MAIZE PRODUCTION TECHNOLOGY IN KHYBER PAKHTUNKHWA

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Maize is a vital cereal crop in Khyber Pakhtunkhwa (KP), Pakistan, serving as a cornerstone for food security, livestock feed, and various industrial applications. In the 2023–2024 agricultural year, Pakistan's maize cultivation spanned approximately **1.7 million hectares**, yielding about **10.9 million tonnes** of maize. KP contributes significantly to this output, accounting for 15% of the nation's total maize production. This translates to an estimated **1.635 million tonnes** produced in the province during that period. Notably, the **Mardan** and **Charsadda** districts stand out within KP, contributing 40% of the province's maize cultivated area and production.

The province's diverse topography and favorable agro-climatic conditions make it well-suited for maize cultivation. However, to fully harness this potential, farmers must adopt advanced production technologies and effective pest management strategies. This comprehensive guide delves into the essential aspects of maize production in KP, including land preparation, sowing methods, fertilization, weed and pest control—with a focus on the fall armyworm—irrigation practices, and post-harvest management.

I. Land Requirement and Preparation

Maize thrives in well-drained silt loam to clay loam soils rich in organic matter. Fields prone to waterlogging, salinity, or alkalinity should be avoided, as these conditions impede root development.

- Initial Ploughing: Begin land preparation at least 15 days before sowing, incorporating organic amendments such as farmyard manure to enhance soil fertility.
- Final Tillage: At sowing time, perform deep ploughing under moist conditions, followed by cross-ploughing and planking. This process helps retain soil moisture, ensuring uniform seed germination.

II. Seed Rate and Sowing Method

Optimal seed rates and sowing techniques vary based on the region's topography:

a. Open Pollinated Varieties:

- **Plains (Spring & Summer):** 10–12 kg of seed per acre.
- **Hilly Areas (Summer Crop):** 12–15 kg of seed per acre.

b. Hybrids:

- **Plains (Spring & Summer): 08-10** kg of seed per acre.
- **Hilly Areas (Summer Crop): 10** kg of seed per acre.

- **Sowing Technique:** Employ line sowing using a maize planter to ensure precise spacing. Maintain 75 cm between rows and 25 cm between plants within a row, which is ideal for late open-pollinated and hybrid varieties.

III. Fertilizer Requirements

A well-balanced nutrient application is essential for achieving optimal growth and maximizing maize yield. The fertilizer recommendations differ for open-pollinated varieties (OPVs) and hybrids, ensuring that each type receives adequate nutrients for strong establishment and grain development.

- **For OPVs:**

At Planting: Apply 1–2 bags of DAP (50–100 kg), 1 bag of Urea (50 kg), and 1 bag of MOP/SOP (50 kg) per acre.

At Earthing-up: Supplement with 1–2 bags of Urea (50–100 kg) per acre.

- **For Hybrids:**

At Planting: Apply 2 bags of DAP (100 kg), 1 bag of Urea (50 kg), and 1 bag of MOP/SOP (50 kg) per acre.

At Earthing-up: Increase the nitrogen dose by applying 3 bags of Urea (150 kg) per acre to support the higher nutrient demand of hybrids.

Additionally, incorporating 8–10 tons of farmyard manure or compost per acre enhances soil fertility, improves structure, and boosts moisture retention, contributing to sustainable maize production.

- **Organic Matter:** Incorporate 8–10 tons of farmyard manure or compost per acre to improve soil structure and nutrient availability.

