Effect of seedling strengthening agent (SSA) on yield and quality

YAO Yanli, XU He, WANG Ruiqing, SONG Zheng, CAI Dongfang, YANG Guozheng

Plant Science and Technology College, Huazhong Agriculture University, Wuhan, China 430070
Email: yl17655360@yahoo.com.cn

Abstract

Taking high quality cultivar Huayouza No.6 (*BRASSICA NAPUS* L.) as an experimental material, the effect of 5 types of self-made seedling strengthening agent (SSA) on rapeseed yield and quality was studied. The result showed: (1)The yield difference was significant under 95% probability with the highest of SSA_2 reaching 232.28kg/667m^2, and the sequence of yield lined SSA_2>SSA_3 (SSA_4)>SSA_1 (SSA_5). (2)The oil content ranging from 36.91% to 39.04% (SSA_2), but no significant difference existed. (3)The difference of primary branches number per plant and grains number per pod among treatments were significant under 95% probability. The sequence for primary branches were SSA_2 (SSA_3)>SSA_4 (SSA_5, SSA_1), and SSA_2>SSA_3 (SSA_4)>SSA_1 (SSA_5) for grains number. And pods number per plant lined as SSA_2>SSA_3>SSA_4>SSA_1>SSA_5. (4)The root of SSA_2 was the heaviest, which was differed from SSA_5 significantly. Root weight was correlated to yield (r=0.74999).

Key words: *Brassica napus* L., SSA, yield, quality

Introduction

Rapeseed is an important oil plant in our country. Researches indicated that high yield will be, if the rapeseed growths well before winter. So, cultivating strong seedlings has been the researching hotspot. This experiment studied the effect of self-made seedling strengthening agent (SSA) on rapeseed yield and quality, to provide the theory understanding of rapeseed development.

Material and methods

The variety of Huayouza 6 (*Brassica Napus* L.) was used and the seed was sown on Sept.12, 2005, the seedlings were transplanted on Oct.14 with a population of 5500 plants/667m^2.

There were 5 prescriptions (named from SSA_1 to SSA_5) random arranged in the field with 3 replications and 16m^2(8m×2m) for each plot. SSA of 0.1% was sprayed 3 times, once every 10 days beginning at the coming back to grow after transplanting. Plants were harvested on May 14, 2006.

From each plot, 10 plants were sampled continuously when harvesting to investigate plant height, branches number, pods per plant, seeds per pod, and 1000-grain weight and so on.

About 3g of seed from the sample plants were collected to analyze protein content, oil content and fatty acid composition by HPLC.

Result and analyses

2.1 Effect of SSA on the economic character of rapeseed

There were different economic characters of rapeseed for different treatments (Table 1). As for plant height, there was no significant difference among the treatments. But SSA_4 was the highest, followed by SSA_1, SSA_2, and SSA_3, SSA_5 was the lowest. Again, no significant difference existed among treatments in root neck width, length of main florescence, pods per plant, and 1000-seed weight. However, the first branch height initiated of SSA_2 was significantly lower than that of SSA_4, number of first branches of SSA_2 was more than that of SSA_1 and SSA_5 obviously, and the seeds per pod of SSA_2 were more than that of SSA_3 which was more than that of SSA_5 significantly.

Table 1 Effect of applying different SSA on the economic character of rapeseed

Treatment	Plant height	Root neck width	First branch height	Number of first branches	Length of main florescence	Pods per plant	Seeds per pod	1000-seed weight
SSA_1	205.54a	2.41a	55.95ab	13.53b	57.75a	863.10a	16.28bc	2.83a
SSA_2	203.29a	2.51a	42.17a	15.70a	61.11a	983.83a	19.41a	2.84a
SSA_3	200.34a	2.47a	54.85ab	14.87ab	59.18a	948.10a	17.36b	2.83a
SSA_4	216.62a	2.48a	57.94b	14.83ab	59.68a	895.90a	16.80bc	2.89a
SSA_5	200.79a	2.42a	51.79ab	13.85b	59.04a	882.39a	14.53c	2.92a

Note: a, b, c different letter means significant $P<0.05$.

2.2 Effect of SSA on rapeseed yield

SSA had significant effect on rapeseed yield (see table 2). Yield of SSA_2 was the highest, 232.28kg/667m^2, remarkable higher than that of SSA_3, which was remarkable higher than that of SSA_1 and SSA_5.

Table 2 Effect of SSA on rapeseed yield

Treatment	Yield/(kg/16m^2)			Average /(kg/16m^2)	Yield /(kg/667m^2)	Sequence
	I	II	III			
SSA_1	3.94	4.71	3.69	4.11	2570.70 c	4
SSA_2	5.81	4.99	5.92	5.57	3484.20 a	1
SSA_3	5.15	4.73	4.64	4.84	3024.60 b	2
SSA_4	4.40	4.49	4.59	4.49	2809.05 bc	3
SSA_5	3.99	3.88	4.13	4.00	2502.15 c	5

Note: a, b, c different letter means significant $P<0.05$.

