

Oilseed-Vegetable-Dual-Purpose Rape Key Technology Research and Its Application Prospect Analysis

Hualei Huang, Youming Shi, Tao Liu, Yan Zhou*

Institute of Feature Crops, Chongqing Academy of Agricultural Sciences, Chongqing, China
Email: hualei_huang@163.com, 550155921@qq.com

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Abstract

This paper mainly studied on the key cultivation technology of oilseed-vegetable-dual-purpose rape, experiments with laboratory testing, including the research of suitable height of harvesting shoot, the degree of harvesting shoot, the contrast experiment of large blocks, nutrition structure analysis of shoot. Harvesting shoot have a certain impact on yield and agronomic traits, but its total economic benefit is very significant, and is a rape synergistic technology good for promotion, having broad application prospects.

Keywords

Oilseed-Vegetable-Dual-Purpose, Shoot, Agronomic Traits, Economic Efficiency, Application

1. Introduction

Rape planting acreage for an average year is 737,000 hectares in China [1], but has low effectiveness compared to planting rape compared with foreign, due mainly to the low level of mechanization, and labor costs are too high. Oilseed-vegetable-dual-purpose is the technology increasing to harvest shoot on the premise of rapeseed, as fresh vegetables or processed-into-dehydrated vegetables, can effectively improve the benefit of rape. Shoot color of new-production is green and tasty, fragrant and has no saline flavor, and basically no pests and pesticide pollution, and content of vitamin B1, vitamin B2, vitamin C, zinc and selenium is higher than traditional shoot. Zheng *et al.* (2005) and Fang *et al.* (2005) had analyzed the effects in times of removing shoots on yield and traits and economic efficiency of oilseed-vegetable-dual-purpose rape, thinking twice removing shoots is suitable [2] [3]. Chen *et al.* (2007) and Tian *et al.* (2007) had thought that rapeseed yield of first harvesting shoot is

*Corresponding author.

close to CK without shoot harvest, but shoot average yield reached 7500 kg/hm², its output of per unit area is more than 1 times compared with CK [4] [5]. Pei (1998) had analyzed the effects of removing shoots to yield and benefit of different cultivation density [6]. Shi *et al.* (2009) and Huang *et al.* (2010) had studied the best suitable removing shoots height and the key cultivation technology of oilseed-vegetable-dual-purpose rapeseed [7] [8]. At present the technology in Zhejiang, Hubei, Jiangsu, Shanghai, and Chongqing provinces had universal application. This paper summarized the correlative research of oilseed-vegetable-dual-purpose in recent years, particularly the analysis of its application prospect.

2. Materials and Methods

The contrast test of large area of oilseed-vegetable-dual-purpose rape in Yuri crop experiment station (Chongqing, Yongchuan) from 2006 to 2008, design two treatment of oilseed-vegetable-dual-purpose rape and single rapeseed (CK), repeat two times, diagonal arrangement, residential area of 66.7 m²; The contrast test of rapeseed shoot nutrition structure has been done, took Chinese cabbage red cabbage (Yongchuan) as control in 2007; rapeseed optimum stage randomized block experiment and test varieties of Zhongshuang 10, with rapeseed shoot high as harvesting appearance index, set 8 treatments: harvesting shoot when it's average height 20, 30, 40, 50, 60, 70, 80 cm and no harvesting shoot (CK), repeated three times, the area was 10 m².

3. Results

3.1. The Research of Suitable Height of Harvesting Shoot

With the random group design, researched the suitable time of harvesting shoot of double-low rape. The experiments set 8 treatments, when the shoot high is 20, 30, 40, 50, 60, 70, 80 cm, harvested or no (CK), with three replications, the size of plot is 10 m². Results show that (Table 1), for rapeseed yield, the effects are not obvious, but for the shoot yield and overall economic benefit, have significant effect in the level of 5%. Shoot high 60 cm harvested is the suitable time, and the net income is the highest, and now rapeseed yield is in the second palace, shoot yield occupies first place, the net income is higher 147.12 yuan than not harvesting shoot (CK), and in this period shoots have the suitable ratio of stem/leaf, good appearance, taste better (Table 2).

