

YIELD PERFORMANCE EVALUATION OF DIFFERENT MAIZE (ZIA MAYS L) VARIETIES UNDER LOCAL CONDITIONS OF GONER FARM DISTRICT DIAMER GB

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ABSTRACT

An experiment was done in Field Crop Research Station, Goner Farm, District Diamer, Gilgit-Baltistan, to compare the yielding of five maize (*Zea mays* L.) varieties such as Jalal, Azam, Pahari, Kohistan White and Zimbabwe line ZM521 in the local agro-climatic conditions. The main task was to find the most resourceful and versatile type of maize in the area. The experimental design was a randomized complete block design (RCBD) that had three replications. The agronomic and yield-related parameters were also measured, such as the number of plants population, the number of plants in height, the number of cobs per plot, the number of rows per cob, the number of grains per cob, the grain yield per hectare, and stalk yield (tons per hectare). The findings showed that there were marked differences between the tested varieties on most of the traits that were being measured. ZM521 had the best figures in terms of grain yield and plant vitality, then Jalal and Azam, and Pahari and Kohistan White had comparatively less yields. The results indicate that ZM521 and Jalal have a greater potential of yield and adjustability to the environment conditions of the locality of Diamer, GB. The findings are very useful to maize farmers and researchers in choosing high yielding and regionally adapted cultivars in order to improve maize yield in the high altitudes.

Keywords: Maize Cultivars, Goner Faram, Grain, Yield, Diamer, Cobs

Introduction:

Maize (*Zea mays* L.) is one of the major Cereal Crops cultivated in Pakistan. Maize ranks 3rd in Cereal Crops after wheat and rice. It is grown throughout the Country as

kharif cereal crop while in some tracks of Pakistan spring crop is also cultivated (A. Ali et al., 2020). The main purpose of its production is provision of food for human and feed and fodder for consumption of poultry farming and animal rearing. It is also utilized for tanning materials in the Leather industries (Shafique et al., 2014).

Maize cultivation is important for production of important commercial products like Corn oil, Corn starch, glucose, Corn flakes etc. It's yield averaged 4.9 tons/ha globally in 2009 (Martinez & Fernandez, 2019). However, yields in major maize growing areas in the developing world still lag behind the world's average (4 tons/ha), producing only about 3.1 tons/ha (Erenstein et al., 2022). Maize grain yield in Pakistan (3427 kg/ha) is very low as compared to developed countries of the world like Italy (9478 kg / ha), USA (7974 kg/ha), worldwide yield (6738 kg/ha) (FAO 2014). In another study maize production in USA 9747 kg/ha and China 4480 kg/ha (Thapa, 2021).

Maize is the second most important cereal Crop in Gilgit Baltistan after wheat. The total production of maize in Gilgit Baltistan was 13263.98 Mt and was cultivated on an area 19685.56 ha (Gilgit Baltistan statistical survey report, 2014). Nowadays, yield level is much lower than the potential of existing varieties. Main constraints to enhance maize productivity are suboptimum plant density, inadequate fertilizer use, inadequate water supply, weed infestation, insect pest attack and the selection of unproductive varieties in a given environments (Abate et al., 2015). Adoption of healthy high yielding suitable varieties not only improves the grain yield and fetches higher income per hectare as compared to conventional varieties of maize (Gebre et al., 2021). The purpose of current study was to compare the production potential of different maize varieties and to select a suitable one for maximum yield potential under the local conditions of Gilgit Baltistan.

Maize (*Zea mays* L.) is Pakistan's third most important cereal, supporting food, feed, and agro-industry; yet on-farm yields remain below potential due to suboptimal cultivar choice and management under diverse agro-ecologies (AARI, n.d.). In Khyber Pakhtunkhwa (KP) and adjacent high-altitude districts of Gilgit-Baltistan (GB), varietal selection and locally adapted agronomy are particularly consequential because short growing seasons, water constraints, and temperature extremes shape performance (Tuladhar et al., 2022). Evaluating locally popular open-pollinated varieties (OPVs) such as Azam, Jalal, Pahari and regional checks (e.g., Sarhad White) alongside introduced germplasm (e.g., ZM521) therefore remains a practical pathway to closing yield gaps.