IV. Weed Management

Effective weed control is essential to minimize competition for nutrients, water, and sunlight, ensuring optimal maize growth and yield. A combination of chemical and mechanical methods should be employed for effective weed suppression.

i. **Pre-emergence Herbicide:** Apply **Primextra Gold** (a combination of S-metolachlor and atrazine) at a rate of **600–1000 ml per acre** immediately after sowing. This provides broad-spectrum control of annual grasses and broadleaf weeds by inhibiting their emergence.

ii. **Post-emergence Herbicide:** If weeds escape pre-emergence control or emerge later in the growing season, a post-emergence herbicide application is necessary:

   a. For broad-spectrum weed control, apply **mesotrione + atrazine** (e.g., Gengwei or similar formulation) at **200–300 ml per acre** when weeds are at the early growth stage (2–4 leaves). This combination effectively controls a wide range of broadleaf and grass weeds.

   b. For grassy weeds, apply **nicosulfuron** (e.g., Milagro) at **40–60 ml per acre** when maize plants are at the **3–5 leaf stage**. This selective herbicide is effective against major grassy weeds like Echinochloa spp. and Digitaria spp.

   c. For **broadleaf weeds and sedges**, use **halosulfuron-methyl** (e.g., Orcus Gold 80 WDG) at **10–12 grams per acre**, particularly for controlling Cyperus spp. (purple and yellow nutsedge). Apply at an early weed growth stage for best results.

iii. **Mechanical Weeding:** Complement chemical control with mechanical weeding to reduce weed pressure further:

   a. **First Inter-cultivation:** Conduct when maize plants reach **10–12 cm in height** using a tractor-driven implement. This helps in loosening the soil and removing early-emerging weeds.

   b. **Second Inter-cultivation:** Perform at the knee-high stage, coinciding with earthing-up operations to improve root anchorage and suppress late-emerging weeds.

Integrated weed management using pre- and post-emergence herbicides along with mechanical weeding ensures effective control, reducing yield losses due to weed competition.

V. Insect Pest Management

Maize crops in KP are susceptible to pests such as stem borers, shoot flies, and the invasive fall armyworm (FAW). Implementing integrated pest management (IPM) strategies is vital:

Cultural Practices:

i. Field Sanitation: Remove crop residues, stubbles, and plant debris from the previous crop to minimize pest and disease carryover.
ii. Weed Management: Timely removal of weeds from field borders and surrounding areas, as they serve as alternate hosts for insect pests and pathogens.
iii. Deep Ploughing: Perform deep ploughing (20–25 cm) during the offseason to expose soil-dwelling insect pests (e.g., borers, cutworms) and disrupt their life cycle. This also helps in incorporating organic matter and improving soil aeration.

- Seed Treatment: Prior to sowing, treat seeds with Confidor WP-70 **(Imidacloprid)** at 5–7 grams per kilogram to combat early infestations of shoot flies and stem borers.
- Stem Borer Control: Before thinning or during drought conditions, apply Furadan 3% granules **(Carbofuran)** at 4–8 kg per acre into the whorls to target stem borer larvae.
- Fall Armyworm Management:
    - Seed Treatment: Treat the seed with systemic insecticidal seed dressing chemicals to avoid FAW damage at seedling stages
    - Monitoring: Deploy pheromone traps (10–15 per acre) to detect and monitor FAW populations.
    - Biological Control: Introduce natural enemies such as *Trichogramma spp.* (egg parasitoids).
    - Chemical Control: If infestations exceed economic thresholds, apply appropriate insecticides (foliar or granular), such as Spinetoram 12 SC or

Emamectin Benzoate for early-stage larvae, and formulations containing Chlorantraniliprole as the active ingredient for more severe infestations.

VI. Thinning Practices

To ensure optimal plant density:

- Timing: Perform thinning 3–6 days after applying Furadan, when plants are 8–12 cm tall.
- Procedure: Remove excess, weak, diseased, or pest-damaged plants to maintain uniform 25 cm spacing between plants within each row.

VII. Irrigation Requirements

Adequate water supply is critical, especially during key growth stages:

- Number of Irrigations: Provide 6–8 irrigations from emergence to maturity, adjusting based on rainfall and soil moisture levels.
- **Critical Stages:**
    - **Vegetative Stage (30–45 days after sowing):** Supports root and stem development.
    - **Flowering Stage (50–70 days after sowing):** Essential for successful pollination and cob formation.

VIII. Harvesting, Drying, and Shelling

Harvesting should be done when:

- Husk leaves dry and turn brown
- Black layer formation appears on seed tips

After harvesting, ears should be dehusked and dried in well-ventilated, shaded areas until grain moisture reaches 12–14%. Shelling should be done using a tractor-mounted maize sheller to minimize grain breakage.

