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MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose VO

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. C5-147

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ENHANCING GENETICS VARIABILITY AND BREEDING IMPROVED SESAME (*S. indicum*) CULTIVARS

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ENHANCING GENETICS VARIABILITY AND BREEDING IMPROVED SESAME (*S.indicum*) CULTIVARS

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ABSTRACT

Thailand Israel cooperative research project on sesame breeding for high yield and desirable characters has been conducted since 1985. Collection of sesame lines and cultivars were studied and crosses were made from selected parents in both Thailand and Israel. Combining determinate mutants and non-shattering characteristics to the adapted high yielding types, the selection is made from segregating populations by plant to row method. F_4 progenies grown now at Ubon Field Crops Research Center in 1987 for further selection. Cultivars with high yield,determinate and non-shattering characteristics are desirable.

1. BACKGROUND/INTRODUCTION

Sesame is one of the world's most important oil crops. It is grown mostly in developing countries and by small farmers. Sesame seed is rich for oil content (50%) of excellent quality and protein (25%) of sulfur containing amino acid. Sesame meal has been used for animal feed and defatted flour can be used for

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human consumption.

Sesame has important agricultural advantages: it can set seeds and yield under relatively high temperature, on stored soil moisture without rain or irrigation. It can be grown in rotation with other main crop in the area and the season when other crops can not be grown and yield.

However,very little research in the past has been devoted to sesame. Limited research has been done in less developed countries where funds and scientists are scarce. No International Research Center has sesame as their mandate crop. Furthermore,sesame research in developing countries could not benefit from research done in developed countries, as has been the case in many other crops,because it is very minor crops or they has not grown sesame in their countries. Therefor mean yields of sesame are very low although potentially they could be much higher. Various factors are responsible for the low yield such as, erratic rainfall, low input levels, uneven ripening of the capsules, dehiscence and seed shattering, diseases and insects and of course the adapted and high yielding cultivar.

Yield components of sesame consists of many characteristics of sesame crops itself and its related functions that contribute to seed yield and all of these characteristics must be improved by plant breeder singly or in combinations. They are as following:

- Height
- Days to first flowering
- Days to 50% flowering
- Number of branches per plant

- Length of branches bearing capsules
- Number of capsules per nodes
- Number of capsules per branches and per plants
- Number of seed per capsules
- Seed size or seed weight (1,000 seed wt.)
- Seed weight or seed yield per plants
- Number of plants per unit area

Due to several components and their variations, sesame breeder will concentrate on only few characters that mainly contribute to yield and has economical value. They are as following:

- Seed size and seed color
- Non-shattering or semi-shattering
- Determinate
- Upright growth,no lodging
- Earliness
- High oil and protein
- Disease resistance
- Drought resistance

Although sesame has been grown in Thailand for very long time but planted area and production of sesame has not been increased during the last ten years. Thai sesame farmers are small holder who do farming under rainfed and drough-prone land with soil low in fertility. Annual planted area is about 35,000 to 46,000 ha while production ranges is about 21,000 to 30,000 ton. Average yield per hectare is relatively low, about 600-700 kg/ha.

Sesame is a versatile crop taht can be grown in many parts of the country. Sesame production area in Thailand are in the North,North-east and the Central Region.

2. OBJECTIVES

Objectices of this project are to create widely based segregating population of sesame for selection and breeding of improved cultivar for Thailand and Israel, which will be determinate and nonshattering types. The determinate type of sesame will mature within a short time span together with non-shattering capsules, thus facilitating harvest with minimum seed losses and shorter growing season.

3. MATERIALS AND METHODS

At the present, all sesame cultivars are indeterminate, i.e. the plants produce leaves,flowers and capsules continuously as long as there is moisture available in the soil. At harvest time, the capsules will be over matured, matured and immature ones on the harvested branches. That make seed losses unavoidable. Determinate genotype,discovered by Ashri by mutation will reduce seed losses and together with non-shattering or semi-shattering it will minimize seed losses to acceptable level.

Most effort in this project is to breed determinate cultivars adapted to various growing conditions in Thailand and Israel using the determine mutant induced by Ashri (1,2) and the local sesame cultivars of desirable types.

Materials in this project are the following.

1. Collection of cultivars from local varieties and introduced cultivars and lines from foreign countries including those determinate mutants and non-shattering lines.

2. Early generation crosses made from hybridization of early and high yielding genotypes with semi-shattering genotyes from collection and single seed descent and plant to row method of selection is used in order to select genotypes of early yieding with non shattering.

3. Early generation crosses made from diallele and reciprocal crosses of 7 selected large seed and high yielding cultivars,(Roi-et 1, MKS-1 81111, Local white Chaibadan, Local Black Nakorn Sawan, Terras 77, Shang Cai Purple Flowers, and ICB-30 P4 (M3)). Again single seed descent and plant to row method is used to select large seed and high yielding cultivars.