Variety performance in northern Pakistan

Multi-genotype trials in KP consistently report significant genotypic differences for plant height, ears plant⁻¹, kernel number and grain yield under RCBD field designs, frequently ranking Azam and advanced lines above Pahari and Jalal in specific site-years (The PAB, 2018; Anjum et al., 2018). Recent factorial or split-plot experiments that include Azam, Jalal, Pahari and Sarhad White also show method-of-planting interactions, with ridge/bed planting or optimized row spacing improving yield formation relative to broadcast/line sowing (Bakht et al., 2011; Ali et al., 2022). Complementary studies from Mansehra suggest Azam's higher biological and grain yield under balanced N management compared with other local genotypes (Nawaz et

al., 2019). Seedling-stage screening has further revealed genotype-specific root architectural responses under drought, with Jalal showing distinct morphology among Azam, Pahari and other cultivars (Ullah et al., 2023).

Yield components driving productivity

Across Pakistan and comparable semi-arid environments, grain yield correlates strongly with grains per cob/row, rows per cob, cob length and 100-grain weight (Khan et al., 2019; Alvi et al., 2025). Correlation analyses and variance components consistently identify number of grains per row and rows per cob as major contributors to yield, aligning with your measured traits (Khan et al., 2019; Alvi et al., 2025). Under combinations of cultivar $\times$ irrigation $\times$ N $\times$ planting date, rows per ear and grains per row remain sensitive, high-leverage traits for improving yield stability (Soufizadeh et al., 2021).

Management practices and plant population

Row configuration and plant density markedly alter canopy architecture and light interception, mediating yield potential (Ali et al., 2022). Pakistani trials in the semi-arid zone (Mardan) indicate that flat planting at 60 cm rows or ridge-furrow systems can maximize grain yield compared with wide twin-row beds, while leaving phenology largely unchanged (Ali et al., 2022). These findings are consistent with broader evidence that appropriate spacing and stand uniformity underpin kernel number and ear size, thus driving final yield (Gomez & Gomez, 1984; Nafziger, 1996; Sangoi, 2001).

Climate and high-altitude context in GB

In the Upper Indus Basin (UIB)—encompassing GB—farmers face increasing water variability, shortened or shifting seasons and rising pest pressure; all of which amplify the value of resilient cultivars and timely management (Tuladhar et al., 2022). Crop-system modeling and empirical studies show that adjusting sowing windows, optimizing N, and selecting earlier-maturing yet high-sink cultivars can buffer yield losses under warming and water stress (Sah et al., 2020; Soufizadeh et al., 2021). These insights support local testing under GB's single to marginal double-cropping zones.

ZM521 and the role of improved OPVs

CIMMYT's ZM521 is an early/medium-maturing white-grain OPV bred for drought tolerance, nitrogen-use efficiency, and resistance to key foliar diseases (GLS, MSV, TLB) across dry/wet mid-altitudes—ecologies analogous to parts of northern Pakistan (CIMMYT, 2022). Product profiles and regional fact sheets report robust adaptation and competitive yield potential relative to traditional OPVs (Lake Agriculture, 2020; CIMMYT, 2010). Including ZM521 in local RCBD trials alongside Azam, Jalal, Pahari and Kohistan White is therefore agronomically defensible, and aligns with Pakistan's wider effort to evaluate and commercialize stress-resilient CIMMYT materials (MAIZE.org, n.d.).

