PN-ABH-731
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PROGRESS REPORT FOR THE SECOND HALF / 1988

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Grant No: RG/AID/10

Title of Project:

"Collection and Evaluation of Sesame Germplasm for Breeding Adapted, High Yielding Cultivars"

Date of Award by NARESA :

17th July, 1986

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MAR 20 1989

The present report covers the work carried out during the Yala (South West Monsoon) 1988 season.

I.FIELD STUDIES

1.1.SELECTION IN SEGREGATING POPULATIONS

In the last report it was mentioned that F_3 seeds of 148 single crosses were obtained by growing the F_2 generation in four separate experiments. The F_3 generation of 89 of these crosses were raised for breeding purposes. Each of these populations was handled in three different ways, viz.:

a) Pedigree selection
b)Bulk population breeding and
c)Modified single seed descent method

For pedigree selection promising individual plants were selected at the time of flowering (for early flowering in particular) and at harvest. Each of these plants was observed for the date of maturity (ripening of the lower capsules), plant height, the number of capsules, the number of branches, seed colour, seed weight and the varietal group according to FAO descriptors. The classification according to the varietal group involves the identification of the number of carpels in the ovary, phyllotaxy and the number of capsules per axil. Each cross was given a catalogue number (RAC -Ruhuna Agriculture Cross) and each selection was catalogued under this number. The catalogue number of selection was given in such a way that the original cross, season of selection and the serial number could be retrieved later.Thus, the pedigree selection was carried out in the classical way. The details of some of the crosses grown and the selections carried out are given in table 1.

For bulk population breeding, each plot (cross) was harvested separately in bulk. After cleaning and weighing, 1/3 rd of the weight of each bulk was taken in a separate seed packet and 1/3rd of the weight of the seeds of each of the selections (selected for pedigree breeding) from that population was added to make the bulk population more representative. Those bulks with the seeds of the selections added are being used to advance the generations for bulk population breeding.

In the modified single seed descent method, three seeds from each surviving plant of a cross were collected and bulked. This was done in all the populations grown. Three seeds instead of one was used because of the difficulty in spacing seeds at planting so that all germinated seeds could be left in the field. When row seeding is practiced, sesame is generally planted densely and the seedlings are thinned out to leave the required plant density.

Breeding and evaluation will be carried out in all the samples

prepared according to these three methods. According to the available literature, research on the breeding methods for sesame have not been carried out. The breeders usually use either pedigree or bulk method to improve this crop. Therefore the results of the comparison of the three methods will be useful in sesame breeding.

1.2. SELECTION UNDER LOW & HIGH FERTILITY

Ten Crosses in their F_3 were raised under increased fertilizer level and in soil with poor fertility with out added fertilizer. Selections for high yield were made in both conditions to compare the performance of the selections in later generations.

1.3.GROWING OF M_2 GENERATION OF GAMMA RAY IRRADIATED TMV 3 x T65 CROSS FOR SELECTING MUTANT CHARACTERS

TMV 3 x T65 cross was irradiated with 20, 40 and 60 krad gamma rays and the first generation was raised in Maha (North - East monsoon) 1987/88 season. A number of different kinds of mutants were observed and the useful mutants were selected. The basic biometrical measurements as described in 1.1. above were taken in the selected mutants.

1.4. GROWING OF M_2 GENERATION OF GAMMA RAY IRRADIATED MI 2 CULTIVAR FOR SELECTING MUTANT CHARACTERS

The methodology and objectives of this experiment are similar to those of 1.3. above.

1.5. GROWING OF M_2 GENERATION OF CHEMICAL MUTAGKN TREATED MI 2 CULTIVAR FOR SELECTING MUTANT CHARACTERS

In the last report it was mentioned that seeds of three cultivars were treated with two chemical mutagens viz. Diethyl Sulphate and Ethyl Methane Sulphonate and the seeds were grown to collect the M_2 seeds. During Yala 1988 the M_2 generation was raised and selection of useful mutants was carried out.

1.6. CONFIRMATION AND PRELIMINARY EVALUATION OF MUTANTS SELECTED IN GAMMA RAY TREATED MI 2 CULTIVAR

In the previous report it was mentioned that 36 morphological mutants were selected in MI 2 cultivar treated with 10 different doses of gamma rays. In yala 1988 these mutants were grown in three replications in a RCB with the parent cultivar MI 2 as control.

