Effect of planting patterns on shoot and seed yields of a new dual-purpose rapeseed cultivar Xiangzayou 780

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Abstract

Studies on effects of planting densities, plastic coverage, and shoot harvest period were carried out with a new dual-purpose rapeseed cultivar Xiangzayou 780. The results showed that when Xiangzayou 780 was harvested for shoots once its seed yield was near to that of Xiangyou 15 and Xiangzayou 780 without harvesting shoot production, and shoot production increased as the planting densities were increased. The averaged shoot yield per hectare reached up to 7500 km, therefore, output value of growing Xiangzayou 780 with shoot harvest was double compared with that of growing Xiangzayou 780 without shoot harvest or growing Xiangyou 15.

Key words: rapeseed, Xiangzayou 780, shoot, planting pattern

Introduction

The major goal of conventional rapeseed production is to only harvest seed yield. Thus, its production efficiency is low and the economical efficiency is not ideal. Through harvesting of shoots and seeds in some early-shooting rapeseed cultivars, the output value of rapeseed production can be obviously improved. By a cross and selection between an early-shooting nuclear male-sterile line 15NA and early-shooting restore line 780, the Oilseed Crop Research Institute of Hunan Agricultural University bred a new dual-purpose *Brassica napus* cultivar Xiangzayou 780 which was registered by the Varieties Inspection Committee of Hunan province in 2005. The remarkable characteristics of this new cultivar are rapid growth before the winter, extremely early floral initiation and bolting, which was usually sowed in the first or middle in September and bolted in the last ten days of November. After their shoots were harvested in December, the plants could produce auxiliary buds rapidly and therefore form sturdy primary branches and secondary branches, and almost the same silique number compared with control. Finally, a high seed yield can be harvested. This experiment was to study the effects of different planting patterns on shoot and seed yield, which would provide the foundation for the large-scale production.

Material and methods

The experiment was done at the experimental farm of Hunan Agricultural University in 2004-2005, whose previous crop was single-season rice and soil fertility was medium. Provided by the Oilseed Crop Research Institute of Hunan Agricultural University, the new dual-purpose cultivar Xiangzayou 780 was sowed on September 19 and transplanted on October 14 with row space of 33 cm and plant spacing depending on the planting densities. Nine treatments were designed which included four densities (9000 plants/ha,12000 plants/ha, 15000plants/ha,18000plants/ha), two shoot harvest time treatments (harvesting two times: main stem once and primary branch once before the end of January and harvesting three time: main stem once and primary branches twice before the end of February), plastic coverage treatment. Xiangzayou 780 without shoot harvest and Xiangyou 15 were used as the control at the experiment. In the experiments excluding density treatments, the planting density was 120000 plants/ha, and shoots were harvested when it grew at 10 cm high or 15-20 cm long in main stem. Only main stem was harvested under plastic coverage.

The randomized block design was used with three replicates and a plot area of 20 m^2. The borax (15 kg/ha) and compound fertilizer (7500 kg/ha) with NPK content 16-16-16 were used as a base fertilizer. Rapeseed plants began bolting on November 25, 2004. The shoots were picked up between December 2 and December 22. The same compound fertilizer (150 kg/ha) was dressinged after shoot harvest. The field management was followed to local conventional practices of rapeseed production. The yield components were investigated before reaping on May 5. Statistic analysis of the yield and its components were carried out.

Results

Effects of planting patterns on shoot yield

The shoot yield with an average of 8114.4 kg/ha was harvested under all the treatments, and the highest shoot yield was 9500.0 kg/ha harvested totally three times (Table 1). Plastic coverage made the plants bolted earlier and produced more shoots at the treatment of the plastic coverage. The shoot yields increased with the increase of planting density, and the maximum difference occurred between 12000 plants/ha and 15000 plants/ha. The shoot yield also increased with the increase of shoot harvesting times, but the difference was smaller between harvesting twice and three times than between harvesting once and

twice. Because the weather was cold at this stage, plants grew slowly with diminutive branches and low weight. So there was no obvious effect on the increase of shoot yield (Table 1).

Table 1 Effect of cultivation patterns on shoot. seed yields and output value

Treatment	Shoot yield (kg/ha)				Seed yield (kg/ha)		Output value (yuan/ha)		
	main axis	Second	third	total	Yields	To CK +-%	Seed	Shoot	Total
90000 plants/ha	5950.5	0	0	5950.5	2500.05	-3.10	6500.1	5950.5	12450.6
120000 plants/ha	6250.5	0	0	6250.5	2490.00	-3.49	6474.0	6250.5	12724.5
150000 plants/ha	8400.0	0	0	8400.0	2434.95	-5.62	6331.9	8400.0	14731.9
180000 plants/ha	8800.5	0	0	8800.5	2460.00	-4.65	6396.0	8800.5	15196.5
Plastic Coverage	9300.0	0	0	9300.0	2385.00	-7.56	62.0.0	9300.0	15501.0
Harvest twice	6349.5	2250.0	0	8599.5	2290.05	-11.24	5954.1	8599.5	14553.6
Harvest thrice	6450.0	2100.0	950.0	9500.0	2140.05	-17.05	5564.1	9500.0	15064.1
Without harvest	0	0	0	0	2550.00	-1.16	6630.0	0	6630.0
CK	0	0	0	0	2580.00	0	67.6.0	0	6706.0