Synthesis and gap

Taken together, regional trials indicate significant, actionable genetic variation among Azam, Jalal, Pahari, Sarhad/Kohistan White and related lines for the very traits you measured (ears/plot, rows per cob, grains per cob, grain and stalk yields). Management—especially row spacing/planting method and balanced N—modulates expression of these traits. Under GB's high-mountain constraints, pairing earlier-maturing, stress-tolerant OPVs like ZM521 with locally favored lines (Azam/Jalal) and GB-specific planting windows is a promising route to resilience and higher yield. Your study adds needed evidence from Diamer's on-farm conditions, where published data remain sparse but the climatic rationale is strong (Tuladhar et al., 2022).

Materials and Methods

Research area

A field experiment to evaluate the yield performance of different maize cultivars under the local conditions of Goner Faram GB was carried out at the Field Crop Research station Goner Faram during the year 2023.

Research design and time

The experiment was laid out in randomized complete block design (RCBD) with 3 replications having a net plot size of 3m into 5m. Crop was sown on 12th July 2023 on well prepared seed beds with dibbling method using rate of 2 seeds per hill or 25kg/ha with row to row and plant to plant distance of 75cm and 20cm respectively. Fertilizer was applied @ 250kg N, 120 kg P and 125kg k /ha. Half of the N and all the P & K were applied at sowing in the form of urea, single super phosphate and sulphate of potash, While the remaining nitrogen was applied at the knee height stage. The plant population was controlled in all treatments by gap filling and thinning after germination. The crops were harvested when it reached physiological maturity.

Morphological data

The plant morphological data was recorded in laboratory book. The data was taken before harvest at plant maturity. This was undertaken by using laboratory measuring scales and measuring taps available at the research station in collaboration with directorate of agricultural research.

RESULTS AND DISCUSSION:-

An experiment was carried out to evaluate the yield performance of different maize varieties under the local conditions of Goner Faram Diamer. The statistically analyzed data along with their discussion interpretation regarding the yield performance of different varieties are presented in this chapter.

Plant population:

Plant population at harvest is presented in Table-1. Statistical analysis of the data showed that the varieties did not affect significantly. These results did not differ with those reported by (Atere et al., 2016) who also recorded similar plant population among various maize varieties. This study also correlate with work of (Husna et al., 2022) in which he employed integrated nutrient management practice for better growth in various varieties of maize. The plant population in general was not

significantly effected under different nitrogen dosages reported by (Arshad et al., 2020) which coincide with the current study.

Plant Height:

Plant height is a genetically as well as environmentally controlled factor and different varieties have different plant heights. Data in table-1 indicate significant differences among the varieties. Maximum plant height (216.80 cm) was recorded in Kohistan White, followed by Zimbabwe line (open pollinated varieties) (213.73 cm), Jalal (210.00 cm). The minimum plant height (194.33 cm) was recorded in Azam. This was due to the fact that plant height is a genetically controlled factor so that height of different varieties does not remain same. These results are in accordance with the results of (Al-fatlawy et al., 2022), who reported differences in plant height for the maize varieties under this study. A similar study also report that plant height maybe higher in varieties like Pahari and Kohistan followed by Jalal and Azam (Arshad et al., 2020), in the cited study the researcher tested various maize varieties with split nitrogen doses in different agro climatic zones of Gilgit-Baltistan.

Number of Cobs harvested/plot:

The number of cobs/plot in table-1 showed that the number of cobs/plot significantly affected the crop yield and more number of cobs/plot resulted in more grain yield. Maximum number of cobs/plot (80.66) was recorded in variety Pahari and Azam (78.33). Minimum number of cobs/plot (63.66) was found in Zimbabwe line, while Jalal and Kohistan white (71.66) showed similar results. The number of cobs/plot is also a genetically controlled factor. These results were also reported by (Al-fatlawy et al., 2022), who depicted significant variations in number of cobs/plot for the tested varieties of maize. A study conducted by (Arshad et al., 2020) also reported such results where he compared various varieties of maize in which his result showed best performance (higher no. of cobs) in Pahari followed by Azam under a test dose of nitrogen in MARC, a Federal govt. research Centre in Jaglot valley district Gilgit. .

