

Improvement of Maize: Emerging Trends in the State of Jammu and Kashmir (India)

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Maize (*Zea mays*, L.) is grown on approximately 140 million hectares (M ha) worldwide: 97 M ha in developing countries, 34 M ha in the high income countries, and 9 M ha in the Eastern Europe and the former Soviet Union (CIMMYT, 1994). Maize is a staple food for several hundred million people in the developing world. The average inhabitant of eastern and southern Africa consumes 80 kg of maize each year; in Mexico, Central America, and the Caribbean, 170 kg. Annual per capita maize utilization averages 100 kg in East Asia and more than 190 kg in the Southern Cone of South America, largely as animal feed in both cases. Unfortunately, developing countries do not produce enough maize to meet their needs and must therefore import approximately 30 million tons of maize annually. Use of improved cultivars and management practices should help increase maize yields and reduce imports in developing countries. CIMMYT believes that superior OPVs have an important role to play in the developing world, mainly because they are easier to develop than hybrids, their seed production is relatively simpler and inexpensive, and resource-poor farmers who grow them can save their own seed for planting the following season.

The maize statistics of Jammu and Kashmir state (India) reveals that maize crop occupies an area of 0.32 M 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 and staple food for more than half million families rather one full tribe of *Gujar and Bakerwal* (nomadic race) is fully involved with the crop. Due to economic growth the demand for mutton and poultry has drastically risen and has given a further importance to maize. Besides, maize is the only alternative to rice in the circumstances of drought which are of recurrent occurrence. For the last one decade the demand for maize grains has shown a constant rise because of following key factors.

- Population of state of Jammu and Kashmir as per 2011 census has reached to 12.5 million which was just 9 million in 2001. Due to an abrupt change in population figures the greater

demand for maize has also been felt from every nook and corner of the state. Rough maize grain flour is usually taken as breakfast food and fine grain flour for bread purposes.

- Change in food habits: - Majority of population of Jammu and Kashmir consumes rice and wheat as staple food. But the change in food habits has been felt in the past few years and even people in the urban areas are showing great interest to consume bread made of maize flour. Some of the consumers add fine wheat flour to maize flour to make leavened and tasty bread because of the fact the bread made of maize flour is unleavened due to absence of gluten.
- Jammu and Kashmir has lush green fields and pastures and support a huge cattle, sheep and goat population approximately numbering 10 million and there is great demand for maize from this sector. Hence to support this industry the maize production is to be increased to bridge the gap between demand and supply.
- With the economic development consumption of meat protein has increased and to sustain the steadily supply of slaughter animals by virtue maize production has to take a big leap.
- Poultry ration is solely met by maize grain. For the last two decades the consumption of poultry meat (white meat) has steadily increased at a faster rate because of economic growth and concern for better health.
- The total production and productivity in the state is very low when compared to average at national and international level. It is estimated that per hectare productivity in the state of Jammu and Kashmir is just 1.8 tons. The main reasons of low production and productivity are briefly mentioned below.
- Generally open pollinated varieties (OPVs)/landraces predominate in entire maize grown tracts of the state. They are low yielding and are grown under marginal conditions with least interventions of inorganic fertilizers. The OPVS are not as successful as had been expected. These varieties tend to lose their genetic advantage or their phenotypic identity during successive cycles of seed sowing.
- No or very less use of chemical fertilizers: - In our state there is plenty of scope in enhancing production through change in cultural methods. A plateau has reached in developed countries with respect to use of commercial fertilizers and herbicides. In Jammu and Kashmir state low or no use of chemical fertilizers is made to grow the maize crop.

- Poor adoption of hybrid technology. The maize area planted to improved varieties such as hybrids and synthetics has not increased significantly. It is estimated that not more than 20% area is under hybrids or improved maize varieties in the state and this is the main reason that commercial maize production has not boosted on commercial lines.
- No stable market: The stable marketing does not exist in the state. Because of this fact farmers cannot be assured of a reasonable price for their crop year in and year out and as a result they do not take any risk in the investment to grow it.
- No access to new technology:- Since maize is generally grown as a rainfed crop and is the crop of mountain tracts of the state. Farmers are resource poor and conditions of soil health are also deteriorated. Technologies are developed at the research stations of agricultural universities and actual growers are far located.
- Resource poor farmers:-The maize growers do not afford prices for chemical fertilizers. The high prices have been a major factor for discouragement of use of chemical fertilizers.
- Poor transportation facility:-Transportation is inadequate to bring in supplies in a timely fashion and to transport products to the market.
- Extension services and links are not adequate to make aware the maize growers about the urgent needs during different cropping operations and the new challenges brought on by demographic changes and urbanization.
- Seed industry insufficient:-Needed quantities of seed of improved varieties on time are not met by commercial and small holding maize growers. As a result they plant the land with their own saved seed.
- Stress resistant varieties not available:-Heat, cold, drought are a continually recurring problems. The varieties bred specifically to combat these challenges have not been bred locally for specific agroecologies of Jammu and Kashmir.
- Small land holdings:-Small holders no longer depend on their plantings as the sole source of food for the family, outside income of one or another supports substantial proportions of their daily needs for food and shelter. This has a direct impact on farmer's choice about the kind and amount of maize they grow.

- Independent research by the scientists and non scientific methods by farming community add little in delivering useful products to the maize farmers.

There is a big challenge before the maize sector to overcome all these bottlenecks and to meet the demand of various aforementioned sectors of the state which directly or indirectly depend on the success of maize crop. Various strategies to increase maize production by 2020 are highlighted below.

