v. 4, n. 11, 2024

Journal of Agricultural Sciences Research

*Acceptance date: 19/09/2024*

# GENOTYPES FOR SAFFLOWER PRODUCTION IN BAJA CALIFORNIA SUR

***Jesú Navejas Jiménez***
Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias, INIFAP

***Lope Montoya Coronado***
Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias, INIFAP

***Militza Ochoa Xochitl***
Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias, INIFAP

***José Guadalupe Loya Ramírez***
Universidad Autónoma de Baja California Sur, UABCS

***Gustavo Mercado Mancera***
Departamento de Ciencias Agrícolas, FES-C, UNAM. Cuautitlán Izcalli, México

**Abstract:** In arid zones, socioeconomic systems are related to the sustainable use of natural resources, so the search for productive agricultural alternatives such as safflower represents an important economic value for the oil industry and great adaptability to these conditions. Thus, limiting factors can be evaluated through genotype trials in different locations. The objective of the present work was to know the production and determine the yield potential with the use of new safflower genetic materials. Eleven safflower genotypes were evaluated under drip irrigation conditions. A randomized block experimental design was used. No significant difference was found between treatments (P≥0.05). The highest yields were: 3.680, 3.555, 3.317, 3.101, and 3.059 t $ha^{-1}$ , obtained with M-CW-3268, S-323, C 63-OY, HUATSON OL and C 45-2 MOC, respectively. The genotypes C 63-1-MOC and CHEY-OL, resulted with the lowest yield, obtained 2.811 and 2.593 t $ha^{-1}$ , respectively. The productive comparison showed that the highest yield means a potential gap of 164 %, the deviation in the b/c ratio was 133% and in productivity in relation to the water used, indexes of 6.92 \$ $m^{3-}$ and 1.036 kg $m^{3-}$ of water were obtained, which represents a deviation of 134% with genotype M-CW-3268.
**Keywords.** *Safflower, genotypes, production.*

## INTRODUCTION

The main water problem in arid zones is related to water supply, quality and availability for human and productive needs. In arid zones, socioeconomic systems have always been closely linked to an intelligent and sustainable use of natural resources, especially water. The natural scarcity of water has limited the intensive exploitation of the territory while at the same time giving rise to ecosystems that are often home to a unique biodiversity of great interest. In the same way, arid zones have historically developed very sophisticated traditional forms of water use adapted to the specific conditions, giving rise to a very rich, specialized and valuable water culture. Practically every arid and semi-arid zone has developed its own traditional water use systems (Martínez, 2012). Environmental factors, saline intrusion and low precipitation in the Santo Domingo valley in Baja California Sur, as well as global conditions of climate change and the socioeconomic scenario, have led to changes in direct proportion to the search for productive agricultural alternatives. Such is the case of oilseed species such as safflower, a crop that has an important economic value for the oil industry and great adaptability to these conditions (Navejas *et al*., 2022). Economic, adaptation and agroecological factors (soil-plant-atmosphere interaction) make safflower cultivation an extremely interesting and attractive product for producers, industrialists and consumers in the northwestern region of Mexico (Sotelo *et al*., 2011). In Mexico there is a deficit of more than 5.0 million tons in oilseed production, the average yield of safflower production in Baja California Sur, in the last year was 1,390 t $ha^{-1}$ (SIAP, 2018). In the Santo Domingo Valley, the area established with safflower in recent cycles has decreased with preference for highly remunerative crops such as asparagus and potatoes. However, it represents an alternative in the face of the emergency of water scarcity due to exceptional drought declared for the region; where alternative production schemes should consider appropriate systems towards hydro-social sustainability (Troyo *et al*., 2010). Since, unplanned rural development has extensively used natural resources with the conception that they are unlimitedly renewable (Carabias, 2017). The objective of the present work was to know the production and determine the yield potential that may exist with the use of new safflower genetic materials from the genetic improvement program of INIFAP.

## MATERIALS AND METHODS

The present work was carried out in the O-I 2022-23 cycle, at INIFAP, Valle de Santo Domingo Experimental Site, B.C.S., under arid conditions typical of the zone; with geographical location at coordinates 24º 30' north latitude and 111º 41' west longitude. The type of tillage consisted of a cross-cropping to properly condition the soil for planting, being considered as minimum tillage. It was sown on January 10, 2023, dry, manually, leaving 20 seeds per linear meter, with furrows of 0.80 meters wide. Fifteen kg $ha^{-1}$ of seed were used. Fertilization was carried out with 120 kg $ha^{-1}$ of nitrogen and 40 kg $ha^{-1}$ of phosphorus applied after germination; phosphorus in the early stages of crop development, and nitrogen (N) fractionated on four occasions, For weed control was performed manual weeding. No insecticides were applied. Eighteen frequent irrigations were made using 6.0 mil drip tape, with a total drip rate of 4.35 lhm, with a total sheet of 35.5 cm. A randomized block experimental design was used with 4 replications, plots of four furrows of 0.8 m and 4 m in length, equivalent to 12.8 $m^2$ and two furrows of 2 m in length as a useful plot with 3.2 $m^2$ . It was analyzed by ANOVA and comparison of means with Tukey's test.

