The influence of relay cropping on growth length, light, interception and solar radiation depreciation of some specieses of Brassica

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Abstract

In order to evaluate the effects of relay cropping on growth length and characteristics, that related to light in 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 all experimental parameters, expect of the number of days from stem elongation to ripening. The effects of cultivars were significant on the number of days from planting date to stem elongation, the number of days from stem elongation to ripening, light interception, light depreciation and LAI. The interaction between planting date and cultivar had significant effects on the number of days from planting to stem elongation, light interception, light depreciation and LAI. The best cultivar in normal planting date were Zarfam and Opera and in relay cropping was SLM046 that these cultivars with suitable growth length, could provide appropriate conditions to intercept light

Keywords: Relay cropping, growth length, light interception, solar radiation depreciation, Isfahan.

Introduction

Canola is a cool-season crop and the duration of flowering period determines very much the amount of seed yield and hence oil content (Omidi et al., 2010). The biological yield of winter oilseed rape is the product of the growth rate and duration of vegetative period (Diepenbrock, 2000). The sustainability of cropping systems can be achieved through the choice of certain field crops which are better able than others to exploit natural resources like solar radiation which is a no-cost resource (Rinaldi and Vonella, 2006). Diepenbrock (2000) reported that almost complete interception of light by rapeseed is observed from the end of April to the beginning of June. He also demonstrated that small interception is probably, is an important limiting factor of the growth rate in early spring and during maturation. Sowing times affect plant canopy development (growth, number, size and age of green leaves) in relation to global and intercepted solar radiation throughout the crop season (Rinaldi and Vonella, 2006). Radiation is only source of expendable energy essential for photosynthesis (Wang et al., 2001). It has been found that a late sowing date partially decreased the oleic acid (Omidi et al., 2010). Flowering is the most critical stage influencing the yield of rapeseed (Diepenbrock, 2000). The increasing flower cover intensifies photon reflectivity and absorption to 60-65% of incoming radiation (Leach et al., 1989). The aim of this investigation was to determine the influence of relay cropping on growth length, light, interception and solar radiation depreciation of some specieses of Brassica under climatic condition of Isfahan.

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^o $30^/$ S, 51^o $49^/$, 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).At ripening stage with Lutron-101, solar radiation absorption was evaluated. Means were separated by Duncan 's Multiple Test at p ≤ 5%. All statistics was performed with MSTAT-C program

Result and Discussion

Planting date had significant effect on all experimental parameters, expect of the number of days from stem elongation to ripening. The effects of cultivars were significant on the number of days from planting date to stem elongation, the number of days from stem elongation to ripening, light interception, light depreciation and LAI. The interaction between planting date and cultivar had significant effects on the number of days from planting to stem elongation, light interception, light depreciation and LAI (Table 1). The highest number of days from planting to stem elongation (165.5), from 50% of flowering to 100% flowering (15.8), from beginning of stem elongation to ripening (29.14), from stem elongation to ripening (62.17) and from planting to ripening (227.7) was obtained by 27th Sep. light interception was decreased significantly, when plantation was changed from 27th Sep to 27th Oct. The highest light depreciation was related to 27th Sep (0.621), and the lowest one was related to 27th Oct (0.544). The maximum LAI was related to 27th Sep (3.07). Wang et al., (2001) reported that the amount of radiation that may be absorbed by a plant canopy is strongly related to the vegetative cover or LAI.. There was significant difference in LAI, between 27th Sep and 27th Oct (Table 2). Light interception is a function of the leaf area (Collino et al., 2001). The highest light interception was obtained by RGS003 (96.2). The light interception in Zarfam was 95.1%. The maximum and minimum LAI, was related to Zarfam and Parkland, respectively (Table 2). Faragi (2003) in his experiment on early maturation cultivars, reported that cultivars had significant effect on phonological traits, Hyola308 and Syn-3 were complete their life cycle form emergence to start of flowering, and the highest number of day from emergence to start of flowering was related to Dakini cultivar, In his study Dakini had highest maturity duration among all cultivars. Also, changing the number of growing days to flowering stage can help the crop to adapt to specific environments, more quickly. Also, changing the number of growing days to flowering stage can help the crop to adapt to specific environments, more quickly.

Table 1- Analysis of variance for the number of days from planting to stem elongation, 50% of flowering to complete flowering, beginning of stem elongation to ripening, planting to ripening, maximum percentage of light interception, light depreciation and Effective LAI.

S.O.V	d.f	planting to stem elongation	50% flowering to 100% flowering	beginning of stem elongation to ripening	Stem elongation to ripening	planting to ripening	light interception	Light depreciation	LAI
Replication	2	40.5	113*	1.0	100.3*	2.4	104.4**	0.004**	2.39*
Planting date	1	8712**	475.3*	25.7*	3.1	9054.1**	783**	0.106**	16.38**
Error (a)	2	45.8	35.3	1.4	38.8	0.3	0.1	0.0001	0.08
Cultivar	11	441.6**	24.4	93.4	259.6**	55.1	24.9**	0.003**	0.47**
Planting date× Cultivar	11	64.1**	110.6	54.2	72.4	23.8	24.3**	0.002**	0.35**
Error (b)	44	12.9	98.6	63.4	39.5	42.4	3.7	0.00005	0.005

*significant at 0.05 significance in F-tests
**significant at 0.001 significance in F-tests

Table 2- Mean comparison for the number of days from planting to stem elongation, 50% of flowering to complete flowering, beginning of stem elongation to ripening, planting to ripening, maximum percentage of light interception, light depreciation and Effective LAI..

Treatment	planting to stem elongation	50% flowering to 100% flowering	beginning of stem elongation to ripening	Stem elongation to ripening	planting to ripening	light interception	Light depreciation	LAI
Planting date								
27 September	165.5a	15.8a	29.14a	62.17a	227.7a	96a	0.621a	3.07a
27 October	143.5b	10.7b	27.94a	61.75a	205.3b	89.4b	0.544b	2.11b
Cultivar								
Option500	150.7de	13.7a	33.5a	67abc	217.7a	91.1cd	0.614a	2.34d
Hyola330	152.3cd	15.0a	31.5a	63.2abcd	215.5a	94.8ab	0.597b	2.84b
Hyola401	153.5cd	15.3a	24.7a	63.8abcd	217.2a	90.8d	0.566de	2.62c
Sargol	150.0de	11.3a	30.2a	63.8abcd	213.8a	92.2bcd	0.565e	2.58c
Modena	166.5a	13.0a	25.8a	53.8d	220.3a	90d	0.571de	2.33d
Sim046	163.2ab	11.3a	30.0a	54.5d	217.7a	94.6abc	0.571de	2.86b
Opera	165.0a	11.2a	23.3a	52.3d	217.3a	91.8abc	0.554f	2.39d
Zarfam	157.7bc	13.3a	29.2a	58.8dbc	216.5a	95.1ab	0.568de	2.90b
RGS003	149.2de	17.7a	26.8a	68.8ab	218.0a	96.2a	0.619a	2.09a
Park land	138.3f	11.7a	23.5a	70.0ab	208.3a	90.6d	0.589bc	2.20e
Echo	145.5e	13.8a	35.8a	70.8a	216.3a	92.1bcd	0.596b	2.35d
Land race	162.2ab	11.5a	28.3a	56.7cd	218.8a	92.6bcd	0.579cd	2.20c

Common letters within each column do not differ significantly.

Conclusion

Delayed maturity and light interception to be the most important parameters for obtaining higher seed yields.

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