4. 57 second generation of segregating lines from crosses of high yielding cultivar and determinate mutants in Israel. Single seed descent is used in F_2 and plant to row selection is employed in F_3.

This cooperative breeding project will make possible for Thai sesame breeder to obtain seeds of cultivars, segregating populations and advance selected lines of genotypes adapted to Thai conditions and needs, training and also enable us to advance the program faster by shifting and sharing the breeding materials between the two countries.

The project was planned for 3 years in both Israel and Thailand (June 1985 - June 1988).

4. RESULT AND DISCUSSION

Project in Israel started later than planned because Dr. Ashri the principle investigator was on one year sabbatical leave. However, the materials he developed earlier were available to start the project in Thailand without delay.

Progress Report 1985.

At Ubon Field Crops Research Center, 243 lines collected locally and from foreign sources were planted in September 1985 and harvested in December 1985. Days to first flowering, days to 50% flowering, days to harvest, seed yield and seed weight were recorded. Twenty lines of high seed yield and other desirable characteristics were selected for further study. Some lines in the study were non-shattering but seed yield was extremely low.

Progress Report 1986.

Approximately half of the whole collections of sesame lines (318 lines) were planted in early rainy season and late rainy season in order to study in details all 33 characters according to IBPGR descripter for both seasons and their interaction to seasonal variation. In early rainy season of 1986, some results were as following.

maturity date 83-124 days

83-90 days-113 lines

- Seed Yield 1.6-253.0 kg/rai

101-140 kg/rai - 19 lines

more than 141 kg/rai -2 lines

- Seed weight 1.360-4.763 gm/1000 seeds

3.5 gm/1000 seed - 19 lines

In late rainy season, little change was observed in maturity date. Seed yield, seed weight and number of capsules per plant were significantly lower than the early crops. All lines in both season were indeterminated and shattering. They were non branched, basal branched and top branched.

2. Hybridization Program.

2.1 Twenty-three crosses of several high yielding large seeded varieties were made in early season of 1986. F_1 seed were planted in late season at Ubon Field Crops Research Center and F_2 seed were planted at Supanburi Field Crops Research Center in dry season with irrigation. F_3 seeds harvested from F_3 were supposed to be planted at Ubon Field Crops Research Center in June. However, it was postponed to late season due to lack of rain in early season 1987.

2.2 Hybridization program was made on early and high yielding varieties (Roi-et 1 and MKS-I-81111) with 5 lines of semi-shattering types in order to incorporate the non-shattering characters into the standard and new varieties. F_1 seeds from 16 crosses were planted at Ubon Field Crops Research Center in 1986. F_2 and subsequent F_3 were planted at Supanburi Field Crops Research Center under irrigation in dry season and F_4 was planned to plant at Ubon Field Crops Research Center in rainy season of 1987 with plant-to-row method of selection.

3. Selection in segregation population. Fifty-seven families of F_2 seed made from crosses of determinated, non-shattering and high yielding types in Israel were sent and planted at Supanburi Field Crops Research Center in 1986 dry season with irrigation. Plant to row selection in F_4 in rainy season at Ubon Field Crops Research Center will be employed in rainy season 1987.

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All F_4 lines were planted at Ubon Field Crops Research Center as planned in early rainy season. At the present, plants are in late vegetative stage. Early rainy season collections has to be postponed due to lack of early season rain this year.

REFERENCE

1. Ashri, A. (1981) Sesame, Status and Improvement, POA Plant production and Protection Paper No.29, Rome, pp 198.
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3. Benjasil, V. (1984) Production, Research and Development of Sesame and Safflower in Thailand. Proceeding of FAO International Export Consultation on Sesame and Safflower. Vitarbo, Italy, (in press).
4. Meerith, C. (1986) Sesame Genetics and Varietal Improvement. Proceeding on the First Sesame Research Workshop, Faculty of Agriculture, Khon Kaen University, Khon Kaen. p 75 - 78 (in Thai).