Table 1. Effect of different treatments for seed and shoot yield and economic benefit.

Treatment	Shoot high (cm)	Seed yield (kg/ha)	Shoot yield (kg/ha)	Output value (Yuan/ha)	Net benefit (Yuan/ha)	To CK±%	To CK±%
1	CK	3013.5	/	12596.4	7571.40	/	/
2	20	2127	2145	13181.9	7556.85	-14.55	-0.2
3	30	2293.5	2490	14566.8	8941.80	1370.4	18.1
4	40	2230.5	2223	13769.6	8144.55	573	7.6
5	50	2130	2563.5	14030.4	8405.40	834	11.0
6	60	2307	2880	15403.2	9778.20	2206.8	29.1
7	70	2347.5	2313	14438.6	8813.55	1242.15	16.4
8	80	2304	1870.5	13371.8	7746.75	175.35	2.3

Table 2. The harvested shoot appearance in different treatment.

Shoot high (cm)	Leaf number (piece)	Shoot length (cm)	Stem weight (g)	Leaf weight (g)	Weight ratio of leaf/stem
20	4.6	5.3	24.8	21.3	0.86
30	4.7	8.1	23.8	18.7	0.79
40	6.3	13.1	25.7	17.3	0.68
50	7.8	16.8	29.4	17.3	0.59
60	7.9	17.6	31.1	18.8	0.60
70	8.9	18.9	27.1	15.6	0.58
80	8.1	18.3	20.3	8.9	0.44

3.2. The Research of Shoot Harvesting Times

Different shoot harvesting treatments have directly effects to seed and shoot yield and agronomic traits. Research shows that increased as the number of shoot harvest, growth period is longer, the branches position was decreased distinctly, the number of single plant branches was increased evidently, the 1000-seeds weight appeared downtrend, and seed yield has reduced, but shoot yield was increased obviously, all in all, they think two-times shoot harvest is the suitable, with higher output value [2]. However, when first harvesting shoot, seed yield is close to CK without shoot harvest, due to shoot average yield 7500 kg/hm², its output of per unit area is more than 1 time than without shoot harvest [4].

3.3. The Contrast Experiment of Large Blocks

Through the contrast experiment of large blocks from 2006 to 2008 in Chongqing-west crops Experiment Station (Yongchuan), studying on yield and benefit and agronomic traits of Oilseed-vegetable-dual-purpose rape. Results show the double-low dual-use rape cultivation is an efficient technology and increasing significantly on the premise of benefit priority.

Yield: Twice experiments in 2006-2008, shoot and rapeseed average yield is 2368.5 kg/ha and 2233.5 kg/ha, rapeseed yield reduced 17.7% comparison with only harvest rapeseed (Table 3). the results is inconsistent with most of previous achievements, may be associated with relatively specific ecological conditions in Chongqing which wintering period is not clear, on the other hand associated with shoot harvesting period.

Benefit: Average net income of dual-use rape is 8450.1 yuan/ha in the twice experiments, increasing 2130.6 yuan/ha, raising net income 33.7% comparison with Scythe ratio of input and output is 1:3.5. The results showed the technology is good for income increase.

Agronomic traits: The experiments showed shoot harvest has an obvious effect on rape agronomic traits (Table 4). After shoot harvest, the plant branch height and primary branches was fall off 63.6% and 58.6% respectively. The silique number of primary branches dropped by 42.1%, silique number of secondary branches was increasing 376%, but the silique number all plant is considerable, making possible to hold seed yield of dual-use rape. While the early flower season and maturity delayed 7 days, 2 days respectively, anti-lodging ability increased obviously.

3.4. Compassion Research of Shoot Nutrition Structure

Shoot of *Brassica napus* L. (T1) and *Brassica campestris* L. (T2) nutritional quality has been tested in 2007 (Table 5). The shoots of *Brassica napus* L. is better or equal to *Brassica campestris* L. in fact of vitamin C and trace elements, including, calcium, Selenium, zinc, except the iron, and soluble total sugar and coarse fibre. Results indicated the shoot of *Brassica napus* rape is an excellent green vegetables.