The Number of Rows/Cob:

The number of rows/cob is also genetically controlled factor but environmental and nutritional level may also get influence the number of rows/cob. More number of rows/cob resulted more grain yield. Maximum number of cobs per hectare was found in Azam (15.067). Minimum No of rows/cob was recorded in ZM521 (13.333). Varieties Jalal, Pahari and Kohistan White (14.66, 14.00, 14.20) showed nearly similar results. The statistical data showed that the number of rows did not affect significantly with each other in our study (A.-F. Ali et al., 2023). The rows/cob was also reported higher in a study conducted by (Arshad et al., 2020), where Azam showed good results (9.3) followed by Pahari(8) local(7.5). this study also satisfies the current study.

No. of Grains /Cob:

Grain yield is directly related to number of grains/cob. The more number of grains/cob results in more grain yield. The statistical data showed that the no. of grains/cob is significantly affect with the variety Jalal (574.93) Pahari (510.60) Zimbabwe line- (ZM521) (533.47) while variety Kohistan white (577.43) and Azam

(586.27) shows similar results. Maximum number of grains/cobs (586.27) was found in Azam. Minimum number of grains/cob (510.60) was found in Pahari. These results were also reported by (Al-fatlawy et al., 2022) which reported nearly similar performance of Jalal Pahari and best results in Azam variety.

Grain yield t/ha:

Grain yield is a factor which is related to many other factors like plants population, number of cobs /plot, Number of rows /cob. Increase or decrease in any of the above factor may affect the crop yield. Statistical analysis showed non-significant differences for grain yield among the varieties. Variety Kohistan white produced highest grain yield of (6.823 t/ha). The lowest yield of 4.880 t/ha was noted in Zimbabwe line- (ZM521). The grain yield in the test varieties ranged between 6.046 to 6.286 t/ha. Similar results were reported by (Madan et al., 2021) who evaluated and identified high yielding maize varieties. (Ullah et al., 2017) and (A.-F. Ali et al., 2023) also reported similar for grain yield in various varieties of maize.

Stalk yield t/ha:

Data regarding stalk yield t/ha is given in Table-1. The statistical analysis of the data showed that stalk yield t/ha did not affected significantly. Maximum stalk yield per hectare was found in Kohistan White (19.553) ZM521 (19.330). The varieties Jalal and Azam showed similar results (19.330) (18.773). Minimum stalk yield t/ha (13.773) was found in variety Pahari, non-significant differences were recorded in this study and the results are in line with (Zahra et al., 2020).

Table -1: Evaluation of Yield Performance of different maize varieties under local conditions of Goner Farms District Diamer Gilgit Baltistan

Variety	Plant population at harvest	Plant Height	No of Cobs harvested/plot	No of lines/row per Cob	No of seeds/Cobs	Grain Yield/hectare	Stalk yield/hectare
Jalal	82.333 A	210.00 AB	73.667 BC	14.667 A	574.93 AB	6.0467 A	18.220 A
Pahari	82.667 A	187.13 C	80.667 C	14.000 A	510.60 B	5.5700 A	13.773 B
Kohistan White	84.000 A	216.80 A	71.667 C	14.200 C	577.47	6.8233 A	19.553 A
Zimbabwe Line	78.667 A	213.73 A	63.667 D	13.333 A	523.47 AB	4.8800 A	19.330 A
Azam	86.000 A	194.33 BC	78.333 AB	15.067 A	586.27 A	6.2867 A	17.773 A
LSD	9.0755	18.064	6.305	1.936	65.845	2.223	2.818

CONCLUSION:

In the current study evaluation of the yield performance of different Maize (*Zea mays* L) varieties under local conditions of Goner Farm. The tested varieties under local conditions of Goner Faram, Azam and Kohistan White producing highest yield than other tested varieties. a ZM521 producing lowest yield (kg), so Kohistan white is suitable variety for producing maximum Yield. ZM521 Produced highest stalk yield in the local conditions of Goner faram GB (Zahra et al., 2020). Kohistan white can be successfully grown in Goner Faram due to best adaptation and best performance on the basis of local conditions as compared to other maize varieties. Further experimentation for more performance is required.