IX. Storage Recommendations

Proper post-harvest storage ensures grain quality and prevents spoilage:

- Further drying to 12% moisture before storage.
- Storing in gunny bags in a dry, well-ventilated warehouse at 10–25°C.
- Use of sealed containers or hermetic bags to prevent insect infestations.

To mitigate the impacts of climate change, farmers must adopt climate-resilient maize varieties suited for different agro-ecological zones. Improved drought-tolerant open-pollinated varieties (OPVs) and efficient agronomic practices—such as optimized fertilizer application, water conservation techniques, and integrated pest management (IPM)—can help maintain productivity under changing climatic conditions. The following table presents key agronomic features of maize varieties and hybrids recommended for different regions of KP, taking into account their maturity range, planting time, plant population, and yield potential across varying elevations.

AGRONOMIC FEATURES/CHARACTERISTICS OF COMMERCIAL MAIZE VARIETIES (OPVs)

Agronomic Features	**V A R I E T Y**			
	JALAL	**AZAM**	**IQBAL**	**PAHARI**
Variety Type	**OPV**	**OPV**	**OPV**	**OPV**
Maturity Group	Medium – Late	Medium	Early	Early
Maturity Range	100 – 110 days	90 – 100 days	80 -85 days	85 - 90
Planting Time				
i. Plains	June 15 – July 15	June 20 – July 20	June 20 – Aug 10	June 20 – July 31
ii. Mid Hills	May 20 – June 10	May 20 – June 15	May 20 – June 25	May 20 – July 10
iii. High Hills	May 01 – May 15	May 01 – May 20	May 01 – May 31	May 01 – May 25
Grain color	White	White	White	White
Grain Type	Flint	Flint	Flint	Flint
Cob Color	White	White	Mixed	Mixed
Plant Stature	Medium Tall	Medium	Medium	Medium
Fertilizer Requirement/ acre				
At Planting	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 1 ½ bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 1 ½ bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 1 bags Urea = 1 bag MOP/ SOP = 1 bag
At Earthing-up	Urea = 2 bags	Urea = 1 bag	Urea = 1 ½ bags	Urea = 1 bag
Plant – plant distance	25 cm	20 cm	20 cm	20 cm
Row – row distance	75 cm	75 cm	75 cm	75 cm
Seed rate/ acre				
i. Plains	10 – 12 Kg.	10 – 12 Kg.	12 – 15 Kg.	12 – 15 Kg.
ii. Hills	15 – 20 Kg.	15 – 20 Kg.	20 – 25 Kg.	20 – 25 Kg.
Plant Population/ acre	20,000 – 25, 000	25,000 – 30,000	30,000 – 35,000	35,000 – 40,000
Irrigation	6 - 8	6 – 8	6 – 8	6 - 8
Yield potential/ acre				
i. Plains	4 – 5 tons	3 – 3.5 tons	3 – 4 tons	2 – 2.5 tons
ii. Hills	5 – 6 tons	4 – 4.5 tons	4 – 5 tons	3 – 4 tons
Average Yield / acre	3 – 4 tons	2 – 2.5 tons	2 – 3 tons	1.5 – 2 tons
Area of Adaptation	Peshawar, Nowshera, Mardan, Charsadda, Swabi, D.I. Khan, Kohat, Bunnu, Newly merged districts, Lower and Medium altitudes of Malakand and Hazara divisions including Azad Jammu Kashmir.			

