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RELATIVE PERFORMANCE OF SYN 1 AND SYN 2 POPULATIONS OF SUNFLOWER GERMPLASM MATERIALS

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SUMMARY

Introduction, collection, preservation and evaluation of germplasm materials is absolutely necessary in any result-oriented breeding programme. For this reason, 34 sunflower hybrids introduced from three different countries have been evaluated in the field for two consecutive years (1986 and 1987). The performance of the Syn 1 (F_1) relative to the syn 2 indicate a mean reduction in the syn 2 generation of 62, 48, 31 and 28 per cent for seed yield, head diameter, plant height and number of leaves per plant, respectively. The use of synthetic cultivars and the method of their devlopment were discussed.

INTRODUCTION

In crop breeding, the collection, preservation, and identification of desirable germplasm types is of utmost importance. It is important for preservation against disappearance due to calamities of diseases and pests, physical development, changing requirements of high yields and better quality.

According to Creech and Reitz (1971), the sources of crop germplasm are mainly three. The first source is the natural germplasm which includes the wild and primitive species in primary centers of origin and diversity. The second source is the migrant species in intermediate hybridization zones and secondary and tertiary centers of diversity. The third source is the developed germplasm which contains the assorted series of unique plant breeding products.

Choice of germplasm is a critical decision that requires considerable thought. The germplasm chosen would form the basic materials of the breeding programme. The choice of the germplasm will determine the maximum potential improvement that can be achievod via breeding while the breeding procedure used will determine how much of that maximum potential can be realized (Halluer and Miranda FO, 1981). Hybrid varieties from established lines are important parental sources for developing new inbred lines in breeding programmes. Thus now lines are primarily developed from eithor crosses between elite lines or advanced populations undergoing recurrent selection.

The objective of this paper was to report the performance of introduced sunflower hybrids and the immediate generations derived from them. This is with a view to selecting suitable germplasm for use in the development of synthetic varieties as well as for further improvement of the crop.

MATERIALS AND METHODS

The experimental material consisted of 34 hybrids introduced from three different countries. The experiment was conducted under field conditions at the Institute for Agricultural Research Farm, Samaru, for two consecutive years (1986 and 1987). In each year a randomised complete block design with three replications was used for the experiment. Plots of 9.0m^2 consisting of four 75 cm ridges of 3.0m length were used. Seeds were overplanted at a spacing of 30 cm within row.The seedlings were later thinned to two plants per hill at first weeding. In the first year, syn 1 (F_1) seeds were grown. The syn 1 generations grown in the first year were allowed to mate at random without any

Table 1. The accessions of sunflower hybrids used in the experiment

Serial number	Accession number	Variety name	Country of origin
1	A 002	Cargill 205	Canada
2	A 003	Cargill 206	Canada
3	A 004	Cargill 207	Canada
4	A 006	Do 321E	U.S.A.
5	A 007	DO 705	Canada
6	A 008	DO 725	Canada
7	A 009	DO 730	U.S.A.
8	A 010	DO 734	U.S.A.
9	A 011	DO 855	Canada
10	A 015	IS 3001	Canada
11	A 016	IS 7000	Canada
12	A 017	IS 7101	Canada
13	A 018	IS 7111	Canada
14	A 019	IS 7775	Canada
15	A 020	J 507	Canada
16	A 021	Morden 21	Canada
17	A 022	MRS 27	Canada
18	A 023	Pag SF 102	Canada
19	A 026	RO 59	Romania
20	A 027	RO 1197	Romania
21	A 028	RO 1206	Romania
22	A 029	RO 4242	Romania
23	A 030	S 166	Canada
24	A 031	S 316	Canada
25	A 032	S 448	Canada
26	A 033	S 1888	Canada
27	A 035	Sig Co 445	Canada
28	A 036	Sig Co 450	Canada
29	A 038	Serem 80	Romania
30	A 039	Select	Romania
31	A 040	Sunbred 265	Canada
32	A 041	Super	Romania
33	A 042	Sun M 20	Canada
34	A 044	894	Canada

restriction whatsoever except for incompatibility and assortative mating due to differences in flowering time.