Table -2: ANOVA Table of Various Agronomic Parameters (Mean Squares)

Source	D.F	Plant Population	Plant Height	No. of Cobs/plant	No. of rows/con	No. of seeds/cob	Grain Yield/hectare	Stock Yield/hectare
Rep	2	12.066	114.792	37.800	1.810	4409.27	0.087	8.108
Variety	4	21.733	503.780	131.067	1.309	3633.28	1.627	16.3363
Error	8	22.233	92.092	11.217	1.057	1222.99	1.394	2.240
Total	14	296.993	2981.44	689.600	17.314	33135.6	17.842	99.489

References

- Abate, T., Shiferaw, B., Menkir, A., Wegary, D., Kebede, Y., Tesfaye, K., Kassie, M., Bogale, G., Tadesse, B., & Keno, T. (2015). Factors that transformed maize productivity in Ethiopia. *Food Security*, 7(5), 965–981.
- Al-fatlawy, A. O., Khaleel, A. H., Merjan, H. A. K., Alenawey, A. W., & Ali, M. S. (2022). Evaluation of the performance of some cultivars of corn (*Zea mays* L .) in three planting dates . 14(1).
- Ali, A.-F., Khaleel, A., Merjan, H., Alenawey, A., & Ali, M. (2023). Evaluation of the performance of some cultivars of corn (*Zea mays* L.) in three planting dates. *Euphrates Journal of Agricultural Science*, 14(1), 171–176.
- Ali, A., Adnan, M., Abbas, A., Javed, M. A., Safdar, M. E., Asif, M., Imran, M., Iqbal, T., Rehman, F. U., & Ahmad, R. (2020). Comparative performance of

- various maize (*Zea mays* L.) cultivars for yield and related attributes under semi-arid environment. *Agricultural and Biological Research*, 36(4), 63–66.
- Arshad, M., Ahmed, S., Nafees, M. A., Karim, A., & Ullah, S. (2020). Response of maize varieties to different nitrogen levels under agro-climatic condition of Gilgit-Baltistan. *Pure and Applied Biology*, 9(2), 1541–1546.
- Atere, A. O., Olalusi, A. P., & Olukunle, O. J. (2016). Physical properties of some maize varieties. *Journal of Multidisciplinary Engineering Science and Technology*, 3(2), 3874–3880.
- Erenstein, O., Jaleta, M., Sonder, K., Mottaleb, K., & Prasanna, B. M. (2022). Global maize production, consumption and trade: trends and R&D implications. *Food Security*, 14(5), 1295–1319.
- Gebre, G. G., Mawia, H., Makumbi, D., & Rahut, D. B. (2021). The impact of adopting stress-tolerant maize on maize yield, maize income, and food security in Tanzania. *Food and Energy Security*, 10(4), e313.
- HUSNA, A. (2022). GROWTH AND YIELD OF MAIZE VARIETIES AS INFLUENCED BY INTEGRATED NUTRIENT MANAGEMENT.
- Madan, S. G., Singh, A. K., Shukla, R. N., & Souvik, H. M. (2021). Physico-chemical properties of different corn (*zea mays*) varieties. *International Journal of Food and Nutritional Sciences*, 11, 557–564.
- Martinez, E. L., & Fernandez, F. J. B. (2019). Economics of production, marketing and utilization. In *Corn* (pp. 87–107). Elsevier.
- Shafique, M., Hussain, A., & Arshad, M. (2014). The Country Report Maize in Pakistan. *Maize for Food, Feed, Nutrition and Environmental Security*, 282.
- Thapa, R. (2021). A detail view on status and prospect of maize production in Nepal. *Food and Agri Economics Review*, 1(1), 52–56.
- Ullah, M. J., Islam, M. M., Fatima, K., Mahmud, S., Rahman, J., & Akhter, S. (2017). Comparing modern varieties of white maize with local races: ear characters. *J. Expt. Biosci*, 8(2), 49–58.
- Zahra, N., Raza, Z. A., & Mahmood, S. (2020). Effect of salinity stress on various growth and physiological attributes of two contrasting maize genotypes. *Brazilian Archives of Biology and Technology*, 63, e20200072.
- Ali, S., Haq, Z. U., Malik, A., Khalil, T. M., & Khan, I. A. (2022). Maize yield performance under planting patterns and row spacing in semi-arid zone of Pakistan–Mardan. *Sarhad Journal of Agriculture*, 38(5), 26–34.
- Anjum, S. A., Shahzad, K., Hussain, M., et al. (2018). Phenology and yield response of different maize varieties to spt nitrogen application in Peshawar Valley. *Pure and Applied Biology*. PDF:
- AARI (Ayub Agricultural Research Institute). (n.d.). Maize and millets—crop varieties (overview for Punjab, Pakistan).
- Alvi, A. et al. (2025). Genetic diversity and yield determinants in maize (*Zea mays* L.). *IJERT Conference Proceedings*. PDF:
- Bakht, J., Shafi, M., Rehman, H., Uddin, R., & Anwar, S. (2011). Effect of planting methods on growth, phenology and yield of maize varieties. *Pakistan Journal of Botany*, 43(3), 1629–1633. PDF:
- CIMMYT. (2010). Maize—improved OPVs (including ZM521) for stress-prone

