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Investigation note

Evaluation of canola varieties and elite lines in Southern Sonora

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Abstract

Canola is a type of rapeseed (*Brassica napus* L. and *B. rapa* L.) which was genetically improved in Canada; it was achieved that the seed had less than 2% erucic acid in the oil and less than 30 micromoles of glucosinolates per gram of meal and in this way, it can be used in human and animal food. Limited water availability is also a recurring problem, forcing producers to look for water-efficient crop options such as canola. This study aimed to identify varieties and elite lines of canola with high yield potential, which allows their recommendation for sowing to producers. The research was established at the Norman E. Borlaug Experimental Field-INIFAP, in Ciudad Obregón, Sonora, Mexico. The sowing was carried out on November 24, 2020, in the autumn-winter 2020-2021 agricultural cycle. A yield trial was carried out on 10 elite lines and six varieties of canola; demonstration plots of five elite lines and five varieties of canola were also set up. The following agronomic traits were established: beginning of flowering (20% of the plants have the first flowers), physiological maturity (80% of the plants show typical coloration), recorded in days after sowing (DAS), lodging, plant height, hectoliter weight (HW), and grain yield (kg ha^{-1}). The canola varieties with the highest yields were Centenario, Aztecan, and Canorte. Outstanding elite lines, such as SEL-M-F3-445 and SEL-F3-135, were identified, which outperformed commercial varieties in yield and agronomic behavior, making them important for the release of new varieties. Based on the yields obtained from the different varieties evaluated, it is feasible to recommend them for sowing to producers in the region of Ciudad Obregón, Sonora.

Palablas clave:

Brassica napus L., Aztecan, Canorte, Centenario, production.

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Canola is a type of rapeseed (*Brassica napus* L. and *B. rapa* L.) that was genetically improved in Canada, which made the seed have less than 2% erucic acid in the oil and less than 30 micromoles of glucosinolates per gram of meal and in this way, it can be used in human and animal food (Castillo, 2004; Ríos *et al*., 2013). In Mexico, a production of 4.07 thousand tons was obtained in 2016; however, only 7.49% of the national requirement of this oilseed is covered; there are estimates of a potential production of 6.18 and 7.77 thousand tons for the years 2024 and 2030, respectively (SAGARPA, 2024). Also, the limited availability of water is a recurring problem, which forces producers to look for crop options, such as canola, because it is feasible to produce 1 613 kg ha^{-1} with supplemental irrigation in semi-arid areas (Ortegón *et al*., 2006) and because it has low production costs and low water requirements (Castillo *et al*., 2004; Inzunza *et al*., 2010). In this sense, in Southern Sonora, around 350 000 ha can be sown in the autumn-winter cycle (SIAP, 2024), where a small number of crops that require high volumes of water for irrigation are sown. The study aimed to identify canola varieties and elite lines with high yield potential, which allowed their recommendation to producers for sowing.

The study was established at the Norman E. Borlaug Experimental Field-INIFAP, in Ciudad Obregón, Sonora, Mexico. A yield trial was carried out on 10 elite lines and six varieties of canola and demonstration plots of five elite lines and five varieties of canola were established. The sowing was carried out on November 24, 2020, in the autumn-winter 2020-2021 agricultural cycle. During the development of the crop, the canola technological package recommended by INIFAP was used (Castillo, 2004; López and González, 2005). It was established in a clay soil (> 50% clay) and under irrigated conditions. It was fertilized in pre-sowing with the formula 149-52-00 (N-P-K), with the application of 300 kg ha^{-1} of urea (46% of N) and 100 kg ha^{-1} of MAP (11-52-00).

The herbicide Trifluralin 480 g of ai L^{-1} was applied in doses of 2 L ha^{-1} in pre-sowing for the control of broadleaf and narrow-leaved weeds. A final population of 15 plants per linear meter was obtained. There were no problems with pests, diseases, and weeds. In the yield trial, an experimental design of randomized blocks with four replications was used; the experimental plot was four rows 0.8 m wide by 6 m long (19.2 m^2) and the useful plot was the two central rows 5 m long (8 m^2). The demonstration plots were eihgt rows 0.8 m wide by 100 m long (640 m^2); to evaluate grain yield, six samples of two rows 5 m long (8 m^2) were obtained. The following agronomic traits were recorded: beginning of flowering (20% of plants with the first flowers present), in days after sowing (DAS); physiological maturity (Physiol. Mat. 80% of the plants show typical coloration); lodging (0= without lodging; 10= 100% lodged); plant height in cm; hectoliter weight (HW) in kg hl^{-1} and grain yield (kg ha^{-1}) with 8% moisture, and they were statistically analyzed by analysis of variance (Anova) with a Tukey test at 0.05 through the statistical program of SAS, 9.4, 2023.

As can be seen in Table 1 yield trial and Table 2 demonstration plots, except for the Ortegón and IMC 205 varieties with 127 and 131 DAS to physiological maturity, the rest presented an early cycle, where the SEL-M-F3-406 and SEL-M-F3-414 lines and the Centenario variety stood out with 118 DAS, which agrees with what was mentioned by Escalante *et al*. (2016), who report physiological maturity at 117 DAS in different canola genotypes.

