

Study on Gibberellin Resulted in Male Sterility to Produce Hybrid Strain of Sunflower Huang Zengqiang

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Abstract

This experiment used gibberellin as male-sterilant to deal with thirty self-lines, among which ten self-lines belonged to B-lines. They were compared with their corresponding A-lines by supplementary pollination in the same way of commodity production of hybrid seed. The results were as follows: at 25--150ppm dose of gibberellin, the different concentrations might result in different emasculative effects for the different self-lines. Two self-lines reacted less to gibberellin. The suitable concentration was 50-75ppm to oil-sunflower and 75-12ppm to confection-sunflower. If the appropriate concentration was adopted, emasculative effect would be ideal, and the cross-fertility characteristic of crossbred seed would not be obviously influenced.

Key words

Sunflower Gibberellin Chemical emasculation Cross-fruitfulness

Introduction

In 1959, Schuster, a French scientist, discovered that when the aqueous solution of gibberellin was affected on young alabastrum on sunflower, it could lead to male-sterility. After that scholars of many countries proved the conclusion one after another. Also, it has been used as a means of averting artificial emasculation in experiments. Considering the yield of kernels may reduce after the sunflower was treated by gibberellin and the aqueous solution couldn't be applied quantitatively and directly during a fixed period to the young buds in large areas and intensive seed production, it hasn't been used widely in commodity production of hybrid seed. It is worth mentioning that L.K. Voskoboynik and N.I. Dvoryadkin of the previous Soviet Union probed the method of producing commodity hybrid seed by using mechanized spray and chemical emasculation. In Shanxi rural areas, the sunflower fields are scattered among families, with small land areas and sufficient labour force. The

aqueous solution can be sprayed directly according to fixed time. Artificial complementary pollination can be adopted in florescence to increase fruits. When we considered that chemical emasculation could make more self-lines fully combine and be made full use of, especially like the self-line with the fertility gene of the same kind, such as B-line can be combined, research was carried on as to the aspects of the effect of gibberellin chemical emasculation, the influence to the plant growth, the cross-fruitfulness and the seed-marketability.

Materials and methods

Select thirty stable self-lines, among which seventeen for confection -lines and thirteen for oil-sunflower (listed table 1). The concentration of gibberellin aqueous solution is divided into six levels, that is, ck, 25, 50, 75, 100, and 125 ppm, each to deal with twenty plants. When spraying, use artificial knapsack sprayer. In the early days when flower buds are formed, spray them completely. The dose is about 1--1.5ml. Observe the fertility change and calculate the semisterile by $1/2$. Make a growth observation to the ten B--lines materials and in blooming period, ten B lines and corresponding A -lines adopted the supplementary pollination. When they are mature, harvest ten plants and compare the fruitfulness.

Results, discussion and conclusion

1. The effect of gibberellin inducing male-sterility

Listed in table 1 below are the testing results. From it we can conclude that at 25-125ppm of concentration, different self-lines react differently from different concentration treatments. Generally, oil self-lines can reach ideal male-sterility effect at 50-75ppm dose. confection self-lines are slow in reacting concentration. The suitable concentration is 75-125ppm. Two self-lines react less to gibberellin.

2. The influence of gibberellin to sunflower's growth

After the plants are treated by gibberellin, such characteristics as leaf blade number, the flower disc diameter, stem width, etc. don't influence obviously. Because of the function of plant growth hormone, the plant height for each self-line becomes higher with the progressive increase of the concentration. The blooming stage of self-lines usually comes 2-4 days earlier. The shapes of flower disc have protrusions of

different degrees under various concentration gradients. Too high concentration makes the flower disc grow abnormally.

3. The effect of gibberellin to the cross-fertility yield and characteristics of crossbred seed.

Gibberellin may lead to sunflower's male-sterility and make the plants' self-pollination impossible. Under natural conditions, influenced by bees' number and pollination quality, it is natural that the yield of crossbred seed is less than that of usual plants. If artificial supplementary pollination is carried on, compared with their corresponding A-line, the yield of kernels doesn't reduce within appropriate concentration range. The hundred-grain weight is not influenced, either. However, the excessive concentration may make the discs grow abnormally and the counts of floscule decrease and there is a big decrease in yield (table 2) and the seeds become long and thin. The commodity appearance is also poor. Gibberellin pulvis is very cheap, which can be easily bought in market. Each breeding unit has a large quantity of self-lines. Limited by ternary-lines, many self-lines couldn't be combined. If we can compound two-lines crossbreeding by using gibberellin chemical emasculation, self-lines can be made full use of. It is an important research to produce hybrid strain outside the cytoplasmic male-sterility line.