Table 3. Shoot and rapeseed yield of dual-use rape and CK.

Treatment	Shoot yield (kg/ha)			Rapeseed yield (kg/ha)			±%
	2007	2008	Average	2007	2008	Average	
Dual-use rape	2382	2355	2368.5	2218.5	2248.5	2233.5	-17.7
CK	/	/	/	2415	3013.5	2715	/

Table 4. Effect of shoot harvest on main agronomic traits.

Treatment	Plant height (cm)	Branch height (cm)	Primary branches per plant	Silique number				Seeds per silique	1000-seeds weight (g)	Yield per plant (g)	Ratio of lodge (%)
				Main head	Primary branch	Secondary branch	Whole plant				
Dual-use rape	192	35	4.3	0	214	295	509	16.4	3.62	29.5	10
CK	213	95	10.3	84	369	62	516	15.4	3.93	30.5	40
±%	-9.6	-63.6	-58.6	/	-42.1	376.0	-1.2	6.3	-8.0	-3.4	/

Table 5. The main nutrition indicators of two shoots, (mg/100g, %, mg/kg).

Treatment	V _C /mg/100g	Soluble total sugar/%	Coarse fiber/%	Trace elements			
				Ca/mg/100g	Fe/mg/100g	Zn/mg/kg	Se/mg/kg
T1	87.4	1.95	1.12	5.0×10^2	9.6	7.2	9.2×10^{-3}
T2	47.1	1.90	1.04	3.7×10^2	15.4	6.5	7.0×10^{-3}
±%	85.6	2.6	7.7	35.1	-37.7	10.8	31.4

4. Discussion and Conclusions

In this experiment, although the harvesting shoots making plant height, effective branch height, first branch number and secondary branch number of effective pods significantly reduced, while the two branch effective pod number significantly increased, it is related to the relative enhancement on growth of rapeseed reproductive and vegetative growth, and also the main reason for the difference of the pods is not significant. With decreasing plant height and branch height, rapeseed lodging resistance increases correspondingly, especially in Southwest China too much wind and rain the weather conditions of rape planting, conducive to preserving property insurance income.

When shoot height is 60 cm, harvested shoot is the suitable time, and the net income is the highest, and now rapeseed yield is in the second palace, shoot yield occupies first place, the net income is increased 147.12 Yuan, compared with CK, and in this period shoots have the suitable ratio of stem/leaf, good appearance, and taste better.

5. Application Prospect Analysis of Oilseed-Vegetable-Dual-Purpose Technology

Rape cultivation is large in China, has the realistic foundation to promote the Oilseed-vegetable-dual-purpose technology. In recent years, after scientific research institute, extension services and farmers work together, double-low rape area and coverage of improved strains is increasing year by year, edible shoots can be effectively guaranteed, and have the great extension basis.

The shoot nutrient is very rich, and help balance dietary pattern of public. *Brassica napus* double-low rape shoot is stout, light, bright green and taste sweet, rich in vitamins and trace elements. Furthermore, winter rape shoot is rapidly extracted in a low temperature environment, and is a pollution-free green vegetable.

Effectiveness significantly, contributes to promote the farmer increasing both production and income. Studies have shown that dual-use rape averages net income of 8450.1 yuan/ha, newly increasing net income of 2130.6 yuan/ha, raising 33.7% compassion to get in rapeseeds singly, the ratio of input and output is 1:3.5 [7]. Double-low rape dual-use technology benefits significantly. Especially in winter rape area, the shoots have been sold during the Spring Festival; economic efficiency will be even more pronounced. So it's a practical technology to realize benefit agriculture and promote farmer increasing both production and income.

The shoot deep processing promotes to the depth development of rape industry. After the shoot harvested, through the frozen fresh or dried, salted and other technical, processed into a variety of food or deep processing into dehydrated vegetables, which is convenient for long-term preservation, to extend store season, convenient for transportation and food, with high added value, also improving the farmers planting rape enthusiasm, thus promoting rape industry development in depth.

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