RESEARCH ARTICLE

A DETAIL REVIEW ON STATUS AND PROSPECT OF MAIZE PRODUCTION IN NEPAL

Rajan Thapa
Institute Of Agriculture and Animal Science, Tribhuvan University, Lamjung Nepal
*Corresponding Author Email: Dolpali123@gmail.com

This is an open access article distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ARTICLE DETAILS

ABSTRACT

Maize ranks second after rice in terms of both production and area coverage in Nepal. Maize being the principal staple food for majority of people and source of animal feed, cultivated from March to May depending upon distribution of rainfall. Although maize area and production has shown a steady increase in recent years, its productivity has been low (2.67 t/ha). Despite the many efforts made to increase the maize productivity in the country, the results are not much encouraging. This paper was prepared after intensive review of all the information obtained from all available resources to analyze the production of maize and reason for decrease in productivity of maize. The research work conducted in several periods has shown numerous reason such as insect pest, disease, weeds, biotic stress, lack of labour, unavailability of improved seed, poor extension and research Programme and frequent occurrence of drought and many more. Therefore, in order to streamline the future direction of maize production in Nepal, an attempt has been made in this paper to highlight the present status and future prospect with key pathways for increasing the productivity of maize.

KEYWORDS

Maize Production, Productivity, Significant, Constraints, Adaption strategies

1. INTRODUCTION

Maize (Zea mays) is the second most important staple crop after rice in terms of area and production in Nepal (Kandel et al. 2017; MOAD 2017/18). Maize is the major traditional cereal crop grown for food, feed and fodder. Maize demand has been constantly growing by 5% annually in last decades. Per capita maize consumption in Nepal was 98g/person/day (Ranum et al., 2014). At present, maize cultivation area in Nepal is 954,158 ha with a total production of 2,555,847 metric tons/ha and productivity of 2.67 t/ha (MOAD 2017/18). It contributes about 25.02% of total cereal production, 6.88% in Agriculture Gross Domestic Product (AGDP) and 3.15% in Gross Domestic Product (GDP) (Pandey and Basnet 2018; MOAD 2014/15).

In Nepal maize is grown in sub-tropical to cool temperate climates. It is cultivated as food, feed and fodder on slopping bari land (rainfed upland) in the hills. Maize is grown under rainfall conditions during the summer (April-August) as a single crop or relayed with millet later in the season. In the terai, inner-terai, valleys, and low-bing river basin areas, maize is also grown in the winter and spring with irrigation.

More than two third of the maize produced in the mid hills and high hills is used for direct human consumption at the farm level.

1.1 Status of Maize Area, Production and Productivity

The area, production and productivity of maize are slowly and constantly increasing since 2007 in Nepal (Figure 1). However, the production of maize is low as compared to other developed nation. Maize contributes 24.93% in total edible cereal grain production in Nepal. In Nepal mid hill, terai and high hill occupies 72.85, 17.36 and 9.79% of total maize cultivation area respectively (MOAD 2014).

Maize yield level in Nepal at present is much below than potential yield 6.7 t/ha (on station experimental yield), attainable yield of about 5.7 t/ha (on farm with improved practices) and national yield of 2.67 t/ha (Figure 2). There are various biotic and abiotic yield limiting factors in maize of which diseases and poor crop management are important ones.

Figure 1: Maize production trend in Nepal. Source: [MOAD, 2017/18]
2.2.2 Soil Fertility

With the increase in population, industrialization, modernizations, urbanization, deforestation and land pollution are increasing day by day. Among important recent changes, reduction in livestock, forest degradation, reduced land availability and stall feeding of cattle led to reduction in manure. High cost, non-availability at key time, lack of knowledge of use and no updated recommendation on the dose of fertilizers are also main reason behind low soil fertility and productivity.

2.2.3 Water Management

The total irrigated area in Nepal is only about 1331521 ha (MOAD, 2014). More than two thirds of the maize is produced in the mid hills and high hills during summer season and is mostly grown under rainfed condition. Delay in monsoon during planting, uneven distribution of rainfall and prolonged drought during crop season may affect the crop yield adversely. Water stress due to drought is probably the most significant abiotic factor limiting plant and also crop growth and development (Khalilli et al., 2013). The very limited area under winter and spring maize in Terai is irrigated.

2.2.4 Socio-economic

Maize is predominantly grown in the mid hills and the farm sizes are also quite smaller compared to Terai region. Maize farming is considered as subsistence farming in Nepal. It is regarded as a staple food of hill people. Staple commodities such as rice, wheat, potato and vegetables have higher commercialization rates (30-50%) than maize and fruits (15-25%) (ADS, 2014). The productivity is adversely affected by the shortage of agricultural labor. Due to an inadequate policy intervention for prioritization of agriculture research, NARC, is suffering from inadequate operational budget as a consequence maize research is also being affected.

