing	BxB=36" PxP= 13"	4750
	Bed sowing	BxB=42" PxP= 11.5"	5180
	Bed sowing	BxB=48" PxP= 9.0"	4463
Spring 2017	Ridge sowing	RxR=30" PxP=8"	8087
	Bed sowing	BxB=36" PxP= 13"	7182
	Bed sowing	BxB=42" PxP= 11.5"	7393
	Bed sowing	BxB=48" PxP= 9.0"	6563

3.4 Pathological Studies

Stalk rot, caused by *Fusarium moniliforme*, is major disease against maize crop in all maize growing areas of Pakistan. Any maize hybrid or variety susceptible to it may result in severe yield losses. Therefore this variety was screened against stalk rot and it showed moderately resistant disease reaction to stalk rot disease. It is also important to note that the newly developed variety was moderately resistant in both seasons showing a stable genetic behavior.

Table 4: Disease Reaction of “CIMMYT Pak” against Stalk Rot (*Fusarium moniliforme*) by Artificial Inoculation using Hookers Scale

Name of OPV	Stalk Rot Reaction	
	Kharif 2016	Spring 2017
CIMMYT Pak	MR	MR

3.5 Quality Analysis

Quality analysis of the variety was performed in Cereal Technology Lab. Wheat Research Institute, AARI Faisalabad to compare it with the check variety. It is evident from the results (Table 5) that CIMMYT Pak has better fiber and ash content while lesser quantity of protein and fat than check.

Table 5: Quality parameters of CIMMYT Pak in comparison to check

Variety	Crude Protein (%)	Crude Fat (%)	Crude Fiber (%)	Ash (%)
CIMMYT Pak	7.53	4.23	1.70	2.0
Pearl (check)	8.43	4.29	1.47	1.26

3.6 Justification for Approval

- Short duration variety maturing in 90-100 (spring) and 85-90 (kharif) days
- Higher shelling percentage (86)
- Highly suitable for arid zone, hilly areas and potato growing areas
- Ability to withstand adverse climatic condition
- Suitable for both seasons (spring & autumn)
- Better root anchor/lodging resistant
- Moderately tolerant against stalk rot

4. References

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