Agronomic Features	V A R I E T Y			
	KAPTAAN	**SAAD**	**EDHI**	**MALHAN**
Variety Type	**OPV**	**OPV**	**OPV**	**OPV**
Maturity Group	Medium – Late	Medium	Medium – Late	Medium – Late
Maturity Range	100 – 110 days	90 – 100 days	100 – 110 days	100 – 110 days
Planting Time				
i. Plains	June 15 – July 31	June 15 – August 10	June 15 – July 31	June 15 – July 31
ii. Mid Hills	May 15 – July 31	May 15 – August 05	May 15 – July 31	May 15 – July 31
iii. High Hills	May 01 – June15	May 01 – June 30	May 01 – June15	May 01 – June15
Grain color	White	White	Yellow	White
Grain Type	Semi Flint	Flint	Semi Flint	Semi Dent
Cob Color	Mixed	White	Mixed	Mixed
Plant Stature	Medium Tall	Medium	Medium Tall	Medium Tall
Fertilizer Requirement/ acre				
At Planting	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 1 ½ bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag
At Earthing-up	Urea = 2 bags	Urea = 2 bags	Urea = 1 ½ bags	Urea = 2 bag
Plant – plant distance	25 cm	20 cm	25 cm	25 cm
Row – row distance	75 cm	75 cm	75 cm	75 cm
Seed rate/ acre				
i. Plains	10 – 12 Kg.	12 – 15 Kg.	10 – 12 Kg.	10 – 12 Kg.
ii. Hills	12 – 15 Kg.	15 – 20 Kg.	12 – 15 Kg.	12 – 15 Kg.
Plant Population/ acre	20,000 – 25, 000	25,000 – 30,000	20,000 – 25, 000	20,000 – 25, 000
Irrigation	6 - 8	6 – 8	6 – 8	6 - 8
Yield potential/ acre				
i. Plains	4.0 – 4.5 tons	2.5 – 3.5 tons	4.0 – 5.0 tons	4.0 – 4.5 tons
ii. Hills	5.0 – 5.5 tons	4 – 4.5 tons	5.5 – 6.5 tons	5.0 – 5.5 tons
Average Yield / acre	3.0 – 4.0 tons	2.0 – 3.0 tons	3.5 – 4.0 tons	3.0 – 4.0 tons
Area of Adaptation	Peshawar, Nowshera, Mardan, Charsadda, Swabi, D.I. Khan, Kohat, Bunnu, Newly merged districts, Lower and Medium altitudes of Malakand and Hazara divisions including Azad Jammu Kashmir.			

AGRONOMIC FEATURES/CHARACTERISTICS OF COMMERCIAL MAIZE HYBRIDS

Agronomic Features	**H Y B R I D**	
	BILAL	**AZLAN**
Hybrid Type	**Single Cross**	**Single Cross**
Maturity Group	Medium	Medium-Late
Maturity Range	90 – 100 days	100 – 110 days
Planting Time		
i. Plains	June 15 – August 10	June 15 – July 31
ii. Mid Hills	May 20 – June 15	May 20 – June 10
iii. High Hills	April 15 – May 31	April 15 – May 20
Grain color	White	Yellow
Grain Type	Flint	Semi Flint
Cob Color	White	Red
Plant Stature	Medium Tall	Medium Tall
Fertilizer Requirement/ acre		
At Planting	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag	DAP = 2 bags Urea = 1 bag MOP/ SOP = 1 bag
At Earthing-up	Urea = 3 bags	Urea = 3 bag
Plant – plant distance	25 cm	25 cm
Row – row distance	75 cm	75 cm
Seed rate/ acre		
i. Plains	08 – 10 Kg.	08 – 10 Kg.
ii. Hills	10 Kg.	10 Kg.
Plant Population/ acre	25,000 – 30, 000	20,000 – 25,000
Irrigation	6 - 8	6 – 8
Yield potential/ acre		
i. Plains	4.5 – 5.5 tons	5.0 – 5.5 tons
ii. Hills	5.5 – 6.5 tons	6.0 – 6.5 tons
Average Yield / acre	3.5 – 4.5 tons	4.0 – 5.0 tons

Moreover, the sowing dates mentioned here cannot be fixed and may be adjusted based on weather forecasts and rainfall patterns, while still remaining within the recommended range. Farmers are advised to monitor meteorological updates and plan their maize planting accordingly to optimize germination and crop establishment.

By following these recommendations, farmers can achieve higher yields, enhance their livelihoods, and contribute to the agricultural prosperity, ensuring food security, economic stability, and improved well-being for farming communities of Khyber Pakhtunkhwa province.