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**Title: Retrospective analysis of Maize breeding for the humid tropic in México**

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# Maize

*Maize is the most important crop in Mexico because it is the base of the human consumption, 7.4 million hectares are planted and we have a production of 26.55 million tons. From this production 19.35 million tons are used for the direct consume which of them, 33% is through the flour industry and 67% through the masa and tortilla industry in the nixtamalization process*



## *Uses of maize*

*Maize in Mexico have multiple uses as grain, fodder and industrial use; however, the most important use is the direct consumption through the tortillas, tamales, Huchepos, Corundas, Atoles, Totopos, Tlayudas, Pozole, among others. Through the nixtamalization process, there have been created multiple dishes and ways for direct consumption.*



## *Objectives*

*The objectives of this research were: To elaborate an historical review on the genetic improvement of maize for the tropics, varieties, hybrids and synthetics of improved maize seed used by farmers.*



# Methodology

*Localization. The area of influence the maize breeding program of the Cotaxtla Experimental station, is the humid and sub-humid tropical region of Mexico, at altitudes ranging from 0 to 1200 meters above sea level in the coast region of the Gulf of Mexico and the Pacific Ocean.*

*Procedure. In maize breeding for the humid tropics of Mexico, population breeding, hybridization, and synthesis are used.*



## *Maize breeding*

*Maize breeding program generates byproducts such as open-pollinated varieties, synthetics and hybrids. The genetic resources that have served as the basis for genetic improvement have included native maize collections, the integration of maize germplasm composites with a broad genetic base (CABGs) that function as genetic repositories for getting inbred lines or in recurrent selection.*



**Table 1**  
**Hybrids and maize**  
**varieties released**  
**for the humid**  
**tropic in México**  
**1952 a 2025**

<i>Genotype</i>	<i>Description</i>	<i>Registration number</i>	<i>Year of release</i>
<i>V-520C</i>	<i>Open pollinating Variety</i>		<i>1952</i>
<i>H-503</i>	<i>Double cross Hybrid</i>		<i>1955</i>
<i>H-507</i>	<i>Double cross Hybrid</i>		<i>1961</i>
<i>V-522</i>	<i>Open pollinating Variety</i>		<i>1975</i>
<i>VS-523A</i>	<i>Synthetic variety</i>		<i>1975</i>
<i>V-524</i>	<i>Open pollinating Variety</i>		<i>1975</i>
<i>H-510</i>	<i>Double cross Hybrid</i>		<i>1975</i>
<i>VS-525</i>	<i>Synthetic variety</i>		<i>1981</i>
<i>H-511</i>	<i>Single cross Hybrid</i>		<i>1981</i>
<i>V-530</i>	<i>Open pollinating Variety</i>	<i>MAZ-501-251104</i>	<i>1989</i>
<i>V-531</i>	<i>Open pollinating Variety</i>		<i>1990</i>
<i>V-532</i>	<i>Open pollinating Variety</i>		<i>1990</i>
<i>V-534</i>	<i>Open pollinating Variety</i>	<i>MAZ-502-251104</i>	<i>1990</i>
<i>VS-536*</i>	<i>Synthetic variety</i>	<i>MAZ-511-251104</i>	<i>1992</i>
<i>H-512</i>	<i>Double cross Hybrid</i>	<i>MAZ-428-030904</i>	<i>1993</i>
<i>H-513*</i>	<i>Single cross Hybrid</i>	<i>MAZ- 429-030904</i>	<i>1994</i>
<i>H-519C</i>	<i>High quality protein hybrid</i>	<i>MAZ-432-030904</i>	<i>2000</i>
<i>V-537C*</i>	<i>High quality protein variety</i>	<i>MAZ-503-251104</i>	<i>2000</i>
<i>V-556AC</i>	<i>High quality protein variety and yellow grain</i>	<i>MAZ-505-251104</i>	<i>2001</i>
<i>H-520*</i>	<i>Híbrido trilineal</i>	<i>MAZ-984-240209</i>	<i>2004</i>
<i>H-564C</i>	<i>High quality protein hybrid</i>	<i>MAZ-1018-260210</i>	<i>2010</i>
<i>H-518*</i>	<i>Trilinear hybrid</i>	<i>MAZ-2220-191120</i>	<i>2023</i>
		<i>(Obtentor) 3154</i>	
<i>V-540*</i>	<i>Open pollinating Variety</i>	<i>4849-MAZ-2644-301024/C</i>	<i>2025</i>