In the second year both the syn 1 and the syn 2 developed by panmixia in the previous season were planted. In each year, data were recorded at harvest on plant height (m), number of leaves per plant, head diameter (cm) and stem diameter (cm). Seed yield (kg), and percent multiheaded were recorded on plot basis.

In each year, fertilizers at the rates of 30 kg K_2O per hectare in form of muriate of potash, 50 kg P_2O_5 per hectare as single superphosphate and 100 kg N per hectare as calcium ammonium nitrate were applied at planting by band placement 5 - 10 cm away from the seed. The plots were kept weed-free by hoe weeding.

RESULTS AND DISCUSSION

The names and sources of the experimental materials used are given in Table 1. It could be seen from the table that 24 hybrids were introduced from Canada, seven from Romania and three from the United States of America. Table 2 shows the phenotypic variability in the sunflower germplasm evaluated. The designation of the generations adopted were syn 1 for the hybrids (F_1) and syn 2 for the panmictic progeny of syn 1. This designation is used in preference to the F_1, F_2 etc. because the populations produced by planting advanced generation seed of panmixia are really synthetics.

It may be seen from Table 2 that the mean performance of the syn 2 generations was lower than in the syn 1 generation for seed yield, plant height, number of leaves and head diameter. The mean stem diameter in the two populations is approximately the same indicating the stability of the character.

Table 2. Phenotypic variability for agronomic and morphological charaters in two generations of sunflower

Character	Range		Mean		Coefficient of variation	
	Syn 1	Syn 2	Syn 1	Syn 2	Syn 1	Syn 2
Seed yield kg/ha	977.8-2811.1	344.4-1755.6	1.62	0.62	0.24	0.35
Plant height n	1.28-2.01	0.95-1.41	1.68	1.17	0.11	0.09
Number of leaves	18.00-39.00	15.83-24.75	27.68	19.84	0.15	0.10
Head diameter cm	12.75-24.00	8.05-12.13	19.14	9.96	0.15	0.10
Stem diameter cm	1.10-2.33	1.42-1.94	1.77	1.71	0.16	0.08
Percent multi-headed	0-1.49	0.00-23.81	0.40	8.18	0.63	0.72

The percentage of multiheaded plants was considerably higher in the syn 2 generation. This increase in multiheaded plants could be attributed to the fact that some self-fertilization in the syn 1 might have occurred resulting in recombination of recessive genes which govern the branching habit and multiheadedness.

The higher coefficient of variation values in the syn 2 than in the syn 1 for seed yield and multiheadedness indicate the heterogeneity of the syn 2 relative to the syn 1 populations for the traits. The lower coefficient of variation values in the syn 2 for plant height, number of leaves, head diameter, and stem diameter indicate that these characters

are relatively more homogeneous in the populations. This corroborates the report of Kloczowski (1971) that the F_2 and F_1 were similar in plant height and plant maturity but contradicts the report for head diameter.

Table 3 shows the comparison in performance between syn 1 and syn 2 generations grown at Samaru. All populations in the syn 2 generation have shown a reduction in yield, plant height, number of leaves and head diameter. The mean reduction in yield in the syn 2 populations of 62 per cent is remarkable. This result could be explained on the basis of possible changes in gene frequency. This is because when mating occurs between closely

Table 3. Comparison of plant height,number of leaves,head diameter and seed yield in syn 1 and syn 2 generations of sunflower