Effects of planting patterns on seed yield

The seed yields varied slightly among the different treatments which of all were lower than that at the control without shoot harvest and the CK (Xiangyou 15) (Table 1). The average seed yield was 2385.75kg/ha at the shoot harvesting treatments and only decreased by 6.44% and by 7.53%, respectively, compared with the control without shoot harvest and the CK. The seed yields were decreased up to 7.56% under plastic coverage, and 11.24% and 17.05% under harvesting shoots twice or thrice, respectively, compared with the CK (Table 1).

Analysis of the economic benefits under different planting patterns

As shown in Table 1, the output value was calculated on the basis of the sales price of seeds and shoots at the same year. The average of the output value at shoot harvesting treatments was 14317.46 yuan/ha, which was 7687.46 yuan/ha and 7611.46 yuan/ha higher than that without shoot harvesting treatment and CK, respectively. The output value changed with the shoot yield and increased with the increase of planting density. The output value under plastic coverage was the highest because of a high shoot yield.

Effect of planting patterns on yield components

The average of the plant height at shoot harvesting treatments was 153.7 cm, which was obviously lower than that without shoot harvesting treatment. Among shoot harvesting treatments, plants under plastic coverage were the tallest. The plant height was decreased slightly with the increase of planting density (Table 2). The plants produced less primary branches (an average of 3.9 primary branches per plant) at the shoot harvesting treatments, which were thicker and longer and formed much more secondary branches than the control without shoot harvest and the CK. At the same planting density, the silique number per plant with shoot harvesting was lower than that without shoot harvesting and CK. The silique number per plant was reduced with the increase of planting density just as in the ordinary planting density experiment. Although the seed number per silique with shoot harvesting was lower than that without shoot harvesting and CK, 1000-seed weight did not vary remarkably among all the treatments (Table 2).

Table 2 Effects of planting patterns on yield components

Treatment	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Silique per plant	Seeds per silique	1000-seeds weight (g)
90000 plants/ha	155.7	4.3	16.8	486.1	19.4	4.34
120000 plants/ah	152.8	4.0	14.7	411.3	18.1	4.48
150000 plants/ha	151.8	3.9	13.0	356.1	18.7	4.48
180000 plants/ha	150.9	3.3	10.3	256.2	18.2	4.41
Plastic Coverage	160.5	4.2	13.2	376.9	19.9	4.46
Harvest twice	154.1	3.2	9.5	351.0	18.6	4.57
Harvest thrice	150.1	3.0	8.3	330.7	19.7	4.46
Without Harvest	167.8	9.0	9.3	440.1	20.9	4.48
CK	171.2	8.5	8.2	435.6	20.1	4.40

Discussion

It was known from the experiment results that the seed yield of the new dual-purpose *Brassica napus* cultivar Xiangzayou 780 did not decrease significantly under shoot harvesting and was close to that of the control Xiangyou 15. The averaged shoot yield reached up to 7500 kg/ha and output value of Xiangzayou 780 with harvest of shoots was double compared with that of Xiangzayou 780 without harvest or Xiangyou 15. The evaluation of nutritional quality of shoots showed that the water content of Xiangzayou 780 was 91.5%, 10.42% for the fiber content (dry weight), 68.11 units for

vitamin C content and 1.28% for protein content (dry weight), but the corresponding indices were 90.7%, 10.87%, 57.1 units and 1.16%, respectively, for purple shoots, an edible subspecies of *Brassica rapa*. So the nutritional quality of shoots picked up from Xiangzayou 780 is better than that of the purple shoots. Not only consumed fresh, the shoots can also be made into Chinese sauerkraut and Kraut. If there is a good sale market for shoot, the economic return for growing this cultivar combined with harvesting of shoots is higher than that of common rapeseed production. Because the high shoot yield, the plant area of this cultivar depends on the market. The shoot yield and the corresponding output value increases with the increase of planting density. If the major goal of growing this cultivar is to harvest shoots the planting density should be increased further. Commodity of shoots is better because the shoots are thinner under a high planting density. The treatment of continuous harvesting of shoots in spring was not conducted in this study. But it was found that shoots grew quickly at the beginning of spring and better taste. If the shoots can be sold well, the economic returns of harvesting shoots in spring sound good. Although it can make the plants bolt earlier and produces high shoot and seed yields, the plastic coverage treatment increases the cost, early shoots are thin and do not taste good, and resistance of plants to lodging becomes worse at the late stage of ontogeny. So the profit is not increased greatly. In addition, the resistance of this cultivar to the *Solerotinia* rot should be observed further under shoot harvesting because of little damage by *Solerotinia* rot in recent years.

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