2. RESULTS AND DISCUSSION

2.1.SELECTION IN SEGREGATING POPULATIONS

The area occupied by the segregating populations was about 0.5 ha. A total of 89 different crosses were grown. Ten of these crosses

were grown in high and low fertility fields and selections were made under these contrasting environments. The cultivars involved in the crosses, their origin and their special features are given in the table 1.

As seen from table 1, the genotypes involved in the crosses have diverse origin and several useful features for increasing the production of the crop. The main features for which the parents were selected include plant architecture, adaptability (from the data of regional trials conducted by the Dept. of Agriculture), disease resistance, increased yield components, determinate growth habit, seed quality (colour, size, dormancy and oil content), time of maturity, reaction to day length etc.

The number of selections carried out per each cross in the pedigree breeding programme is presented in the table 2. The main features of the selected plants in these crosses are given in the last column of this table. Although seed yield per plant has not been mentioned in all the crosses, it was given a higher weightage. The crosses that produced selections with atleast 10 g. per plant have been mentioned as producing selections for yield. At the usual plant spacing of 30 x 5cm and with a yield of 10 g. per plant the crop should produce a yield of 6666.7 kg/ha ! Thus the many lines emanating from these crosses are expected to increase the potential yield of the crop.

The other characters that were considered when selecting single plants include early flowering (early flowering selections during the long day season of Yala are expected to have a lower reaction to day length in a short day crop such as sesame), low disease reaction, white seed coat, plant architecture (branching habit, branch angle, phyllotaxy and leaf shapes that provide more light to lower layers of canopy), better adapted and taller determinate segregants, yield components including the number of capsules per plant, number of locules per capsule, number capsules per leaf axil, even maturity, low shattering losses (plants with upright capsules which open partially at maturity) etc.

These selections will be evaluated in single rows to identify their yield potential and other useful characters.

2.2.SELECTION UNDER LOW & HIGH FERTILITY

The crosses grown in this experiment are 149 x 67; 157 x 146; 136 x 31; 152 x 166; 175 x 157; 150 x 67; 51 x 161; 100 x 145; and 161 x 146. A total of 100 selections were carried out in each fertility level. The bulk populationa and the Single Seed Descent populations were also sampled for future studies.

2.3. ; 2.4. and 2.5 SELECTING IN M_2 GENERATION OF GAMMA IRRADIATED AND CHEMICAL MUTAGEN TREATED POPULATIONS

The selections for useful mutant characters in M_2 and sampling in the M_1 generation for future selection have been carried out.

These mutants will be described once they are evaluated in the next generation and confirmed as true to type.

2.6. EVALUATION AND CONFIRMATION OF MUTANTS DERIVED FROM GAMMA RAY IRRADIATED MI 2 CULTIVAR

The thirty six selections carried foreward were tested in larger plots for yield and other biometrical characters. The analysis of variance showed that the yield differences among the treatments were significant at 5% probability level. The yield of three mutants significantly exceeded that of the parent cultivar MI 2 (table 3).

2.7. HYBRIDIZATION

Following crosses were successfully carried out and F_1 seeds collected;
Promising mutants x (TMV3 x T65)
(TMV3 x T65) x Promising mutants
Promising mutant lines x UCR 82-203-NS
UCR 82-203-NS x Promising mutant lines
Eight backcrosses, four of which were with phytophthora resistant mutant lines and a diallel cross of six parents whose F_2 generation seeds are already available from previous season. The completion of this cross will enable us to grow all possible F_1 & F_2 combinations of these cultivars and get information on the combining ability as well as inheritance pattern of various characters.

