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MUTATION BREEDING IN SUNFLOWER (*HELIANTHUS ANNUUS* L.) FOR DISEASE RESISTANCE AND OIL CONTENT

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1. INTRODUCTION

Sunflower is an oilseed crop with wide adaptation, due to its tolerance to low temperatures and drought. The seeds have a high oil content with very good quality. This crop represents a new option for the Brazilian farmers, considering both agronomic and market aspects. Diseases are one of the major limiting factors of sunflower production worldwide. The plant is a known host of more than 35 infectious microorganisms, mostly fungi, which may, under certain climatic conditions, significantly reduce yield and quality. One of the most important diseases occurring in sunflower in Brazil, especially in the South, is *Alternaria* leaf and stem spot, seedling blight and head rot. This pathogen produces dark brown lesions on leaves, petioles, stems, and flower parts and, when numerous, these lesions form large necrotic areas. Chemical control is not recommended because of the difficulty in obtaining complete foliar coverage by aerial application of fungicides. Also, there are no fungicides registered for the control of foliar diseases of sunflower in Brazil. Therefore genetic control of the disease through breeding for resistance, is a highly desirable objective. However, the genetic base of cultivated sunflower is narrow and resistance genes are scarce. Resistance to *Alternaria* has been found in some other species of *Helianthus*, such as *H. tuberosus*, *H. hirsutus* and *H. resinosus*. The use of these species as sources of resistance requires interspecific hybridization with *H. annuus*. This is particularly difficult because these species are tetraploid or hexaploid, while cultivated sunflower is diploid. The increase of variability within *H. annuus* would be very useful in order to get sources of resistance to *Alternaria* diseases. One way for creating genetic variability in cultivated sunflower is the use of induced mutation by radiation with gamma ray. Seed treatment with gamma radiation has been extensively used for sunflower to increase variability for several characteristics, like days to flowering, seed weight and oil content.

The objectives of the present work are: to create genetic variability in cultivated sunflower; to select mutant lines resistant to *Alternaria* diseases; and to evaluate these lines for oil content. Advanced resistant mutant lines will be multiplied for field trials and selected for hybrid production. The best hybrids will be rapidly distributed to sunflower farmers.

2. RESULTS

A preliminary experiment was performed at the Radiation Genetic Section of the Agricultural Atomic Energy Center (CENA), in collaboration with EMBRAPA Soja, to define the level of gamma radiation that should be used for treating sunflower seeds. Seeds of the line S_4 94N208 89V2372, from Embrapa Soja, were irradiated with gamma rays at 100, 200, 300, 400 and 500 Gy at 30 cm distance for 14,4 minutes. Each treatment was composed of 10 seeds, with 3 replications. The irradiated progeny were grown in the greenhouse with non-irradiated seeds as the control. Seedlings were evaluated for: survival, hypocotyl and epycotil length and plant height.

The results of the preliminary experiment for determining the optimum level of gamma radiation for sunflower seeds showed that seeds survived the 200 Gy level. However, this dose rate reduced plant height by 37 %. Based on these results, the 180 Gy level was chosen for further experiments.

Four thousand sunflower seeds of the line S_4 94N208 89V2372 were irradiated with 180 Gy of gamma rays at 30 cm for 14.4 minutes. The irradiated and non-irradiated seeds were planted in the field, where the M_1 germination rate was less than 50% and most of the plants were sterile, showing that this level was still too severe.

In June 1996, eight thousand seeds were irradiated with 150 and 165 Gy of gamma rays. M_1 seeds were sown in the field to produce 4000 M_2 self pollinated plants. About 300 non-irradiated seeds were sowed as controls. Seedlings and plants were evaluated for: survival, chlorosis, plant height at harvest, sterility and number of seed per head. The results of seedling survival indicated a reduction both for 150 and 165 Gy radiation levels. No plants showed chlorosis. Sterility was more of a problem with the 165 Gy than the 150 Gy treatment. Both treatments reduced plant height and the number of seeds per head. Height ranged from 60 to 90 cm in the control and 35 to 60 in the irradiated material. These results indicated that the radiation levels used for sunflower seeds were still high, and studies on the determination of the best radiation level should be continued. All M_1 plants were harvested in bulk.

In January 1997, the next generation (M_2) was sowed in a density of about 70.000 plants/ha, in order to provide conditions for high incidence of *Alternaria* leaf spot. Plants of the M_2 population from 150 Gy seed treatment (8406) and from the 165 Gy seed treatment (5552) were screened for disease resistance. The plants were irrigated twice a week to increase the humidity thereby enhancing the pathogen's spread. The plants were evaluated for *Alternaria* leaf spot symptoms using a disease scale from 0 (no symptoms) to 5 (disease maximum). Before flowering, the plants showing no symptoms of *Alternaria* leaf spot (grade 0) or less than 5% diseased leaf area (grade 1) were bagged for self-pollination. These plants were periodically assessed to observe disease development. Seed from five bagged and self-pollinated M_2 plants, two from the 150 Gy and three from the 165 Gy population, which had no disease symptoms, was harvested for confirmation of disease resistant in M_3. Additionally, open pollinated M_2 plants were selected (25 from the 150 Gy population and 28 from the 165 Gy population) at maturity. These plants had mild disease symptoms, but developed and matured without severe symptoms. Other unprotected plants that showed head deformation were also collected, to evaluate the maintenance of this character in the next generation.

3. REFERENCE

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