Table 1 The effect of gibberellin treatment on fertility in self-lines of sunflower (male-sterile set -x)

concn ppm		25	50	75	100	125	concn ppm		25	50	75	100	125
materials							materials						
non-oil self-lines							oil self-lines						
92-2B	0	0	40	67.5	70	92-106	5	67.5	100	100	100	100	
92-4B	0	0	0	25	15	7601-6	17.5	40	100	100	100	100	
92-6B	27.5	72.5	82	97.5	100	74102-4B	85	100	100	100	100	100	
92-11B	12.5	65	55	72.5	90	76202-3B	60	55	75	100	100	100	
92-19B	0	35	45	100	100	76-64B	70	100	100	100	100	100	
92-25B	0	10	75	75	100	90-1516B	90	100	100	100	100	100	
92-31B	55	85	95	100	100	90-337B	67.5	70	100	100	100	100	
92-8	0	0	0	5	17.5	6104	70	100	100	100	100	100	
92-10	10	60	100	100	100	7911	100	100	100	100	100	100	
92-59	100	100	100	100	100	92-310B	70	100	100	100	100	100	
92-60	0	22.5	70	100	100	662	55	82.5	100	100	100	100	
92-63	0	70	100	100	100	664	100	100	100	100	100	100	
92-65	0	30	62.5	100	100	667	100	100	100	100	100	100	
92-81	50	80	100	100	100	671	100	100	100	100	100	100	
92-104	12.5	80	100	100	100	644	70	100	100	100	100	100	

Table 2 The effect of gibberellin treatment on cross-fruitfulness and 100-grain wt. in self-lines of sunflower
(1—seed yield, 2—compare with A-line \pm %, 3—100 grain wt.)

treatment self-lines	treatment (ppm)	A-line	B-line (ck)	25	50	75	100	125
		74102-4B	1	343	371	348	339	327
	2			+1.5	-1.2	-4.7	-35.6	-44.9
	3	7.5	7.5	7.6	7.5	7.5	7.5	7.3
76202-3B	1	510	552	550	489	382	332	332
	2			+7.8	-4.1	-25.1	-34.9	-34.9
	3	9.6	9.8	9.7	9.7	9.6	9.4	9.5
76-64B	1	360	360	354	371	322	301	158
	2			-1.7	+3.1	-10.6	-16.4	-56.1
	3	7.0	6.9	7.2	7.1	6.9	6.5	6.5
90-1516B	1	283	270	265	277	254	192	89
	2			-6.4	-2.1	-10.2	-32.2	-68.9
	3	4.2	4.2	4.3	4.2	4.3	4.0	4.1
92-2B	1	465	470	481	453	423	437	441
	2			-3.4	-2.6	-9.0	-6.0	-5.2
	3	9.6	9.6	9.7	9.7	9.7	9.7	9.6
92-4B	1	600	509	513	601	534	494	501
	2			-14.5	+0.2	-11.0	-17.7	-16.5
	3	7.9	7.6	7.6	7.6	7.6	7.4	7.4
92-6B	1	666	658	652	649	627	581	617
	2			-2.1	-2.6	-5.9	-12.8	-7.4
	3	8.3	8.2	8.7	8.2	8.1	7.9	8.0
92-11B	1	667	64	642	645	630	607	565
	2			-3.7	-3.3	-5.5	-9.0	-15.3
	3	12.6	11.1	11.1	10.9	10.0	10.8	10.0
92-19B	1	346	331	343	347	329	326	298
	2			-0.9	+0.3	-4.9	-5.8	-13.9
	3	10.0	9.8	10.1	9.9	9.7	9.7	9.7
92-25B	1	642	641	661	647	612	613	604
	2			+3.0	+0.8	-4.8	-4.5	-5.9
	3	10.7	10.5	10.5	10.7	10.8	10.4	9.6