2.3 Input Supply Constraints

The problems associated with availability of quality maize seeds differ between agro-ecologies. In the eastern to western mid hills farmers are not able to get improved maize varieties of their choice. Hybrid yield 20 -30% more than OPVs but unavailability of location specific maize hybrids is one of the major causes of low productivity. National Maize Research Program (NMRP), Rampur, has registered and released seven maize hybrids but they are not suitable for all agro-climatic region of Nepal. The SSR for maize is also very low (<10%).

The farmers of the high hill and mid hill are deprived of quality seeds and fertilizers due to:

a. Remoteness of the area (no developed infrastructure).

b. Lack of awareness and demand of modern inputs.

c. Lack of purchasing capacity of farmers because of high piece of input supply.

2.4 Institutional Constraints

Although the District Agricultural Development Office (DADO) has offices in the district headquarters and satellite offices at the service center, it has not been able to provide sufficient services to farmers, especially in remote hills. Farmers of the remote hill are not in access to National Maize Research Programme (NMRP, Rampur, Ghanwan) regarding research activities and production technology. The NGOs are more inclined towards production of cash crops such as vegetables and fruits.

NMRP have modest facilities of land for research and seed production, disciplinary and multidisciplinary research projects funded by Nepal Agricultural Research Council (NARC), some scientific and technical staffs, and laboratories. It also works in collaboration with International Maize and Wheat Improvement Center (CIMMYT) and ICRISAT, the international CGIAR organizations. In particular, NMRP is incessantly suffering from inadequate research funds and no fixed term research staffs, lack of motivational schemes for the research staffs including exposure visits and training, poor technology delivery mechanisms, and inadequate system-based research. 
Disciplinary laboratories like soil, seed, entomology, plant pathology, plant breeding and Agri-mechanization are not in full operation.

2.5 Information Constraints

Lack of information is most acute for farmers in the High hills and remote areas of the midhills. Many farmers in these areas did not know which

![Figure 2: Yield gap of maize in Nepal (NMRP, 2014)](image)
improved varieties are suitable for their farms and where to obtain them. Lack of knowledge of improved crop management practices including spacing, fertilization, and choice of variety are other problems. Farmers, in many instances, could not identify insect pests, diseases, and nutritional deficiencies in their crops and had no knowledge of pesticides that could be used for their control. In most locations improved technology was beyond the reach of the farming community because of their unavailability and high price.

2.6 Environmental Stresses

Environmental stress such as high temperature, chilling, irregular pattern of rainfall, water logging, salinity, toxicity also reduces the production of maize. They cause growth inhibition, morphological changes, affects photosynthesis activity and biochemical mechanism. These stresses adversely affect the plant performance by disrupting the cellular functions and metabolic activities. Similarly, drought stress is also one of the most serious environmental stress affecting the productivity, quality and quantity of the maize.

2.7 Market Facility

Because of the underdeveloped marketing system, poor market infrastructure, and shortage of inputs, excess maize production is not easily disposed of at an attractive price. This has indirectly slowed the pace of adoption of new technologies. Annual requirement of maize seed in Nepal is 19,552 MT. Prevalence of farmers saved seed and OPVs. Contribution of the formal sector to this demand is 15% (2932 t). Companies contribute 10% and balance 90% are produced by cooperatives, DADOs, NARC and CBSPs. Three varieties viz., Rampur Composite, Manakamana-3 and Arun-2 (constitutes 81% of the total source seed production of 75 t). Growing trend of hybrids import worth NRs 1 billion. Hybrids developed by NARC are yet to be commercialized and Low capacity of private sector and limited market development activities.

3. ADOPTION STRATEGIES FOR IMPROVING MAIZE PRODUCTION

Drought stress impairs many physiological processes. The stressful Threat is tremendous opportunities to increase the maize production there by narrowing down the wider yield gap and horizontal expansion in winter season. The conventional maize production system needs to be converted into modern, resource use efficient and climate smart under the pretext of stagnant productivity as a result of limited area expansion, low yield potential of the existing genotypes, imported hybrid seed, declining soil fertility, and emergence of new pest species, labor and water. Therefore, the research should focus on utilizing the latest tools of plant breeding for the development of stress resilient maize genotypes, hybrid seed production effort, climate smart, and resource conserving agro-techniques like conservation agriculture.

