Appraising the hybrid variety of sunflower by using grey connecting degree

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Abstract: By using the grey connecting degree we made a comprehensive and quantitative analysis to the data materials of the main economic properties of sunflowor hybrid variety in the comparative trial: diameter of flower disc, grnin weight of one flower, disc weight of 100 grains and yield per unit area. Then we appraised the advantage and disadvantage of each hybrid variety . The result of our appraisement was the same with the result by using the comparative method of single yielddata. This method was simple and feasible. It could provided reliable result to breeders.

Key words: sunflower、economic propertiees、connectingdegree analysis

Most breeders made simple comparison to single prosperty of crops when they appraised different crops at present. This method was influenced quitely by the people who made it. Some people used the indistint comprehensive appraising methed to improve it, but it did not solve the problem thoroughly. Some people used the grey connecting degree on the appraisement of cotton and wheat varieties and got better result in recently years.

We made appraisement on sunflower hybrid varieties by using this method.

1、Material and method

The sunflower hybrid varieties were: 74102-4A×47-17, Nei Monggol sunflower hybrid No. 2, Liaolin sunflower hybrid No. 2, white sunflower hjybrid, 74102-4A×46-17, 74102-4A×46-16, 74102-4A×48-22, 74102-4A×38-7, 61A×77-1, 61A×77-2, 75144-4-1-5-2A×87-1, 75144-4-1-5-2A×87-2, 75-28A×149. The trial was made in the Anlinqu experimental farm of our academy from 1989 to 1990. The fertility of the trial soil was of middle. The crop that last year planted in the soil was luctrne. The soil was cultivated in the autumn and irrigated in the winter. One trial plot was 6.0m×3.5m, 6 lines, random arranging, repeated 3 times. Bunch planted in the spring, hole distance was 60cm×60cm, two plants in a hole. Harvested four lines, gived up the two lines in the left and right . Took 10 plants from each plot for seed examination. Examined the

following items: diameter of flower disc、grain number of one disc、weight of 100 grains and counted the yield. Counted the connecting coefficient of each variety with the "ideal hybrid" from the above results by using the following formula:

$$\S i(k)=\frac{\min_i \min_k \left|Xo(k)-Xi(k)\right| + Pmax \max_i \max_k \left|Xo(k)-Xi(k)\right|}{\left|Xo(k)-Xi(k)\right| + Pmax \max_i \max_k \left|Xo(k)-Xi(k)\right|}$$

Xi: variety; k: properities; p: distinguishing coefficient, its value was 0 to 1, often was 0.5. Countedthe connecting degree from connecting coefficient and made appraisement to each variety at last. The result trends of two year were the same. We used the resalt of 1990 in this paper.

2、Result and analysis

(1) Defined the "ideal hybrid variety"

Every main property of the "ideal hybrid variety" was better than the comparative varieties. We defined 74102-4A×47-17 as the "ideal variety" by our observation and breeding aim. The main properties of the varietis were seen in table 1.

Table 1. Main properties of the "ideal variety" and other varieties

variety or hybrid compose	code name	diameter of flower disc (cm)	weight of the grain of one disc (g)	weight of 100 grains (g)	yield (kg/ha)
74102-4A×47-17	X0	29.34	137.58	10.6	3821.40
Nei Monggol sunflower hybrid No.2	X1	25.86	124.02	8.1	3444.15
Liaolin hybrid No.2	X2	24.60	116.50	8.9	3237.75
White sunflower hybrid	X3	23.38	124.54	9.7	3460.20
74102-4A×46-17	X4	22.08	72.20	10.1	2004.45
74102-4A×46-16	X5	21.00	68.67	5.6	1907.25
74102-4A×48-22	X6	24.20	96.26	8.4	2673.30
74120-4A×38-7	X7	23.54	112.34	7.5	3120.00
61A×77-1	X8	17.62	36.08	9.5	1002.15
61A×77-2	X9	24.96	126.02	9.5	3515.85
75144-4-1-5-2A×87-1	X10	19.50	71.06	8.6	1974.30
75144-4-1-5-2A×87-2	X11	21.20	107.98	7.3	2999.70
75-28A×149	X12	19.10	88.50	9.1	2458.05

(2) Handled the original data

The purpose of handling the original data was to dispel the influence of different dimensions and amount degrees of every factors, so we could make the comparison and analysis easier.

There were two main handling methods: initializing and averagizing. We used the former method. That was: every data divided the related Xo. The results was seen in table 2.

Table 2. The initialized values of all properities of every variety

XI	K			
	1	2	3	4
X0	1.0000	1.0000	1.0000	1.0000
X1	0.8814	0.9014	0.7642	0.9013
X2	0.8384	0.8468	0.8396	0.8473
X3	0.7969	0.9052	0.9151	0.9055
X4	0.7526	0.5248	0.9528	0.5245
X5	0.7157	0.4991	0.5283	0.4991
X6	0.8248	0.6997	0.7925	0.6996
X7	0.8023	0.8165	0.7075	0.8165
X8	0.6005	0.2622	0.8962	0.2622
X9	0.8507	0.9160	0.8962	0.9200
X10	0.6646	0.5165	0.8113	0.5166
X11	0.7226	0.7849	0.6887	0.7850
X12	0.6510	0.6433	0.8585	0.6432

(3) Strived for the difference of two levels

Counted the absolute difference of every initial value from table 2:

$\triangle i(k) = | Xo(k) - Xi(k) |$ (i=1, 2, ... 12, k=1, 2, 3, 4)

The results was seen in table 3

Table 3. The absolute values of difference of the initialized values of every properity

△ I	K			
	1	2	3	4
△ 1	0.1186	0.0986	0.2358	0.0987
△ 2	0.1616	0.1532	0.1604	0.1527
△ 3	0.2031	0.0948	0.0849	0.0945
△ 4	0.2474	0.4752	0.0472	0.4755
△ 5	0.2843	0.5009	0.4717	0.5009
△ 6	0.1752	0.3003	0.2075	0.3004
△ 7	0.1779	0.1835	0.2925	0.1853
△ 8	0.3995	0.7378	0.1038	0.7378
△ 9	0.1493	0.0840	0.1038	0.0800
△ 10	0.3354	0.4835	0.1887	0.4834
△ 11	0.2774	0.2151	0.3113	0.2150
△ 12	0.3490	0.3567	0.1415	0.3568

Counted the maximum value and minimum value of two levels. The maximum and minimum differences of the first level were:

$$\min_k \{\Delta i(k)\} = \{0.0986\ 0.1527\ 0.0849\ 0.0472\ 0.2843\ 0.1752$$
$$0.1779\ 0.1038\ 0.0800\ 0.1887\ 0.2150\ 0.1415\}$$

$$\max_k \{\Delta i(k)\} = \{0.2358, 0.1616, 0.2031, 0.4755, 0.5009, 0.3004, 0.2925$$
$$0.7378, 0.1493, 0.4835, 0.3113, 0.3568\}$$

The difference of the second lerel were:

$$\min_i \{\min_k[\Delta i(k)]\} = 0.0472 \qquad \min_i \{\max_k[\Delta i(k)]\} = 0.7378$$

(4) Strived for the connecting coefficient of every variety with the "ideal variety".

Using the following formula:

$$\S i(k) = \frac{0.0472 + 0.5 \times 0.7378}{\Delta i(k) + 0.5 \times 0.7378} = \frac{0.4161}{\Delta i(k) + 0.3689}$$

Put $\Delta i(k)$ of every variety to the above formula, then we got the connecting coefficient (table 4).

Table 4. The connecting coefficient of every properity

§ I	K			
	1	2	3	4
§ 1	0.8535	0.8901	0.6881	0.8899
§ 2	0.7844	0.7970	0.7861	0.7977
§ 3	0.7274	0.8973	0.9169	0.8979
§ 4	0.6752	0.4980	1.0000	0.4928
§ 5	0.6370	0.4784	0.4950	0.4784
§ 6	0.7647	0.6218	0.7219	0.6217
§ 7	0.7610	0.7533	0.6291	0.7533
§ 8	0.5415	0.3760	0.8803	0.3760
§ 9	0.8030	0.9187	0.8803	0.9269
§ 10	0.5908	0.4882	0.7462	0.4882
§ 11	0.6438	0.7125	0.6117	0.7126
§ 12	0.5760	0.5735	0.8152	0.5734

(5) Counted the connecting degree

The counting formula was

$$ri = \frac{1}{n} \sum \S i(k)$$

The result counted with this formula was the common connecting degree. We could make appraisement to every variety only when the

importantes of each properity of every variety were the same. But in fact, the importances of different properities were not the same. The weighed conncting degree must be used to make real appraisment of every variety. That was: entrusted different weighted value to different connecting coefficitent:

$$ri=\frac{1}{n}\sum_{k=1}^{n} Wk\,\S i(k)$$

From former experience, we got the weighted valus of follow disc diameter, grain weight of one disc, weight of 100 grains and yield: 0.10、0.30、0.15、0.45. We got the sequence weighted connecting degree by used these values. The result was the same with that from the single yield comparison. The result were different when used the common connectingg degree(Table 5).

Table 5. The result comparison of three methods

code name of hyrid variety	common connecting degree		weighted connecting degree		yield	
	connecting degree	sequence	connecting degree	sequence	kg/ha	sequence
X1	0.8304	3	0.85606	3	3444.15	3
X2	0.7913	4	0.79443	4	3237.75	4
X3	0.8599	2	0.88353	2	3460.20	2
X4	0.6653	8	0.58718	9	2004.45	9
X5	0.5222	12	0.49675	11	1907.25	11
X6	0.6825	6	0.65107	7	2673.30	7
X7	0.7242	5	0.73545	5	3120.00	5
X8	0.5435	11	0.46820	12	1032.15	12
X9	0.8822	1	0.90507	1	3515.85	1
X10	0.5784	10	0.53716	10	1974.30	10
X11	0.6702	7	0.69137	6	2999.70	6
X12	0.6345	9	0.60996	8	2458.05	8

3、Summary

It was little seen for the use of grey connecting degree on crop breeding. We used it in sunflower hybrid. The result indicated that: it was simple and feasible, it could be spreaded. Notices must be taken to choose the "ideal hybrid variety". It must be the best on each proprity and a little highr than the comparatived variety, so to assure the positive of the connecting. The weighted value of each propority could be got by expaters giving or difined from former results. The recognization of peoplee to objeeect was mostly grey(not

comprehensive). We ought do from grey point when we made research to a systeem. The appraisemeent to crop variety belonged to the grey system category, so we should use grey theory and method. It could make a conmprehensive and completely appraisement to a variety, and could improve the quility of field trial and the accuracy of data.