## *Maize breeding program*

*Over seven decades of continuous research, 16 hybrids, 10 open-pollinated and 3 synthetic varieties have been released, with great acceptance by farmers. Among them, the following are currently in use: H-520, H-518, VS-536, V-537C, and V-540 ([Sierra et al., 2025](#); [Sierra et al., 2019](#)).*



## *Use of Improved Seed*

*Seed is undoubtedly the number one input in production, as it represents the yield potential and quality of the product. After the official release of a genotype, it is important to inform farmers, technicians, and seed producers about the benefits of the genetic material, as well as its performance and advantages for commercial seed production. This requires having seed of high genetic, physiological, physical, and sanitary quality ([Sierra et al., 2016](#)).*



# *Seed production*

*INIFAP produces corn seed in basic and registered categories of varieties, hybrids, and their parents of outstanding genotypes adapted to the tropical region in southeastern Mexico. This seed is supplied to producers and/or companies that produce certified seed for commercial use by farmers. VS-536 is the synthetic variety and H-520 is the hybrid, both with the highest use of improved seed in southeastern Mexico.*



## *Conclusions*

*The tropical maize breeding program has generated hybrids and varieties with agronomic advantages, as well as advantages in commercial seed production.*

*There is outstanding maize germplasm that has been adopted by seed producers and groups, as well as by farmers in southeast of Mexico.*



## References

### *Basics*

García., M.E. 2004. [Modificaciones al sistema de clasificación climática de Köppen](#). 5ª Ed. Universidad Nacional Autónoma de México. Instituto de Geografía. México DF México 246p.

Hallauer A., R. and J.B Miranda. 1981. [Quantitative genetics in maize breeding](#). Iowa State University Press.

Servicio de Información Agroalimentaria y Pesquera (SIAP) 2022. [Servicio de Información Agroalimentaria y Pesquera. Acciones y programas Producción agrícola](#). Secretaría de Agricultura, Ganadería y Desarrollo Rural (SADER). Disponible en: [http://www.gob.mx/siap/acciones y programas de producción agrícola](http://www.gob.mx/siap/acciones-y-programas-de-produccion-agricola). (Cons. 31 de julio del 2023). s/p.

Servicio Nacional de Inspección y Certificación de Semillas (SNICS) 2014. [Manual gráfico para la descripción varietal de maíz \(Zea mays L.\)](#). México D.F. 39 p.

### *Supports*

Andrés M., P.; Vázquez C., G.; Sierra M., M.; Mejía C., J.A.; Molina G., J.D.; Espinosa C., A.; Gómez M., N.; López R., G.; Tadeo R., M.; Zetina C., P.; Cebada M., M. 2017. [Genotype environment interaction on productivity and protein quality of synthetic tropical maize \(Zea mays L.\) varieties](#). *Interciencia* Vol 42 (9): 578-585.

Andrés M., P.; Vázquez C., M.G.; Sierra M., M.; and Espinosa C., A. 2016. [Calidad de grano en variedades sintéticas tropicales de maíz](#). *Revista de Ciencias Naturales y Agropecuarias* Vol.3 (8): 9-16

Andrés M., P.; Sierra M., M.; Mejía C., A.; Molina G., J.D.; y Espinosa C., A. Gómez M., N.O.; Valdivia B., R. 2014. [Genotype-environment interaction in tropical maize varieties developed for the tropical Region of Veracruz, Mexico](#). *Interciencia* Vol. 39 (3): 180-184

Reyes C., P. 1990. [Diseño de experimentos aplicados](#). Ed Trillas 3ª Ed. México D.F. 348p

### *Antecedents*

Sierra, M. M., Cano R., O.; Palafox C., A.; Tosquy V., O.H.; Espinosa, C., A.; Rodríguez, M. F. A. 2005. [Progreso del Mejoramiento genético de maíz \(Zea mays L.\) en el trópico húmedo de México](#). *Agricultura Técnica en México* Vol. 31 (1): 21-32

Sierra, M. M., Rodríguez, M. F. A., Espinosa, C., A.; Andrés M., P. 2018. [Adaptabilidad de híbridos trilineales de maíz en el área tropical de los estados de Veracruz y Tabasco, México](#). *Revista de Ciencias Ambientales y Recursos Naturales* Vol. 4 (11): 15-19.