Table 1.
Cultivars used in crosses, their origin and features

Catalogue No	Name	Origin	Features
145	Instituto 71	Mexico	Height, 3 fruits/axil
163	182/3	Sri Lanka	Selection for phytophthora resistance
160	MI3 x Aus. Intr.	Sri Lanka	Low reaction to photoperiod, adapted
152	MI 2	Sri Lanka	High yield, adapted
166	125 BON	Japan	plant type
133	24-MKS-II-82190	Thailand	Plump white seed, Mildew resistance
159	T 40x Paloma(sel)	Sri Lanka	Yield, adaptability
153	MI 3	Sri Lanka	Released cultivar, white seeds
136	27 MKS II 82202	Thailand	Yield, Tallness, Competitive, white seed
67	Determinate	Israel	Determinate growth
73	Hnani 25/160	Burma	Branching, Yield
39	D-7-11-1	India	Yield, plant type
146	Instituto 81	Mexico	-- do --
176	Nakansawan	Thailand	
171	ST 70	Thailand	
37	Cola de Borrego	S.America	Seed dormancy
161	180/52	Sri Lanka	Phytophthora resistance
149	Rubio de la Huacana	Mexico	Tall, profuse branching
51	Suweon 9	S.Korea	Earliness
141	Improved Baco	Texas	Non shattering, long capsule, 3 fruits/axil
138	Chai Badan	Thailand	Tall, non branching, white seeds
18	UCR-82-11,NS	USA	Non shattering capsule
155	TMV 3 x T 65	Sri Lanka	Yield, adaptability
84	Egypt 301	Egypt	
50	Suweon 21	S.Korea	Earliness
157	Suduthala 102	Sri Lanka	Yield, adaptability, high seed oil %
150	San Juan de Lima	Colima Mexico	Yield, tall, profuse branching
177	Local black	Thailand	Yield, plant type
154	MI 1	Sri Lanka	Yield, adaptability
162	Aust. Introduction	Australia	Low reaction to photoperiod
78	Zhu-Zhi-2	China	
158	Margo x MI 3	Sri Lanka	Yield, plant type
164	MI 3 x Aus. Intr(tall)	-do-	-- do --
156	Tainan White	-- ? --	
175	SI - 53	Thailand	
99	Mobile Home 3	Arizona	Long capsule
48	Bjal Sadovski	Bulgaria	Early
151	Vera Cruz	Mexico	Tall, early, branching, yield

133	24 MKS II 82190	Thailand	
169	GP 113	Sri Lanka	Adaptability
100	Long pod selection	USA	Long capsule
32	Oro Short	USA	Short internode, 3 fruits/axil
31	Morada Elite	Venezuela	Tall, branching, late

Table 2

F populations raised, number of selections and selection criteri

Cross	No of selections	Main Criteria for Selection
145 x 163	12	Early flowering,seed colour,leaf arrangement, yield
152 x 145	5	Seed colour, maturity date
160 x 163	11	Seed colour, yield
152 x 166	22	Yield, flowering date,seed colour
152 x 133	9	Early flowering
159 x 153	14	Seed colour, time to flowering,yld.
136 x 166	17	Dense capsules, yield, carpel No.
67 x 73	12	Determinate, yield, flowering date
166 x 152	9	Flowering & maturity date, yield
39 x 136	10	Yield, dense capsule setting
67 x 146	16	Yield, determinate with increased number of branches,height
176 x 166	13	Earliness, yield, carpel number
171 x 155	10	Earliness, yield, carpel number stem fasciation
37 x 67	11	Improved determinates,earliness
166 x 161	14	Profuse fruiting,yield,
149 x 67	11	white seed, yield, tall,competitive
37 x 161	19	Earliness, yield,height,
51 x 152	11	Yield, earliness,
67 x 150	7	Determinate, yield, seed colour
141 x 51	11	Earliness, seed colour, yield
67 x 138	8	Plant architecture, yield
153 x 18	8	seed colour,plant type
155 x 160	9	Dense fruiting,seed colour (a determinate type was isolated in non determinate cross)
67 x 84	14	Yield, branch number, height
161 x 146	27	earliness, yield, seed colour, yiel components
50 x 157	13	White seeds,profuse branching,heigh
161 x 160	13	Yield, height, plant type, Disease resistance
18 x 39	7	plant type, yield
150 x 67	22	Improved determinates, seed colour
177 x 154	10	Plant type, yield, earliness
73 x 152	12	Yield, leaf arrangement
152 x 138	5	Yield & white seed
162 x 166	13	Earliness,Yield, dense fruiting
67 x 78	12	Earliness, yield
141 x 152	5	Yield, branching type
171 x 145	10	Yield, White seed,Non-branching tal stem types for high input culture
166 x 162	15	Yield, seed colour, Earliness, Highly branching & dense fruiting
158 x 153	12	Earliness,long branches, white seed
158 x 67	20	Yield,profuse branching,tall plants
149 x 133	6	Early maturing tall plants

