SETTING PERCENTAGE OF SUNFLOWER(Helianthus annuus L.) AND ITS RELATION TO THE YIELD

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ABSTRACT

Setting percentage of 10 hybrids and 25 inbred lines by natural self-cross, illegitimate pollination and free pollination were investigated and analysed. The results showed: Setting percentage of free pollination was higher than that of illegitimate pollination and the latter was higher than that of natural self-cross. Setting percentage of natural self-cross and illegitimate pollination showed significantly positive correlation and regression to single plant yield; the relations between 100-seed weight and the yield was not significant. Whereas, setting percentage of free pollination was slightly related to single plant yield; 100-seed weight showed significantly positive correlation and regression to the yield. When up to 53.11%, setting percentage was hardly related to the yield. Therefore, when setting percentage was below 50%, higher setting percentage lines should be selected. When over 50%, greater 100-seed weight lines should be.

INTRODUCTION

Setting percentage of sunflower is one of major factors forming single plant yield. Not only it directly affects the propagation coefficient of inbred lines and the yield of hybrid seed production, but also it is a stable yield factor of hybrid. Some studies on setting percentage of sunflower were made in some countries by means of weighing seeds[1]. In China, the study is in an initial stage[2]. The report here is a preliminary research on setting percentages of natural self-cross(Y1)[3], setting percentages of illegitimate pollination(Y2) and setting percentage of free pollination(Y3) of sunflower hybrids and inbred lines through investigating and measuring a large

number of lines, and the regressive and correlative relations in statistics between setting percentage, 100-seed weight and single plant yield were analysed The study could be considered as a guide to sunflower breeding work.

MATERIALS AND METHODS

10 hybrids and 25 inbred lines(11B-lines, 14 restorer lines) were planted as material tested in Inner Mongolia Academy of Agricultural Science in 1990. Random blocks and three replications were available for hybrids; every plot area was 31.88m ; row spacing was 70cm; plant spacing was 23cm. Single row planting was available for inbred lines; row length was 9m; row spacing was 70cm; plant spacing was 30cm 15 plants from each material were chosen as typical samples,among which 5-covered-plant was used for self-cross pollination, 5-covered illegitimate pollination and 5-non-covered for free pollination. The setting percentage, 100-seed weight, single plant yield and oil content were investigated and measured The experimental results were analysed by statistics[4]

RESULTS

1. Setting percentage of sunflower

Table1 presented the setting percentage of sunflower (hybrids and inbred lines) by three pollination methods, i.e. Y1,Y2 and Y3. It showed the general tendency and range of three types of setting percentage Whether hybrids or inbred lines, the average setting percentage by free pollination was the highest, illegitimate pollination was next, and natural self-cross was the lowest, i.e. Y3>Y2>Y1. Moreover, the differences among three types of setting percentage were significant.

2. Relations between setting percentage and yield of sunflower

Table2 showed the correlative and regressive relations between setting percentage, 100-seed weight and single plant yield of sunflower hybrids and inbred lines by three pollination methods. For the hybrids and inbred lines of natural self-cross, the setting percentage had very significantly positive correlat-

ive and regressive relations to single plant yield. According to the regression equations, it could be concluded that the single plant yield(y) of hybrids and inbred lines relevantly increased 0.7 gram and 0.5 gram respectively, with every increase of setting percentage (x) by 1%; whereas the correlative and regressive relations between 100-seed weight and single plant yield were not significant. therefore, lines showing higher natural self-cross setting percentage should be selected, which was favourable to select out high yield hybrids and inbred lines.

Table1. Three types of setting percentage of sunflower hybrids and inbred lines

code	hybrids			inbred lines			
	Y1	Y2	Y3	Y1 A	Y1 B	Y2	Y3
1	19.81	57.49	68.62	4.68	2.78	10.30	50.01
2	4.53	32.42	61.69	1.64	6.11	22.67	32.50
3	18.28	34.67	74.35	9.88	11.86	19.70	31.73
4	14.85	60.73	87.45	2.52	57.87	37.37	77.45
5	4.79	13.12	91.62	47.17	37.91	67.29	68.52
6	27.16	58.54	73.95	2.36	1.77	20.33	37.17
7	2.14	79.78	81.41	27.65	28.88	46.79	57.66
8	2.00	25.86	65.31	19.54	16.79	30.00	30.19
9	1.52	40.15	76.57	61.34	28.04	77.01	80.47
10	8.84	63.46	86.96	12.26	38.63	56.75	61.54
11				41.04	11.86	59.65	60.11
12				35.09	1.54	51.11	49.97
					45.75		
mean	10.39	46.62	76.79	22.20		41.58	53.11

Note: A= Y1 value of inbred lines No.1-2
B= Y1 value of inbred lines No.13-25

From the estimated results that broal-sense heritability of setting percentage by natural self-cross was 66.26%, the coefficient of genetic variability was 77.53%, and relative genetic progress was 130%, it could be concluded that transmissed capacity of this character was stronger from parental generation to ficial generation, and ficial generation also obtained greater genetic increment. This character had a wide variation range in heredity, therefore,

