

Study the effects of relay cropping on yield and yield components of different species of Brassica

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Abstract

In order to evaluate the effects of relay cropping on yield and yield components of 12 varieties of winter canola, an experiment was conducted in 2006-2007 at Isfahan Agricultural Research Station as a split plot layout within a randomized complete block design with three replications. Main plots were two planting dates (27 September was normal cropping and 27 October was relay cropping), subplots were inclusive of species *B. napus* (Option 500, Hyola 330, Hyola 401, Sargol, Modena, SLM 046, Opera, Zarfam and RGS003), two varieties of *B. rapa* (Echo and Park land) and one variety of *B. juncea* (Land race). Planting date had significant effect on LAI, seed yield, a thousand grain weight, biological yield, harvest index, Oil percentage and oil yield. The effect of cultivar was significant on LAI, seed yield, the number of seed per pod, a thousand seed weight, biological yield, harvest index, oil percentage and oil yield. The effects of interaction between planting date and cultivar on LAI, seed yield, a thousand seed weight, biological yield, oil percentage and oil yield were significant. The highest seed yield, biological yield, harvest index and oil yield was obtained by Zarfam and Opera at normal planting date and the maximum seed yield and oil yield was related to SIm046 at relay cropping. Oil yield in Zarfam, Opera and SIm046 was 1662, 1587 and 1578 kg/ha.

Keywords: Relay cropping, yield and yield components, Brassica, Isfahan.

Introduction

In many parts of the world, many species of the genus *Brassica* are consumed as vegetable (Ahmad et al., 2007), or use up as for its oil. Yield response of rapeseed varies with different environmental variables, including planting date, plant density, cultivars, soil type, N fertilizer, residual fertility and etc. Laaniste et al. (2008) reported that the optimal sowing date of winter oilseed rape under Nordic climate conditions was mid August. In their study, those plants also gave higher yield (1748 kg ha⁻¹), compared with the plots sown early or later in August. Kumar et al. (2002) reported that the relay cropping of wheat followed by transplanted mint had the highest productivity, 45% higher than that of co-cultivated wheat and mint. Richter et al., (2010) reported that rapeseed (*Brassica napus*) oils differing in cultivars and sites of growth. The relationship between planting date and yield potential was reported (Nielsen et al., 2002). Sowing date can play a major role in determining the seed yield and quality in region. Numerous research studies for different climates have shown that sowing date influences the growth, seed yield and quality of some oil crops such as rapeseed (Taylor and Smith, 1992; Hocking, 2001; Miralles et al; 2001). Degenhardt and Kondra (1981) suggested that delayed seeding resulted in significant decrease in seed yield, harvest index. So, the aim of this study was to Study the effects of relay cropping on yield and yield components of different species of Brassica under semi arid climatic condition of Isfahan province, Iran.

Materials and Methods

In order to evaluate the effects of relay cropping on yield and yield components of 12 varieties of winter canola, an experiment was conducted in 2005-2006 at Isfahan Agricultural Research Station (32° 30' S, 51° 49', 1541 meter above the sea surface) as a split plot layout within a randomized complete block design with three replications. Main plots were two planting dates (27 September was normal cropping and 27 October was relay cropping), subplots were inclusive of species *B. napus*

(Option 500, Hyola 330, Hyola 401, Sargol, Modena, SLM 046, Opera, Zarfam and RGS003), two varieties of *B. rapa* (Echo and Park land) and one variety of *B. juncea* (Land race).). Long term average precipitation was 150 mm and this area is semi arid. Soil analysis was done before beginning of study at two depths (0-30 cm and 30-60 cm). Electrical conductivity of soil at 0-30 and 30-60 cm was 1.7 and 1.6 dS m⁻¹, respectively. The nitrogen fertilizer was used from urea (50 percent before planting and 50 percent in the beginning of reproductive phase). The objectives of this study were (1) to determine the effects of relay cropping on seed yield and oil content of different species of Brassica, and (2) to determine the suitability of Brassica as industrial crops under semi arid climatic condition of Isfahan province, Iran. Means were separated by Duncan 's Multiple Test at $p \leq 5\%$. All statistics was performed with MSTAT-C program