67 x 164	13	Medium height, high yield, dense capsule set with 2 - 4 branches
164 x 153	9	early, white seed
149 x 152	9	Quadricarpellate,white seeded,early
50 x 138	5	Medium compact plants
51 x 161	5	Early, medium sized plants
152 x 164	7	Yield, tall & early
154 x 166	8	Tall,branching & high yield
163 x 156	9	Early, Tall, white seeds
175 x 150	9	Early, white, 2-4 branches
153 x 145	8	Early, tall & white seeded
99 x 48	5	Early, tall,high yield
175 x 157	4	Tall,profusely branched types with dense capsule setting
170 x 151	19	Yield, earliness, height, branches
153 x 51	11	White seeded,tall & basal branching high yielding types
150 x 31	6	Tall types with top branching
162 x 133	5	Earliness & yield
152 x 150	14	Pubescence, Highly productive non-branching types
51 x 153	6	Yield,earliness,basal branching
169 x 157	13	Yield,early,tricarpellate,basal branching
136 x 150	8	Yield, tricarpellate, white seed
39 x 152	7	V. tall,early white seeded
100 x 145	14	High yield, white seeded, medium
159 x 136	7	Branching habit, increased No. of capsules with white seeds
32 x 138	8	Early,branching & productive
175 x 158	10	V. tall,non-branching & branching
73 x 153	12	Profuse branching high yielders
171 x 160	13	-- do -- white seeded
153 x 151	11	Profuse branching,medium height, white seeded high yielders
171 x 152	2	-- do --, black seed
151 x 133	5	High yield
48 x 100	4	Early, white seed, plant type
166 x 137	11	Yield, plnt architecture
150 x 166	14	Medium growth,tall basal brnch
159 x 162	12	Profuse branching & yield
37 x 76	11	Early, white seeded medium plnts
152 x 157	12	Plant type & V. high yield
136 x 31	10	Quadricarpellate,yield, plnt type
151 x 67	11	carpel No.,improved determinates

Table 3
Plant yield (g.) and number of capsules per plant in the mutants compared with parent cultivar MI 2

Mutant No	Capsules per plant	Plant yield
1	29.4	3.15
2	31.1	3.45
3	25.3	3.44
4	26.3	2.61
5	21.6	3.31
6	29.9	3.47
7	27.3	2.92
8	26.4	5.48
9	24.5	2.58
10	23.9	3.75
11	20.7	3.18
12	28.2	2.74
13	26.6	3.27
14	27.3	3.21
15	29.0	4.53
16	24.0	2.78
17	26.6	2.44
18	29.5	5.19
19	30.1	3.00
20	26.2	2.61
21	34.6	5.30
22	26.6	3.16
23	27.1	3.35
24	29.6	3.45
25	24.3	3.19
26	30.3	2.77
27	24.2	3.48
28	25.1	2.86
29	24.9	4.43
30	28.8	3.21
31	29.1	3.23
32	26.4	3.26
33	26.3	3.20
34	25.5	3.35
35	27.0	3.29
36 (MI 2)	27.8	3.46
LSD (5%)	NS	1.58
CV %	23.3	18.6

3.PLAN OF WORK FOR THE NEXT HALF YEAR

Test the selections carried out in two separate experiments for white seeded and coloured sesame.

Generation advance of 25 of the best crosses in the bulk population and single seed descent populations.

Grow parents, F and F of a diallel cross involving six cultivars.

Evaluation of the best cultivars and mutants in a dry zone location.

Continue the backcrossing programme.

Selection in mutant and segregating populations.

Exchange of collected germplasm with collaborators.

4.ANY OTHER REMARKS

Field trials could not be established during the Maha (North East Monsoon) 1988/89 season due to occupation of the campus by the Army and the violence in the South. However most of the planned field experiments have been established at the Agricultural Research Station of the Department of Agriculture, at Girandurukotte in the Mahaweli System C where very high potential for the increase of sesame production exists.

The tissue cultures and the laboratory cultures of phytophthora were lost during that period, due to lack of electricity supply.

The Grantee attended the XVI International Congress of Genetics Aug.20-27,1988 in Toronto and presented poster "Combining ability analysis of sesame (Sesamum indicum L.) under two photoperiods, Abs. No.33.14.5.

Signature of Grantee

Comments of the Head of the Department

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Signature of the Head of the Department