Table2. Correlative and regressiv relations between setting percentage, 100-seed weight and single plant yield of sunflower

Types		Characters	Mean	Correlation coefficient	Regression coefficient	Regression equation
Natural self-cross	Hybrids	Setting percentage(%)	10.39	0.9361**	0.7108**	$\hat{y}$=1.6500+0.7108x
		100-seed weight(g)	6.56	-0.5919	-5.5539	$\hat{y}$=45.4542-5.5539x
	Inbred lines	Setting percentage(%)	22.20	0.8270**	0.5342**	$\hat{y}$=1.1350+0.5342x
		100-seed weight(g)	4.50	-0.1390	-0.8566	$\hat{y}$=16.8483-0.8566x
Illegitimate pollination	Hybrids	Setting percentage(%)	46.62	0.7135*	0.3887*	$\hat{y}$=12.1046+0.3887x
		100-seed weight(g)	4.78	-0.2279	-2.1874	$\hat{y}$=40.6860-2.1870x
	Inbred lines	Setting percentage(%)	41.58	0.7192**	0.3735**	$\hat{y}$=4.8505+0.3735x
		100-seed weight(g)	3.39	0.2879	2.8839	$\hat{y}$=10.6119+2.8839x
Free pollination	Hybrids	Setting percentage(%)	76.79	0.1104	0.0960	$\hat{y}$=63.3172+0.0960x
		100-seed weight(g)	5.34	0.8245**	9.2414**	$\hat{y}$=21.3602+9.2414x
	Inbred lines	Setting percentage(%)	53.11	0.0783	0.0524	$\hat{y}$=26.8234+0.0524x
		100-seed weight(g)	3.91	0.5910*	4.6965*	$\hat{y}$=11.2443+4.6965x

*=Significant at 5% level, **=Significant at 1% level.

Breeding objectives could be achieved easily by systematic selection, and this character of higher hereditary capacity could be selected in early generation.

For the hybrids and inbred lines of illegitimate pollination, the result was similar to that of natural self-cross, i.e. setting percentage had very significantly or significantly positive correlasive and regressive relations to single plant yield. From regressive equations, it could be concluded that single plant yield (y) of hybrids and inbred lines relevantly increased 0.4 gram with every increase of setting percentage (x) by 1%; whereas the correlative and regressive relations between 100-seed weight and single plant yield were not significant. Thus, for illegitimate pollination lines, higher setting percentage lines showed be selected in breeding.

For free pollination hybrids and inbred lines, 100-seed weight had very significantly or significantly positive correlative and regressive relations to single plant yield. The single plant yield (y) of hybrids and inbred lines relevantly increased 9.2 gram and 4.7 gram respectively, with every increase of 100-seed weight (x) by 1 gram. While the relations between setting percentage and single plant yield was very minor. In this case, greater 100-seed weight lines should be selected in breeding.

DISCUSSION AND CONCLUSIONS

Besides the compatibility of self-cross and cross-pollination, setting percentage of sunflower was also affected by pollinator (insects), hand pollination state, environmental factors (temperature , relative moisture) and planting places etc. For illegitimate pollination lines, hand pollination was lasted every other day from the beginning to the end of flowering. Thus it could be ensured that covered heads were self-pollination. In the same material for test, flower head of similar size and similar flowering stage were selected so as to reduce the error caused by natural environment condition when pollinated.

In general, setting percentage of free pollination was higher than that of illegitimate pollination, and the latter was higher than that of natural

self-cross. The setting percentage of natural self-cross and illegitimate pollination were very significantly or significantly correlative and regressive relations to single plant yield, while the relations between 100-seed weight and single plant yield was not significant. In contrast setting percentage of free pollination was slightly related to single plant yield; 100-seed weight showed significantly positive correlation and regression to single plant yield. It could be concluded that as setting percentage was increased, the relations between setting percentage and yield became minorer, while the relations between 100-seed weight and yield became greater. Consequently in breeding procedure, more care should be taken to sunflower setting percentage. When up to 53.11%, this factor would have little relation with the yield Therefore, when setting percentage was below 50%, it was effective to select higher setting percentage lines. When setting percentage was over 50%, greater 100-seed weight lines should be selected When do so, high yield hybrids and inbred lines could be obtained.

In the study, the relations were analysed between setting percentage, 100-seed weight and oil content of hybrids and inbred lines by natural self-cross illegitimate pollination and free pollination. The results showed: among the different pollination methods, setting percentage and 100-seed weight all were not significantly correlated and regressed to oil content. As a result, in breeding, when oil content was considered, it was not necessary to take care of the factors such as setting percentage etc.

In the experiment, some inbred lines showing higher setting percentage of natural self-cross were selected. They were inbred lines No.5,9,11,16, and 25, among which the Y1, Y2 and Y3 value of inbred lines No.9 came up to present would setting percentage level of high quality inbred lines. this achievement was of practical significance to select high quality hybrids of sunflower in China.

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