Accession number	Plant height m			Number of leaves			Head diameter cm			Seed yield kg/ha		
	Syn 1	Syn 2	Percent reduction	Syn 1	Syn 2	Percent reduction	Syn 1	Syn 2	Percent reduction	Syn 1	Syn 2	Percent reduction
A002	1.52	1.03	32.24	26.50	19.00	28.30	16.25	9.36	42.40	1422.2	666.7	53.13
A003	1.84	1.16	36.96	30.50	17.75	41.80	19.75	9.18	53.18	1733.3	622.2	64.10
A004	1.68	1.25	25.60	30.75	20.58	33.07	19.75	11.18	43.39	2011.1	777.8	61.33
A006	1.82	1.21	33.52	30.75	21.39	30.44	17.00	10.53	38.06	2200.0	544.4	75.25
A007	1.41	1.25	11.35	23.75	21.16	10.91	12.75	9.83	22.90	1733.3	477.8	72.44
A008	1.65	1.22	26.06	30.50	19.00	37.71	24.00	10.20	57.50	2111.1	344.4	83.68
A009	1.80	1.12	37.78	29.50	19.41	34.20	18.75	10.65	43.20	2144.4	833.3	61.14
A010	1.81	1.04	42.54	31.50	20.41	35.21	16.50	8.05	51.21	1722.2	533.3	69.03
A011	1.70	1.18	30.59	30.25	21.41	29.22	18.00	9.56	46.89	2811.1	811.1	71.15
A015	1.83	1.26	31.15	28.75	21.08	26.68	19.50	11.30	42.05	1611.1	555.1	65.52
A016	1.28	1.05	17.97	20.75	15.83	23.71	17.75	9.51	46.42	1588.9	666.7	58.04
A017	1.83	1.16	36.61	30.00	20.60	31.33	20.50	9.56	53.36	2088.9	566.7	72.87
A018	1.63	0.99	39.26	24.50	18.60	24.08	13.25	10.02	24.38	1922.2	555.6	71.10
A019	2.01	1.28	36.32	33.00	21.50	34.85	15.50	8.21	47.03	2288.9	566.7	75.24
A020	1.68	1.41	16.07	26.50	21.30	19.62	18.00	12.13	32.61	1700.0	722.2	57.52
A021	1.30	1.30	0	19.50	18.85	3.33	17.00	10.04	40.94	2322.2	1755.6	24.40
A022	1.69	1.24	26.63	26.25	17.27	34.21	18.50	9.05	51.08	1333.3	755.6	43.33
A023	1.63	1.13	30.68	27.25	19.97	26.72	22.25	9.47	56.22	1688.9	622.2	63.16
A026	1.88	1.17	37.77	30.75	22.91	25.50	16.50	11.57	29.88	1377.8	866.7	37.10
A027	1.63	1.22	25.15	25.50	18.75	26.47	23.00	11.06	51.91	1422.2	644.4	54.69
A028	1.82	0.95	47.80	26.50	19.60	26.04	18.50	10.70	42.16	1611.1	444.4	72.41
A029	1.74	1.12	35.63	28.75	20.00	30.43	19.25	11.71	39.17	977.8	888.9	9.09
A030	1.63	1.27	22.09	18.00	12.25	4.17	18.75	10.90	41.87	2366.7	588.9	75.12
A031	1.86	1.20	35.49	29.75	19.16	33.71	21.00	9.82	53.24	2155.6	644.4	70.10
A032	1.57	1.08	31.21	23.75	19.76	16.80	23.00	10.31	55.24	1377.8	666.7	51.61
A033	1.71	1.26	26.32	28.25	16.30	42.30	23.25	9.64	58.54	1900.0	888.9	53.22
A035	1.55	1.07	30.97	28.00	18.68	33.29	23.25	9.26	60.17	2211.1	833.3	60.30
A036	1.81	1.01	44.20	31.50	17.30	45.08	18.00	8.61	52.17	1100.0	622.2	43.43
A038	1.94	1.18	39.18	39.00	23.60	39.49	18.50	8.51	54.00	2333.3	511.1	78.09
A039	1.70	1.22	28.24	27.00	24.75	8.33	15.25	11.13	27.02	1200.0	977.8	18.52
A040	1.49	1.08	27.52	21.75	19.08	12.28	20.25	8.90	56.05	2011.1	422.2	79.01
A041	1.73	1.17	32.37	28.50	21.30	25.26	17.25	9.58	44.46	1211.1	644.4	46.79
A042	1.56	1.27	18.59	26.25	20.60	21.52	16.25	8.53	47.51	1777.8	755.6	57.50
A044	1.69	1.23	27.22	27.25	20.30	25.50	22.50	10.22	54.58	1600.0	666.7	58.33
Mean	1.69	1.17	30.70	27.68	19.84	28.32	19.14	9.96	47.96	1800.0	688.9	61.73

