

Maize composite Vijay: A landmark variety

Baldev S. Dhillon¹ · Surinder K. Sandhu²

Maize is a unique crop plant which has contributed more than others towards the science of Genetics and methods of Plant Breeding. It is the crop in which the concept of breeding hybrid cultivars, the cultivars with better performance than alternatives types, was developed, which is now-a-days is being adopted in almost all crop plants. Above all, maize cytogeneticist Barbara McClintock earned Nobel Prize in 1983 for her discovery of mobile genetic elements.

All-India Coordinated Research Projects (AICRPs) working under the auspices of Indian Council of Agricultural Research (ICAR) serve as a backbone of the National Agricultural Research System. The first AICRP was established on maize in 1957 (initially named as All India Coordinated Maize Breeding Scheme), (Dhillon *et al.*, 2006). Its grand success led to extension of the concept by ICAR to other field crops, horticultural crops, animal sciences, natural resource management, agricultural engineering and home science. At present, ICAR has more than 80 AICRPs including Network Projects, a shorter form of AICRP. The AICRP on Maize released nine hybrids during 1961 to 1964 (Dhillon *et al.*, 2006). These included seven double-cross hybrids: ‘Ganga 1’, ‘Ganga 101’, ‘Ranjit’ and ‘Deccan’ released in 1961, ‘VL 54’ in 1962 and ‘Ganga 3’ and ‘Him 123’ in 1964; and two double top-cross hybrids namely, ‘Ganga Safed 2’ and ‘Hi-Starch’ in 1963. ‘Ganga Safed 2’ became a popular hybrid in *Kharif* season, and ‘Hi-Starch’ played a historical role by laying the foundation of winter maize cultivation in Bihar and South India.

In spite of remarkable success of ‘Ganga Safed 2’ and ‘Hi-Starch’, hybrid maize cultivation did not make an impact on the expected scale. During 1963-64 to 1967-68, the coverage under hybrid maize has been rather slow and about 5% of the total area of 15 lakh acres under maize was sown with the hybrid varieties (Punjab Agricultural University (PAU) (Package of Practices of *Kharif* Crops, 1969). The most serious limitations identified were cumbersome hybrid seed production requiring long term planning and that the farmers have to purchase fresh hybrid seed for every planting. To overcome this, AICRP on Maize gave the concept of breeding composite cultivars, a type of open pollinated cultivar (OPC), and reoriented the breeding programme accordingly. The protocol for producing breeder seed of a composite and retaining its open-pollinated produce to use that as seed by the farmers for two to three generations was also developed (PAU Package of Practices of *Kharif* Crops, 1967).

A composite cultivar is developed by recurrent selection in an open-pollinating base population developed by bulking seed of a number of phenotypically selected genotypes. It differs from a synthetic variety, another OPC, which is produced by crossing *interse* a number of genotypes, selected for good combining ability, in all possible hybrid combinations. AICRP on Maize released six composites, namely ‘Amber’, ‘Jawahar’, ‘Kisan’, ‘Vijay’, ‘Vikram’ and ‘Sona’ for commercial cultivation in different parts of the country in 1967 (Dhillon *et al.*, 2006). Of these six composites, ‘Vijay’ was developed by PAU, Ludhiana. The genetic base of ‘Vijay’ was selection of open-pollinated ears from 14 yield trials, having Caribbean, Mexican, US and Indian materials, grown in *Kharif* season 1961 at Nucleus Seed Farm, Narainagarh, now known as University Seed Farm of PAU. The seeds of the selected ears were bulked and the

✉ Surinder K. Sandhu: suindersandhu@pau.edu

¹Former Vice Chancellor, ²Principal, Maize Breeder, Punjab Agricultural University, Ludhiana-141004, Punjab, India

resulting population allowed to random pollinate in subsequent generations accompanied by selection. Subsequently, it has been maintained in isolation in 1964 and 1965. It was initially known as 'Naraingarh Complex' and was evaluated over years and locations under the name 'J 1'

'Vijay' was recommended for cultivation for grain production across the country and was also grown in certain regions like Punjab, Jammu and Kashmir, Himachal Pradesh and North-eastern region even for green fodder. With time, 'Vijay' was replaced by new high yielding hybrids and composites but it continued to be cultivated in some niches in northern hill region (Jammu and Kashmir, Himachal Pradesh, Uttarakhand and North-east) and Punjab. It is evident from the allocation of breeder seed as per BSP I up to 2019 (Table 1). 'Vijay' was also released in Pakistan under its experimental name 'J1' and in Nepal as 'Rampur Yellow' which further testifies its

outstanding performance and wide adaptation. It was also a parent of two varietal crosses the advanced generations of which served as the base populations to develop composites 'Jawahar' and 'Sona'. 'Vijay' is only Indian maize cultivar which continued to be cultivated in the country for nearly half a century as well as was commercially cultivated outside India, that too in two countries, namely Pakistan and Nepal. The PAU continued to play a stellar role in Indian maize research programme on cultivar development and production technology. 'Ageti 76' is the first early maturing, high yielding variety in the country. It was released for cultivation in *Kharif* season in Punjab in 1976 and at the national level in 1982 (Khehra *et al.*, 1977, 1986). In 1995, PAU took the lead to develop India's first high yielding single cross hybrid 'Paras' (Dhillon *et al.*, 1995), which gave a new orientation to maize breeding programmes in the country.

The pioneering studies started in 1978 by PAU made it possible to commercially cultivate maize during non-traditional winter/spring season. Two high yielding, cold tolerant composites, 'Partap' and 'Partap-1' were released for cultivation in 1983 along with their production technology package for winter season comprising seed rate, sowing date, application of nutrients, irrigation schedule, etc. (Dhillon *et al.*, 1984). The technology package developed by PAU was adopted as such by the Haryana Agricultural University (now Chaudhary Charan Singh Haryana Agricultural University), Hisar and Rajasthan Agricultural University (Now Swami Keshwanand Rajasthan Agricultural University), Bikaner. Further, 'Ageti 76' laid the foundation for maize cultivation (after potato) during non-traditional spring season in Punjab in early 1980s, and maize has now emerged as an important crop in spring season.

Table 1. Year wise details of breeder seed allocation of maize composite Vijay

Year	Actual Allocation as per BSP I target (q)	Actual Production as per BSP IV (q)
1995	3.20	4.00
1996	2.20	-
1997	-	-
1998	0.50	1.70
1999	1.70	3.50
2000	1.80	-
2001	1.00	1.00
2002	0.80	1.50
2003	1.50	4.00
2004	1.37	2.00
2005	1.37	2.00
2006	0.62	2.20
2007	-	-
2008	0.57	1.50
2009	0.59	2.00
2010	0.32	4.00
2011	0.70	2.90
2012	1.00	2.40
2013	0.10	0.20
2018	0.50	0.50
2019	0.40	0.40

Source: Annual Reports, All India Coordinated Research Project on Maize

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