Table 1. Plot Yield (Kg/rai), 1,000 Seed Weight (gm) and Days to Maturity of Some Sesame Line in Collection in Early and Late Rainy Season 1986

Line	Early Rainy Season 1986			Late Rainy Season 1986		
	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturity	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturit
1. MKS-I-81219	70.4	2.22	112	28.8	3.07	82
2. MKS-I-81299	60.8	2.53	108	3.2	2.25	73
3. MKS-I-81339	60.8	2.82	108	19.2	2.87	73
4. MKS-I-81238	64.4	2.97	112	32.0	2.99	82
5. MKS-I-81052	83.2	3.48	108	48.0	3.25	73
6. MKS-II-82254	80.0	3.06	93	25.6	3.51	83
7. MKS-II-82288	64.0	3.10	93	48.0	3.32	85
8. MKS-II-82294	67.2	2.74	93	57.6	3.24	82
9. MKS-L-82431	60.8	3.11	93	25.6	3.09	82
10. MKS-L-82199-1	121.6	2.64	93	41.6	2.43	82
11. MKS-L-82330	115.2	2.63	93	32.0	2.45	82
12. MKS-L-82405	124.3	3.01	93	12.8	2.51	82
13. MKS-L-82550	73.6	2.54	93	27.2	2.62	82
14. MKS-L-82189	121.6	2.65	93	38.4	2.98	82
15. MKS-L-82193-2	105.0	2.44	93	38.4	2.47	90
16. MKS-L-82214	140.8	2.68	93	28.8	2.47	82
17. MKS-L-82284	128.8	2.80	93	24.0	2.70	82
18. MKS-L-82269-2	112.0	2.84	93	44.8	2.18	82
19. MKS-II-81004-1	80.0	3.25	93	22.4	2.79	80

Table 1. (cont.)

Line	Early Rainy Season 1986			Late Rainy Season 1986		
	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturity	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturity
20. MKS-II-81008	118.4	2.79	93	32.0	2.66	82
21. MKS-II-81012-1	121.6	3.20	93	51.2	3.06	83
22. MKS-II-81027	70.4	2.25	93	36.8	2.27	82
23. MKS-I-81162	89.6	3.14	93	-	-	-
24. MKS-I-81375	73.6	2.43	85	32.0	2.80	75
25. MKS-I-81028	115.2	2.40	85	38.4	2.77	82
26. MKS-I-81029	252.8	3.46	85	28.8	2.99	75
27. MKS-I-81040	70.4	3.50	85	25.6	2.58	75
28. MKS-I-81157	64.0	3.13	85	22.4	2.85	75
29. MKS-II-81046	89.6	3.26	85	-	-	-
30. MKS-II-82048-2	83.2	3.07	86	22.4	1.51	75
31. MKS-II-82087	80.0	2.63	86	22.8	2.78	73
32. MKS-II-82189	70.4	2.43	86	14.4	2.69	75
33. MKS-II-82239	86.4	2.79	86	32.0	2.52	75
34. MKS-II-82296	73.6	2.77	86	38.4	2.51	75
35. NW Bi 4	99.2	2.67	86	28.4	2.49	75
36. NW Bi 28	131.2	3.44	86	16.2	2.60	75
37. NW Bi 31	131.2	3.13	86	28.8	2.57	75
38. MKS-I-81250	102.4	2.86	86	35.2	2.82	75

Table 1. (cont.)

Line	Early Rainy Season 1986			Late Rainy Season 1986		
	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturity	Plot Yield (Kg/rai)	1,000 Seed Weight(gm)	Days to Maturity
39. NW Bi 21	124.8	3.04	86	35.2	2.65	75
40. NW Bi 24	124.8	3.05	87	-	-	-
41. NW Bi 26	70.4	3.34	87	28.8	2.89	75
42. NW 106 B	105.6	2.48	87	22.8	2.53	75
43. Br 208	89.6	2.80	87	38.4	2.60	75
44. PL 259	134.4	2.75	87	38.4	2.62	75
45. SI 19	99.2	1.87	87	64.0	2.74	75
46. SI-1	64.0	3.00	87	35.2	2.56	75
47. MKS L 82390	60.8	3.05	87	19.2	2.53	86
48.MSK II 82268	60.8	2.68	87	6.4	2.82	75
49. MKS II 82280	80.0	2.53	87	24.0	2.36	75
50. MKS II 82247	89.0	3.50	87	35.2	2.82	75
51. MKS II 82264	96.0	3.34	87	51.2	2.62	75
52. MKS II 82285	105.6	2.62	87	38.4	3.00	75
53. MKS II 82259	60.8	2.86	87	35.2	2.65	75
54. MKS II 82286	60.8	3.12	87	57.6	2.68	75
55. 2 BAN Br	67.2	2.06	87	48.0	2.34	75
56. 17-3 BO	70.4	2.73	87	22.8	2.72	75
57. 18-2 OO	73.6	2.76	87	22.8	2.67	75

Table 1. (cont.)

Line	Early Rainy Season 1986			Late Rainy Season 1986		
	Plot Yield (Kg/rai)	1,000 Seed Weight (gm)	Days to Maturity	Plot Yield (Kg/rai)	1,000 Seed Weight (gm)	Days to Maturity
58. 18 2 BA	67.2	2.63	87	16.4	2.84	75
59. 17 0	80.0	2.74	87	20.8	2.72	75
60. 10 BAN	112.0	3.42	87	27.2	2.45	75