related individuals, the genetic effect is an increase in homozygosity resulting in loss in vigour and productivity in highly crossfertilizing species. Again seed yield is determined largely by the size of the inflorescence and the percentage of fertile flowers. As the mean reduction in head diameter in the syn 2 populations is up to 48 percent, the reduction in yield becomes obvious. Kloczowski (1971) reported that average yields of sunflower in the F_2 were 48 percent lower than in the F_1. He noted that the actual seed yields were significantly less than those predicted on the theoretical basis, a fact that he attributed to the lower than expected outcrossing percentages. He concluded that his results suggest the importance of selecting lines for a synthetic that are relatively self-incompatible with a strong tendency to cross pollinate, as well as selecting lines with good combining ability. However, where adequate bee colonies are not available to pollinate the crop, highly self-compatible synthetics that will produce a full crop of seed when self-pollinated would be advantageous.

Synthetic cultivars can be developed by intercrossing a large number of inbred lines or plants, and then by growing the bulk population for several generations. The synthetic is therefore a combination of several inbred lines, sibbed lines or other populations. Data from sunflower experiment suggest that four inbred lines would perhaps be the optimum number of inbred lines in a synthetic, considering both yield and oil content (Briggs and Knowles, 1967).

According to Putt (1962) synthetic cultivars were the hybridization percentage was low and variable, as was often the case in hybrid seed produced by natural cross pollination. Synthetic cultivars may be especially useful in countries or programmes where hybrid seed production is not feasible owing to technical or economic reasons.

This development of synthetics is a rapid and sufficiently reliable method to deal with immediate comercial seed production needs of a developing country like Nigeria.

A disadvantage of the synthetics according to Fick (1978) is lower uniformity than in hybrids especially the single cross hybrids. Further, all lines of a synthetic must possess resitance to prevalent diseases, while resistance is required in only one of the parent lines of a hybrid.

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PERFORMANCE RELATIVE DE SYN1 ET SYN2, POPULATIONS DE GERMPLASMES DE TOURNESOL.

RÉSUMÉ:

L'introduction, la collection, la préservation et l'évaluation de matériel germplasme est absolument nécessaire dans tous programmes de sélection. Pour cette raison, trente quatre hybrides de tournesol provenant de trois pays différents ont été testés en champ pendant deux années consécutives (1986 et 1987). Les performances de la SYN1 (F1) par rapport à la SYN2 montrent une réduction moyenne dans la génération SYN2 de respectivement 62, 48, 31 et 28% pour le rendement en grain, le diamétre des capitules, la hauteur des plantes et le nombre de feuilles par plante. L'utilisation de cultivars synthétiques et la méthode de développement sont discutées.

COMPORTAMIENTO RELATIVO DE LAS POBLACIONES SYN 1 Y SYN 2 DE GERMOPLASMA DE GIRASOL

RESUMEN

La introducción, colección, preservación y evaluación de germoplasma es absolutamente necesaria para cualquier resultado en un programa de mejora. Por esta razón, 34 híbridos de girasol introducidos de tres paises diferentes han sido evaluados en el campo en dos años consecutivos (1986 y 1987). El comportamiento de la población SYN (F 1) relativo a la SYN 2 indica una reducción média en la generación SYN 2 de 62, 48, 31 y 28 por ciento del rendimiento, diámetro de capítulo, altura de planta y número de hojas por planta respectivamente. El uso de cultivares sintéticos y el método para su desarrollo es discutido.