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

environments. Program note.

CIMMYT. (2022). ZM521—product page (traits, target ecologies). Available at:

Gomez, K. A., & Gomez, A. A. (1984). *Statistical Procedures for Agricultural Research* (2nd ed.). John Wiley & Sons. (Cited in: Ali et al., 2022 reference list).

See methodological context:

Khan, A., et al. (2019). Phenotypic correlation coefficient studies to determine yield contributors in maize. *Saudi Journal of Life Sciences*, 5(6), 113–116.

MAIZE.org (CGIAR). (n.d.). Pakistan—projects on evaluation/commercialization of drought/heat-resilient CIMMYT maize hybrids.

Nafziger, E. D. (1996). Effects of missing and two-plant hills on corn grain yield. *Journal of Production Agriculture*, 9(2), 238–240. <https://doi.org/10.2134/jpa1996.0238>

Nawaz, M., et al. (2019). Phenological traits and yield of different maize genotypes as affected by nitrogen sources in Mansehra, Pakistan. *International Journal of Biosciences*, 15(4), 303–311.

Sah, R. P., Chakraborty, M., Prasad, K., et al. (2020). Impact of water-deficit stress in maize: phenology and yield components. *Scientific Reports*, 10, 2944. <https://doi.org/10.1038/s41598-020-59689-7>

Soufizadeh, S., Munaro, E., McLean, G., et al. (2021). Phenotypic traits, grain yield and yield components of maize cultivars under combinations of management practices in semi-arid Iran. *International Journal of Plant Production*, 15, 359–372. <https://doi.org/10.1007/s42106-021-00151-7>

The PAB (2018). Evaluation of eight maize genotypes for yield and yield contributing traits (includes Azam, Jalal, Pahari, Sarhad White). *Pure and Applied Biology*.

Tuladhar, S., Hussain, A., Baig, S., et al. (2022). Climate change, water and agriculture linkages in the Upper Indus Basin: a field study from Gilgit-Baltistan and Leh-Ladakh. *Frontiers in Sustainable Food Systems*, 6, 1012363. <https://doi.org/10.3389/fsufs.2022.1012363>