Table 1. Variables measured in the yield trial of 10 elite lines and six varieties of canola.

Variety or elite line	Beginning of flow (DAS)	Physiol. Mat. (DAS)	Lodging (0-10)	Height (cm)	HW (kg hl^{-1})	Yield (kg ha^{-1})
SEL-M-F3-445	56	120	4	155	66	3 005 a
Centenario	55	118	3	145	66	2 889 ab
SEL-M-F3-123	54	120	3	130	66.5	2 887 ab
Canorte	62	122	6	160	65	2 874 ab
SEL-M-F3-406	54	118	4	120	66.5	2 874 ab
Aztecan	56	120	3	150	66.5	2 853 ab
SEL-M-F3-129	55	120	2	130	66	2 851 ab

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Variety or elite line	Beginning of flow (DAS)	Physiol. Mat. (DAS)	Lodging (0-10)	Height (cm)	HW (kg hl^{-1})	Yield (kg ha^{-1})
CAN-VY-P3C2-4-5-41	55	120	5	155	66.5	2 845 ab
SEL-M-F3-135	56	120	4	135	66.5	2 774 ab
SEL-M-F3-414	54	118	4	140	65.5	2 768 ab
Canomex	55	122	2	135	66.5	2 752 ab
SEL-M-F3-358	53	120	4	120	67	2 727 ab
SEL-M-F3-54	55	120	4	125	64.5	2 701 ab
IMC-205	73	131	2	180	63	2 664 ab
SEL-M-F3-83	56	120	4	145	65.5	2 584 b
Ortegón	60	127	3	170	65.5	2 175 c

Different letters in the same column indicate significant differences, Tukey= 0.05.

Table 2. Variables measured in demonstration plots of five elite lines and five varieties of canola.

Variety or elite line	Beginning of flow (DDS)	Physiol. Mat (DDS)	Lodging (0-10)	Height (cm)	HW (kg hl^{-1})	Yield (kg ha^{-1})
SEL-M-F3-135	55	120	6	135	66.5	3 028 a
SEL-M-F3-54	54	122	5	125	64.5	2 959 ab
SEL-M-F3-83	54	120	6	145	65.5	2 944 ab
SEL-M-F3-406	54	118	2	120	66.5	2 885 ab
SEL-M-F3-414	55	118	4	140	65.5	2 821 ab
Centenario	54	118	3	145	66	2 792 ab
Aztecan	56	120	3	150	66.5	2 759 ab
Canomex	54	120	1	135	66.5	2 636 bc
Imc-205	73	131	3	180	63	2 342 c
Canorte	62	122	8	160	65	2 301 c

Different letters in the same column indicate significant differences, Tukey = 0.05.

Yield trial of 10 elite lines and six varieties of canola. Table 1 shows that the CAN-VY-P3C2-4-5-41 line and the Canorte variety were more susceptible to lodging, with records of 5 and 6, respectively. The varieties with the highest height were Ortegon and IMC-205, with 170 and 180 cm. In terms of yield, the SEL-M-F3-445 line and the Centenario variety stand out with 3 005 and 2 889 kg ha^{-1}, respectively.

Demonstration plots of five elite lines and five varieties of canola. Table 2 shows that the Canorte variety and the SEL-M-F3-135 and SEL-M-F3-83 lines were more susceptible to lodging, with records of 8, 6 and 6, respectively. The varieties with the highest height were Canorte and IMC-205 with 160 and 180 cm. Regarding yield, the SEL-M-F3-135 line and the Centenario variety stand out with 3 028 and 2 792 kg ha^{-1}, respectively.

In the yield trial and demonstration plots of canola varieties and elite lines, yields of 2 175 to 3 028 kg ha^{-1} were obtained; this agrees with Ortegón *et al*. (2006), who mention that, in the semi-arid zone of Tamaulipas, with supplemental irrigation, the Hyola 401, Hyola 308, and Hyola 330 hybrids and the ICM 204 variety averaged yields of 1 613 kg ha^{-1}. Likewise, in canola trials with a flatbed system (FBS) and densities of 90 seeds per m^2, García *et al*. (2022) report yields of up to 4 900 kg ha^{-1} with the Hyola 61 hybrid and the Bioaureo 2486 variety. In this sense, Escalante *et al*. (2016) report that applying nitrogen and sowing at short distances between rows result in greater water use efficiency, biomass, grain yield and oil yield, with the use of the canola genotypes Canada I, Canada II, and Westar. Inzunza *et al*. (2014) reports that canola achieves the highest grain yields and water use efficiency (3.3 t ha^{-1} and 0.585 kg m^{-3}) when it grows with 65 and 61%

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of usable soil moisture consumed (UMC) in the vegetative and reproductive stages, respectively. Some elite lines outperformed the varieties in yield, which is important for the purposes of releasing new varieties, if required.

Conclusions

The canola varieties with the highest yields were Centenario, Aztecan, and Canorte. Outstanding elite lines, such as SEL-M-F3-445 and SEL-F3-135, were identified, which outperformed commercial varieties in yield and agronomic behavior, making them important for the release of new varieties. Based on the yields obtained from the different varieties evaluated, it is feasible to recommend them for sowing to producers in the region of Ciudad Obregón, Sonora.

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