3.1 RECOMMENDED STRATEGIES

Following strategies can help in better production of maize:

3.1.1 Varietal Selection

Farmers should select the appropriate crop variety depending upon their farm ecological climate and environment. NMRP has released some recommended varieties for different ecological region which are given in Table 2. National Maize Research Program (NMRP). Rampur, has registered and released seven maize hybrids but they are not suitable for all agro-climatic region of Nepal. Promising NMRP hybrids: RML-32/RML-17, RML-4/RML-17, RML-86/RML-96, RML-95/RML-96. Hybrid yields 20-30% more than OPVs varieties.

3.1.2 Better Crop Management Practices

Better crop management practices like conservation tillage, land preparation, Insect Pest Management (IPM), nutrient and herbicides application, pre- and post-harvest management helps to increase the production of maize. Conservation tillage in maize reduced the impact of drought by lowering soil temperature and surface evaporation, hence increased grain yield.

<table>
<thead>
<tr>
<th>Table 2: Some recommended varieties of maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Area</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>High hills (&gt;1500m asl)</td>
</tr>
<tr>
<td>Mid hills (&gt;1000msl)</td>
</tr>
<tr>
<td>Foot hills (spring maize)</td>
</tr>
<tr>
<td>Inner Terai</td>
</tr>
<tr>
<td>Terai (winter maize)</td>
</tr>
</tbody>
</table>

Source: (NMRP, 2015)

3.1.3 Soil Fertility Management

- To date general recommendation of fertilizer for maize in Nepal is 120:60:40 NP/50%K2O kg /ha. Follow proper rate of fertilizer dose i.e., Spring and Kharif maize: 120:60:40 kg NPK/ha, Rabi maize: 150-180: 60-40 kg NPK/ha, FYM: 10-15 t/ha.
- Full dose of phosphorus and potassium along with 1/2-1/2 dose of Nitrogen should be applied as basal dose during final land preparation before sowing. Remaining 1/3-1/2 dose of N should be applied as side dressing (for wider spacing crops) in two equal splits as:
  - first split dose at ’knee high stage’ (35-45 DAS)
  - Last split dose at tasseling stage (55-65 DAS)
- For zinc deficient soil, 20-25 Kg ZnSO4/ha during final land preparation and thoroughly mix into the soil is recommended for better crop growth and development.

3.1.4 Plant Protection

For Gray leaf spot (GLS) disease the resistant/tolerant varieties such as; Manakamana-3, Manakamana-5, Manakamana-6 (for midhills) & Ganesh-1 & Ganesh-2 for high hills Rampur Composite & Sarlahi Seto should be cultivated.

For maize stem borer management, a commercial mixture of Chlorpyrifos 50% and Cypemethrin 5% spray can be performed.

Maize grains should be treated with 5% dust of malathion and 2-3 tables of Aluminium phosphide (Celphos) per metric ton found to protect against storage pests. In the case of botanicals, Bojho (20 gm/Kg seed) found effective for the control of downy mildew.

3.1.5 Research Priorities

To alleviate the constraints of maize production, both varietal development and crop management research need to be implemented in an integrated approach. Research efforts should be targeted to address both yield potential and on-farm yields by reducing the impacts of abiotic and biotic constraints. So, the following actions are needed to address such problems:

- Development of stress (drought, heat, cold, low nutrient and high density) resistant high yielding hybrids and open pollinated varieties of maize for different production ecologies
- Provision of subsidy to genuine farmers and loan at low rate of interest
- Application of modern tools of breeding like Marker-Assisted and Genomics for the fast track and precision breeding program in collaboration with CIMMYT and other concerned organizations.
4. CONCLUSION

The attainable yield of maize is 5.6 t/ha but the national average yield is only of 2.67 t/ha. There is huge yield gap which can be fulfilled with the help of better crop management, adequate use of manure and fertilizers, supply of quality seeds, advancement in technologies and machineries, continuous research and extension activities, development of infrastructures in hills, flow of information, awareness and so on. With the increasing population, higher production of maize and other cereal crops can minimize the food insecurity in the nation as well as all over the world. Feed industry and poultry farms have huge demand of maize. Out of total maize that was used in feed production, 87% of the maize was imported from India each year by feed industries. Similarly, the poultry feed and animal feed demand are also increasing over recent years. This shows big scope to increase domestic production of maize. Nepal has potential to produce different varieties of maize because of its adverse climate diversity. Hence, there is tremendous scope to increase area, production and productivity of maize in Nepal.

REFERENCES


NMRP., 2013. Registered maize Varieties in Nepal Up to 2013. Published by Government of Nepal/ Nepal Agriculture Research Council/National maize research Program, Rampur,