Sierra M., M.; Rodríguez M., F.A.; Palafox C., A.; Espinosa C., A.; Andrés M., P.; Gómez M., N.; Valdivia B., R. 2016a. [Productividad de semilla y adopción del híbrido de maíz H-520 en el trópico de México](#). *Revista Agricultura Sociedad y Desarrollo* Vol 13 (1): 19-32

Sierra, M. M., Rodríguez, M. F. A., Palafox, C. A., Espinosa, C., A. 2016. [Adopción e impacto de la variedad VS-536 en la región tropical del sureste de México](#). *Revista de Desarrollo Económico* Vol 3 (9): 32-40



Sierra M., M; Márquez S., F.; Valdivia B., R.; Córdova O., H.; Lezama G., R.; Pescador R., A. 2004. [Uso de probadores en la selección de líneas para formar híbridos de maíz \(\*Zea mays\* L\).](#) *Agricultura Técnica en México* Vol 30 (2): 169-181

Sierra, M. M., Rodríguez, M. F. A., Gómez M., N.; Espinosa, C., A.; Ugalde A., F.J.; Andrés M., P. 2019. [Mejoramiento genético de maíz para el trópico húmedo de México.](#) En: *Avances en Investigación agrícola, Pecuaria, Forestal, Acuícola, Pesquería, Desarrollo Rural, Transferencia de Tecnología, Biotecnología, Ambiente, Recursos Naturales y Cambio Climático.* INIFAP, CP, UACH, INAPESCA, UV, TECNIM, Medellín, Ver. p. 482-499.

Sierra M., M; Palafox c., A.; Rodríguez M., F.; Espinosa C., A.; Vásquez C., G.; Gómez M., N.; Filiberto Caballero H., F.; Barrón F., S.; Zambada M., A. 2008. [H-520, híbrido trilineal de maíz para el trópico húmedo de México.](#) *Agricultura Técnica en México* 34(1): 119-122.

Sierra, M. M.; Ríos I., C.; Marín A., A.I.; Fierro L., R.M.; 2024. [Genetic diversity of native maize for the intermediate region in Veracruz state, México.](#) *Journal of Environmental Sciences and Natural Resources* Vol. 10 (25): 1-8

Sierra, M. M.; Ríos I., C.; Gómez m., N.O.; Barrón F., S. 2025. [V-540, New maize \[\*Zea mays\* L.\] variety for the humid tropic in México.](#) *Journal of Environmental Sciences and Natural Resources* Vol. 11 (26): 1-8

Reyes C., P. 1971. [Genotecnia del maíz para tierra caliente.](#) Instituto Tecnológico y de Estudios Superiores de Monterrey. División de ciencias agropecuarias y marítimas. Departamento de agronomía. Monterrey, N.L. 138 p.

Larkins, B., A.; Danneffer, D.,F.; Bostwick, E.,O.; Moro G.,A.; and M.A. Lopez. 1994. [Opaque 2 modifiers, what they are and how they work,](#) In: [Quality protein maize. 1964-1994.](#) *Proc. of the international symposium on quality protein maize.* EMBRAPA/CNPMS, Sete Lagoas MG Brasil. December 1-3 1994, p. 133-148.

Mertz, E., T. 1994. [Thirty years of opaque 2 maize. In: Quality Protein Maize.](#) 1964-1994. *Proc. of the international symposium on quality protein maize.* EMBRAPA/CNPMS, Sete Lagoas M. G. Brasil. p 1-10.

Wellhausen, E. J. 1978. [Recent development in maize breeding in the tropics.](#) In: Walden, D. B. (ed.). *Maize breeding and genetics.* Wiley, NY, USA. p. 59-84.

### ***Discussions***

Márquez S., F.; Ramírez V., P.; Córdova O., H. 1983. [Variedades sintéticas de maíz.](#) Colegio de Postgraduados. Editorial CP. Chapingo, México. 70 p.

Reyes C., P. 1985. [Fitogenotecnia básica y aplicada.](#) AGT Editor, México. 460 p.





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