Result and Discussion

Planting date had significant effect on LAI, seed yield , a thousand grain weight, biological yield, harvest index, Oil percentage and oil yield. The effect of cultivar was significant on LAI, seed yield, the number of seed per pod, a thousand seed weight, biological yield, harvest index, oil percentage and oil yield. The effects of interaction between planting date and cultivar on LAI, seed yield, a thousand seed weight, biological yield, oil percentage and oil yield were significant (Table 1). The highest LAI was obtained by 27th Sep (4.29). There was significant difference in LAI between 27th Sep and 27th Oct. Zarfam had obtained the highest LAI (5.07). Seed yield was significantly changed, when plantation on 27th Sep was changed into 27th Oct. The maximum seed yield was related to Zarfam (3605 kg/ha), and the minimum one was obtained by Echo (1557 kg/ha). The highest number of seer per pod also was related to 27th September, but the maximum a thousand seed weight was obtained by 27th October. The number of seed per pod and a thousand seed weight in Zarfam was 16.51 and 3.89, respectively (Table 2). The highest biological yield and harvest index was related to 27th Sep and 27th Oct, respectively. Zarfam also had obtained the maximum harvest index. In the view of the sensitivity of rapeseed to climatic factors especially to photoperiod and temperature, it is essential that sowing should be done on time, so that there have enough time for vegetative growth. There was significant difference in oil yield and oil percentage between 27th Sep and 27th Oct. With changing planting date, each plant changed oil yield. The highest oil yield was related to 27th Sep (1337 kg/ha). The maximum oil yield was obtained by Zarfam (1662 kg/ha) (Table 2).

Table 1- Analysis of variance for experimental characteristics.

S.O.V.	d.f.	LAI	Seed yield	The number of seed per pod	A thousand seed weight	Biological yield	Harvest index	Oil percentage	Oil yield
Replication	2	4.4*	91083	13.1	0.139*	7381	0.001	13.3*	18463
Planting date	1	20.1**	4409935*	72.9	1.198**	347978142**	0.041*	9*	1092310*
Error (a)	2	0.07	184019	30.4	0.006	1598756	0.001	0.3	41174
Cultivar	11	1.3**	3300134**	42.2**	5.335**	11093274**	0.016**	80.3**	899676**
Planting date × Cultivar	11	0.6**	326046**	1.3	0.153*	3557811**	0.002	5.2	84928**
Error (b)	44	0.003	115536	2.6	0.072	1100731	0.001	6.9	26216

* significant at 0.05 significance in F-tests

** significant at 0.001 significance in F-tests

Table 2- Mean comparison for LAI, seed yield (kg/ha), the number of seed per pod, a thousand seed weight (g), biological yield (kg/ha), harvest index (%), oil percentage and oil yield (kg/ha).

Treatment	LAI	Seed yield	The number of seed per pod	A thousand seed weight	Biological yield	Harvest index	Oil percentage	Oil yield
Planting date								
27 September	4.92a	2966a	15.03a	3.09b	13773a	21b	44.3a	1337a
27 October	3.87b	2471b	13.02a	3.35a	9377b	26a	43.5b	1091b
Cultivar								
Option500	3.78h	2490d	14.01cde	4.24a	9893d	25bc	44.7ab	1117c
Hyola330	4.73c	3140abc	13.52cde	3.97ab	12320abc	26abc	47.2a	1485ab
Hyola401	4.46de	298abcd	14.35bcd	3.95ab	13110ab	24bc	46ab	1373abc
Sargol	4.51d	2550cd	14.88bcd	3.3cd	11870abc	22cd	45.7ab	1169c
Modena	4.02g	2655bcd	17.16ab	2.92d	10560cd	25bc	45.9ab	1222bc
Slm046	4.95b	3585a	17.84a	3.71bc	12930ab	29ab	44ab	1578a
Opera	4.28f	3445a	15.62abcd	3.61bc	11140bcd	31a	45.9ab	1587a
Zarfam	5.07a	3605a	16.51abc	3.89ab	13210a	28ab	46.1ab	1662a
RGS003	4.97b	3205ab	13.44de	3.72gc	12910ab	25bc	45.7ab	1464ab
Park land	3.72h	1658e	10.03f	2.07e	9650d	17de	41.9bc	698d
Echo	3.93g	1557e	9.56f	1.67ef	9753d	16de	39.4c	614d
Land race	3.37e	1748e	11.40ef	1.57f	11560abcd	15e	34.5d	599d

Common letters within each column do not differ significantly.

Conclusion

The highest seed yield, biological yield, harvest index and oil yield was obtained by Zarfam and Opera at normal planting date and the maximum seed yield and oil yield was related to Slm046 at relay cropping.

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