- Increase in area and yield:-Due to urbanization, industrialization, demographic pressures, we are losing major portion of arable land. To increase the production through horizontal growth therefore seems a non viable option. Hence vertical growth is the only alternative for yield increase per unit area. Thus to satisfy future demand for maize production, increasing emphasis must be placed on making improvements in breeding and cultural practices as there seems a little opportunity for any increase in area that is now planted to maize.
- Improvement in cultural and breeding aspects:-Cultural and breeding programmes must go hand in hand, if the full potential of emerging production technologies is to be realized. Maize production and productivity has reached a plateau in developed countries as the hybrid and production technologies has been exploited fully (USDA,1999;WRI,1999). In 1998, 43% of maize area in developing countries (CIMMYT,1999)was planted to hybrids, although when Argentina,Brazil,Chile and China are excluded, only 15% of maize planting are hybrid. Hybrids developed by public sector accounted for 40% of hybrid seed sales in developing countries (excluding China) and public sector hybrids account for 60% of the sale
- Since there is plenty of scope in horizontal expansion of hybrid technology in the state, besides the exploitation of innovative production technologies. A number of HYVs and hybrids have been bred locally by state Agricultural University (Table).As Jammu and Kashmir is physio-geographically diverse state and a uniform breeding strategies and production technologies cannot fulfil the demand and aspirations of maize growers of the state. Hence breeding objectives and production technologies need to be reviewed taking into consideration the aforementioned facts so that adoption of the same does not feel the growers that they are committing a mistake. It appears at this time that use of hybrids and development of hybrid seed industries in the state will continue to grow. To many farmers the perceived advantage of hybrids over local landraces/OPVs is not only their added yield, farmers like the fact that hybrids provide derived genetic improvements with repeatable precision and do so in a clearly distinguishable package.

- Cheaper prices and easy access for new technologies:-The important inputs such as hybrid seed and chemical fertilizers need to be made available at affordable prices. The high cost of both hybrid seed and chemical fertilizers are the factors limiting their usage for increasing crop production and productivity. The government actions should be highly polite rather than political to encourage farmers to use chemical fertilizers and herbicides through subsidised rates and other credit policies.
- Providing market stability and on farm storage:-This is the most important factor which do not exist in this state. In addition to market stability, the prices of maize must be high enough to ensure a better profit for producers. At marketable surpluses the price of maize abruptly go down which discourage maize growers, infact, this is also the reason that they do not take the risk for investment. Community based storage facility be created for storage to hold the produce until price rise so as to enable them to reap good prices for their produce.
- Linking maize growing areas with main roads:-Transportation must be adequate in order to supply inputs timely and to transport products to the market to reduce the additional head load charges.
- Efficient and effective extension services:-The extension services need to be reviewed in a broader perspective and updated so that transfer of technology from research units to maize growers is made more efficient and effective.
- Revival of seed industry: - In the state only Agriculture university has the mandate of producing breeder seed of newly developed varieties recommended for different agroecologies of the state whileas, foundation and certified seeds are produced on the farms of state Department of Agriculture, infact the big constraint such as land, technical man power, labour factors and inappropriate funding for research and development, improved seed bred locally placed in multiplication chain is not adequate. It is estimated that only 15-20% of the demand of farmers is satisfied. Hence there arises the importance of efficient and dependable maize seed industry which will actively supply needed quantities of seed of improved varieties on time, and more importantly update the offering annually to meet changing needs for new kinds of pest resistance, adoption to new cultural methods and in the circumstances of climate change ever increasing levels of stress resistance and thus increasing yields. Since the maize crop in the state is completely offered to the mercy of rains is frequently challenged by cold, drought and heat stresses in different belts during different growth stages. Hence these industries need to breed different cultures intended to raise yields

that will enable maize to yield well at higher plant densities in spite of heat and drought (Edmeads et al,1997).

- Collaborative varietal development and technology generation: - The collaborative methodology of development and invention of new varieties and innovative technologies will go beyond the usual concept of extension services which were conceived as acting primarily to deliver useful products of breeding to non scientist sector (farmers). It will prove one of the most productive investments that could be made by those wishing to improve the economic and social well being of rural poor in the state, although would require investment in time and people that may exceed financial capabilities or political will.

Conclusion:-The demand for maize in the state will shift a higher proportion for use as feed and relatively lesser portion for food. The land resources are getting exhausted at a faster rate in the face of steady population growth, gains in yield rather than increase in planted area must be the major source of increased maize production. Increased use of hybrid maize and production technology can help raise yield levels in the coming decade. The large number of small holders in the state is still an untapped source for increased production. To work with diverse group of farmers collaborative on farm research can be devised for implementation. The maize research need to be given due priority in maize development programme of the state by a good financial support and private sector need to support public sector research in a cooperative and complementary mood for socioeconomic development of maize growers. Maize breeding research itself will have to be devised a new way of planning and supporting an inclusive maize research programme, encompassing public and private institutions and individuals and looking to both short range and long range goals, aimed at overall economic development of the state in general and socioeconomic development of farming folk in particular.

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Table: Different varieties of maize bred locally and released for different agroecologies of the Jammu and Kashmir state

Varieties	Yield potential (q ha⁻¹)
Composite-6 (C6)	45-50
Composite-8 (C8)	40-50
Composite-15 (C15)	45-50
Composite-4	50-55
Super-I	50-60
Shalimar-KG-I	45-50
Shalimar-KG-II	40-45
Shalimar Maize Hybrid-1	60-65

