Quality Protein Maize Variety (QPM-1) Way Out for Better Health and Economy for Temperate Conditions of Kashmir

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Maize is the third most important cereal in the world. Over 43m ha of maize is grown in Asia producing 166 million tons with an average yield of 3.8t/h (Anonymous, 2004). Asia consumes more than 62 per cent of the maize production in the form of animal feed and the remaining for human consumption. The biological value of protein is low owing to the fact that normal maize protein is deficient in essential amino acids like lysine, tryptophan and threonine and therefore needs protein supplementation from legume and animal proteins. There are very few examples where nutritional objective have made an effective contribution to planning agricultural research for developing countries. The complex nature of the nutrition and the limitations of formal planning procedures help to explain the failure. The most important of them is the development of quality protein maize (QPM) after the discovery of maize mutant in the mid 1960's containing the opaque-2 gene (Mertz *et al*., 1964) which enhances levels of lysine and tryptophan in the endosperm protein. This opened a new era in breeding for improvement of quality in maize. Through an interdisciplinary research involving breeders, biochemists and other disciplinary scientists, researches of CIMMYT and worldwide started slowly but steadily developed what we now call as QPM (Vasal, 1993).The QPM is O2 maize (mutant) genetically identified for hard endosperm by selection of modifier genes in order to overcome the agronomic constraints.

Taking the maize statistics of Jammu and Kashmir state (India), it states that largest area under cereals is occupied by maize (3.2 lakh ha. Anonymous, 2009). The maize cultivation assumes much more significance in the hilly tracts of the state where it is the chief source of livelihood for more than five lakh families rather one full tribe is directly involved with the crop. Due demand for meat and poultry has thrusted a further importance for maize. Besides, maize is the only alternative to paddy cultivation owing to the drought which are of recurrent occurrence. Taking these facts into consideration and the low biological value of the protein of the varieties

in vogue together with feeling the impact of nutritionally imbalanced maize on socio economic and health conditions both on growers as well as consumers, efforts were started in this direction since Kharif season 2005 under high altitude temperate conditions of Kashmir, situated at 7500 feet amsl.

The major challenges to maize crop grown under temperate conditions of Kashmir are short growing season (April to September), recurrent drought and its consequences impact more particularly at flowering stage, infestation of cut worms (seedling stage) and more particularly to mention here the two important economic diseases viz, *Turcicum* leaf blight (TLB) and common rust. The variety possessing early maturity (flowering in July), good cob and plant characteristics, stay green habit, drought tolerance and tolerance/resistance to major biotic challenges more particularly to TLB, gains the popularity among farming community.

Breeding for high straw yield with one or two cobs is mostly favoured (HI=0.3-0.35) owing to the fact of high animal/man ratio where stover serves as only fodder more particularly in lean season lasting for six months (October-March) as the freezing period sets in. Hence realizing the rationale behind, facts, statistics and the criteria for variety popularity, so many QPM hybrids/lines/composites/ populations/synthetics were evaluated since 2005. Most of the lines not fulfilling the above mentioned criteria more particularly of early maturity were discarded. Feeling the urgent demand and from the State Government and farmers side a composite QPM development programme initiated in the same year (2005) came to the logical end in year 2009 in the form of variety PS-98 (Shalimar Maize Composite-5) a first QPM variety for temperate conditions of Kashmir with adopted ecology range of 1650-2500 feet amsl. The six QPM lines/populations (List given in table-1) were used as basic material for development of this white QPM composite (QPM-1) selected on the basis of uniformity in maturity, plant and cob characteristics, plant status and grain texture and colour.

The variety is finally growing to be released by the end of Kharif season 2010 after fulfilling some prerequisite formalities. The QPM-1, first SKUAST (Kashmir) QPM variety is early maturing with good grain and plant characteristics, hard endosperm, protein profile is up to expected mark and is tolerant to various biotic and abiotic stresses. The cob is conical, semiflint with cap and creamy white in colour. The other characteristics in comparison with standard

check C-15 are given in table-1. The photographs of the green stand and dehusked cobs are given in Plate-1.

This time QPM-1 is under seed production at various isolations identified by the team constituted for the purpose so as to make sure the availability of the seed at least to fulfill the 30 per cent of the demand in the first phase. During the ongoing seasons and if possible facilities of winter nursery at DRR shell be used for further multiplications of the seed. The extension/informal education regarding the popularity of the said variety has also been given due priority and farmers have shown willingness on their part to grow such kind of variety and to replace their non QPM conventional varieties.

Table-1: Lines/populations used for development of composite QPM-1 (PS 98)

S. No	Name of the entry	Source	Year of collection
1	SO3HI HQ	CIMMYT, Mexico	2004
2	SO3HI WQ	CIMMYT, Mexico	2004
3	SO1HLWQ1	DMR, New Delhi	2004
4	SO1HLWQ2	DMR, New Delhi	2004
5	SO2HLWQ1	DMR, New Delhi	2004
6	SO2HLWQ2	DMR, New Delhi	2004

Table-2: Grain quality traits of QPM-1 (PS 98) viz-à-viz check C 15

S. No	Cultivars	Protein (%)	Percentage of Tryptophan in protein	Percentage of Lysine in protein	Sugar (%)	Starch (%)	Oil (%)
1	QPM-1 (PS 98)	8.96	0.66	2.95	4.48	64.12	4.78
2	C15 (Check)	10.75	0.55	2.02	3.85	69.72	4.70

Table-3: Average yield performance of QPM-1 (PS 98) in station trials over years and locations (2007-2009)

S. No.	Cultivar	Grain yield (q ha^{-1})	% superiority over check
1	QPM-1 (PS 98)	57.78	7.45
2	C 15 (check)	53.77	

Figures in parentheses indicate disease score. 1-5 scale was used for scoring the disease reaction. The cultivars were evaluated during Kharif 2008 & 2009.

Table-5: Screening of QPM-1 (PS 98) against the infestation of major insect pests

Cultivar	Percentage of plants damaged			
	Stem borer	Blue beetle	Cut worm	Aphid
QPM-1 (PS 98)	9.7 (1)	9.5 (1)	27.3 (3)	7.2 (1)
C 15(check)	14.4 (2)	12.9 (2)	32.9 (3)	11.6 (2)

Figures in parentheses indicate pest score
1-5 scale was used for scoring the infestation of insect pests.

Table-6: Benefit: cost ratio analysis (ha^{-1}) of QPM-1 (PS 98)

Variety	Cost of cultivation	Returns	Benefit	Ratio (Benefit/cost)
QPM-1 (PS 98)	27540	93570	66030	2.4
C 15 (check)	15930	35500	19570	1.22

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Plate-1a: QPM-1 at RRSS Larnoo (Kharif 2008)

Plate-1b: Quality Protein Maize-1 (PS-98)