2.3 Effect of SSA on seed quality of rapeseed

The composition and content of fatty acid with different treatments were shown on table 3. The oil content of SSA_2 is the highest, the rest were sequenced as $SSA_4>SSA_3>SSA_1>SSA_5$, ranging from 39.04% to 36.91%. Oleic acid is unsaturated fatty acid which can be absorbed by human body easily. It is one of the important induce of fatty acid quality. Generally, the higher the oleic acid content is, the better the oil quality is. SSA_2 had the highest oil content of 65.10%, followed by SSA_3, SSA_4, SSA_1, and SSA_5 had the lowest. Based on the substrate competition hypothesis, there is negative correlation between oil content and protein content. SSA_2 had the lowest protein content of 21.74%, followed by SSA_3, SSA_1, and SSA_4 and SSA_5 had the highest content of 22.33%, just in the opposite sequence of the oil content. In all these analyses, SSA_2 could ameliorate the nutrition quality of rapeseed oil and make the fatty acid composition more reasonable.

Table3 Effect of different treatments on fatty acid composition of rapeseed

Treatment	Protein content/%	Oil content/%	Oleic acid/%	Linolenic acid /%	Lenolenic acid/%	Glucosinolate/%
SSA_1	22.31	37.44	63.84	21.88	9.23	9.95
SSA_2	21.74	39.04	65.10	21.63	9.00	7.52
SSA_3	22.22	37.89	64.86	21.92	9.14	3.32
SSA_4	22.33	37.90	64.43	21.52	9.12	1.68
SSA_5	22.33	36.91	63.40	21.92	9.26	6.16

2.4 Relationship between dry matter accumulation and yield of different vegetative organs

The result was shown in table 4. Dry matter accumulation varied from treatments. SSA_2 had the highest root weight of 24.67g/plant which was significantly higher than that of SSA_5, and had the highest seed weight of 54.17g/plant which was differed from that of SSA_3 of 46.50g/plant, and the later was more than that of SSA_1 and SSA_5 remarkably.

Table 4 Dry weight of different organs

Treatment	Root /(g/plant)	Stem /(g/plant)	Pot /(g/plant)	Total /(g/plant)	Seed /(g/plant)	Economic index/%	Stem to total/%
SSA_1	21.83ab	98.67a	45.0a	238.17a	39.83c	16.73	41.43
SSA_2	24.67a	103.67a	53.0a	257.67a	54.17a	21.02	40.23
SSA_3	22.00ab	96.00a	50.5a	233.17a	46.50b	19.94	41.17
SSA_4	19.83ab	94.00a	50.0a	220.17a	43.50bc	19.76	42.69
SSA_5	17.67b	89.00a	44.2a	215.17a	38.50c	17.89	41.36

Note: a, b, c different letter means significant $P<0.05$.

There were no differences in stem weight, pot weight, economy indexes and the total weight of the plant, and the weight ratio of stem to the whole plant. However, SSA_2 had the highest dry weight and economic index but the lowest stem ratio to the whole plant weight, which meant that there was a coordinating growth of the vegetative and reproductive organs, and in the seed filling period, more nutrition was transferred from the stem to the seed of SSA_2 than that of the others. There was notable relationship between root weight and yield with the correlation coefficient of 0.74999, but there was no significant correlation between yield and stem weight or pot weight. The ratio of stem to whole weight had negative correlation to economic indexes (Fig 1).

Summary and discussion

3.1 The seedling vigor had been improved by spraying SSA. The growth between the organs of above ground and underground was harmonious. It boosted up root system activity and leaf photosynthesis and increased the chlorophyll content and in the end the yield. There were remarkable differences of yield from different treatments. SSA_2 was the highest, then came $SSA_3>SSA_4>SSA_1>SSA_5$.

3.2 Rapeseed yield is determined by both intrinsic factor and extrinsic factors. The intrinsic factor is physiological and biochemistry characteristic controlled by specific genes, the extrinsic factors include light, temperature, water, soil and so on. But among the factors, the most important is water and nutrition. SSA could operate through adjusting and modifying the intrinsic factor, to coordinate with nutrition effect of extrinsic factors.

3.3 The quality is restricted by varietals. Some researches showed that the fatty acid content of rapeseed is affected by temperature. When the seedling was sprinkled with SSA, the oleic acid and linolenic acid content increased. The mechanism should be searched further.

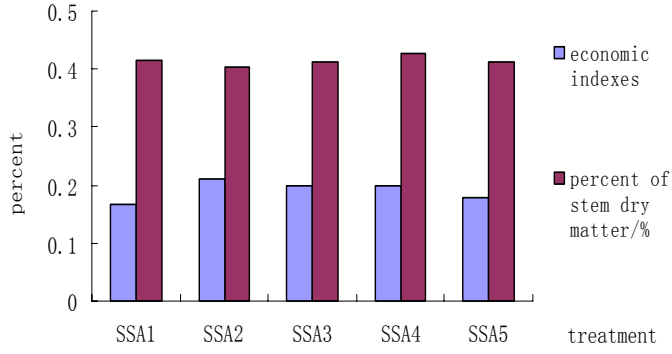

Fig1 the retationship between economic indexes and stem weight

3.4 Seed per pot is one of the yield components. It is controlled by hereditary characteristic. Ecological condition has little effect on it. In this experiment, the difference was remarkable on seeds per pod by different treatments. It's offering a new way for increasing the yield. Does SSA can really increase seeds per pod?

3.5 Correlation analysis indicated that dry root weight and yield had close relationship. Therefore, in order to increase rapeseed yield, to boost up root growth and enlarge root/shoot ratio for enhancing nutritional element intake, all of which could balance source and shed.

Reference

Omitted.