## RESULTS AND DISCUSSION

The safflower genotypes evaluated, based on ANOVA analysis of variance showed no significant difference in the yield obtained ($P \geq 0.05$), the highest values obtained were: 3.680, 3.555, 3.317, 3.101, and 3.059 t $ha^{-1}$ , with genotypes M-CW-3268, S-323, C 63-OY, HUATSON OL and C 45-2 MOC, respectively. The lowest values obtained were 2,811 and 2,593 t $ha^{-1}$ with genotypes C 63-1-MOC and CHEY-OL, respectively (Table 1).

| | Genotype | Performance (t ha )$^{-1}$ |
|---|---|---|
| 1 | M-CW-3268 | 3.680 |
| 2 | S-323 | 3.555 |
| 3 | C 63-OY | 3.317 |
| 4 | HUATSON OL | 3.101 |
| 5 | C 45-2 MOC | 3.059 |
| 6 | CCC 1651-1-1-1-1-2-OY | 2.997 |
| 7 | SEMAY-OL | 2.880 |
| 8 | RED STICK | 2.879 |
| 9 | C-62-MOC | 2.851 |
| 10 | C 63-1-MOC | 2.811 |
| 11 | CHEY-OL | 2.593 |

Table 1. Yield of 11 safflower genotypes in B.C.S. INIFAP 2023.

CV= 19.6% NS

Carrying out consecutive soil analyses according to the productive cycles allows knowing the nutrient utilization in soils with arid conditions, in addition to recognizing the edaphic conditions and predicting the productive response capacity according to the technological level implemented. Safflower requires 27 to 35 kg $ha^{-1}$ of N for each ton of grain produced (IPNI, 2007). Therefore, to produce for example 3.0 t $ha^{-1}$ of grain, the crop should have around 81 to 105 kg $ha^{-1}$ of N to be absorbed by the crop. The recommended dosage for planting safflower in the Santo Domingo Valley under irrigation conditions is 100-40-00 of nitrogen, phosphorus, and potassium, respectively.

The use of the genotypes with the highest yields, M-CW-3268, S-323, C 63-OY, HUATSON OL and C 45-2 MOC, compared to the DDR control, means a gap of 164%. The deviation in the benefit-cost ratio (b/c) was 133%; in productivity in relation to water used, indexes of 6.92 \$ $m^{3-}$ and 1.036 kg $m^{3-}$ of water were obtained with genotype M-CW-3268, which represents a deviation of 134% with respect to these indexes (Table 2).

| Treatment | Productive Indexes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | R | P | b | c | b/c | utility | foil | productivity | |
| | t $ha^{-1}$ | $ $t^{-1}$ | $ $ha^{-1}$ | $ $ha^{-1}$ | | $ $ha^{-1}$ | $m^3$ | $ $m^{3-}$ | kg $m^{3-}$ |
| M-CW-3268 | 3.680 | 11500 | 42320 | 17745 | 2.38 | 24575 | 3550 | 6.92 | 1.036 |
| DDR Witness | 1.390 | 11500 | 15985 | 15657 | 1.02 | 328 | 3400 | 0.10 | 0.441 |
| Deviation | 164 | | 164 | | 133 | | | | 134 |

Table 2. Productivity per unit area and per irrigation water use with outstanding safflower genotype (INIFAP, 2023).

R= yield, P= price, b= profit, c= cost, safflower 6% moisture,

Economic productivity and water use indices were low in the control condition. Therefore, in situ variety validation with growers should be continued. However, economic pressures induce farmers to produce a particular crop as profitably as possible, leading them to ignore sustainable practices (FAO, 2002).

## CONCLUSIONS

The results of the trial with outstanding genotypes such as: M-CW-3268, S-323, C 63-OY, HUATSON OL and C 45-2 MOC, showed significant deviations. This allows considering the positive trend of the productive behavior of the safflower crop in the region. It is recommended that the productive technological package exceeds the limit of 3.0 t $ha^{-1}$ , with the use of the new genotypes.

## REFERENCES


Carabias, J. (2017). Conservación de los ecosistemas y el desarrollo rural sustentable en América Latina: condiciones, limitantes y retos. http://www2.inecc.gob.mx/publicaciones2/libros/363/cap11.html. (Consulta 07-07- 2022).

FAO.2002. Seguridad alimentaria y medio ambiente. Cumbre mundial sobre desarrollo sostenible. disponible en: www.fao.org/3/y1780s/y1780s06.htm#TopOfPage. (Consulta 15 de agosto de 2021).

IPNI. 2007. Informaciones agronómicas del cono sur, No 33. Requerimientos nutricionales. absorción y extracción de macronutrientes y nutrientes secundarios. cereales, oleaginosos e industriales. Archivo agronómico 11:13-16.

Martínez F, J. 2012. Agua y sostenibilidad: algunas claves desde los sistemas áridos. http://journals.openedition.org/polis/5096

Navejas J, J., C.I. Cota B., Montoya C, L., S. Zamora S., G. Mercado M. 2022. Ensayo con genotipos de cártamo en el Valle de Santo Domingo, Baja California Sur. In memoria XXXIV Semana internacional de Agronomía. 07 y 09 de septiembre de 2022. Gómez Palacio, Durango, México. 828-833.

SIAP, 2022. Servicio de Información Agroalimentaria y Pesquera SIAP. http://www.siap.gob.mx. (Consulta 05-07-2023).

Sotelo, N. E. O., R. Vargas M., G. Mercado M., E.Troyo D., J. Navejas J. 2011. Evaluación agroecológica del cultivo de cártamo en el valle de Santo Domingo, Baja California Sur. In memoria XXXVI Congreso Nacional de la Ciencia del Suelo. 21 al 25 de noviembre de 2011, San Francisco de Campeche, Campeche, México.

Troyo D, E., Cruz F, A., Norzagaray C, M., Beltrán M, L. F., Murillo A, B., Beltrán M, F. A., García H, J. L., Valdez C, R. D. 2010. Agotamiento hidro-agrícola a partir de la Revolución Verde: extracción de agua y gestión de la tecnología de riego en Baja California Sur, México. Estudios Sociales, vol. 18, núm. 36, 78-201.