

Effect of planting pattern and plant density on grain yield and its components in apetalous and petalled rapeseed (*Brassica napus* L.) cultivars

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() (Brassica napus L.)

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(Rao et al., 1991)

(Ozer, 2003)

(Rao et al., 1991)

(Ali et al., 1996)

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:(Wells *et al.*, 1991)

$$LI\% = (1 - I/I_0) \times 100$$

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$$R_s = R_a [a + b (n/N)]$$

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(Keating *et al.*, 1993; Kiniry *et al.*, 2005)

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(Kiniry *et al.*, 1989; Kemanian *et al.*, 2004)

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(Rao *et al.*, 1991)

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Table 1. Analysis of variance of yield and yield components as affected by plant density and planting pattern in apetalous and petalled rapeseed cultivars

S. O. V.	Mean Squares										
	df.	No. of branch per plant	Plant height	No. of silique per plant	No. of grain per silique	Silique length	Oil content	1000 grain weight	Harvest index	Biological yield	Grain yield
Replication (R)	2	28.39 ^{ns}	3.69 ^{ns}	0.1838 ^{ns}	1.36*	0.0992 ^{ns}	0.151 ^{ns}	0.077 ^{ns}	12.232 ^{ns}	908242.2*	26588.85 ^{ns}
Planting pattern (PP)	1	13.44 ^{ns}	48.02**	3.725 ^{ns}	0.2704 ^{ns}	0.1393 ^{ns}	6.25**	0.056 ^{ns}	0.099 ^{ns}	351.6 ^{ns}	6185.3 ^{ns}
Error (a) (a)	2	9.361	2.86	1.639	0.584	0.0788	0.217	0.125	1.714	134075.5	3258.78
Cultivar (C)	1	324**	220.02**	1808.517**	11.49**	1.27**	0.165 ^{ns}	4.41**	24.453 ^{ns}	10494900.2**	2285156.27**
Plant density (D)	2	507.11**	867.44**	25500.978**	14.33**	3.07**	2.5**	0.99*	416.543**	56802304.7**	21139765.79**
PP * C *	1	1.78 ^{ns}	26.69*	16.214 ^{ns}	0.1936 ^{ns}	0.04 ^{ns}	1.06 ^{ns}	0.176 ^{ns}	8.653 ^{ns}	7296 ^{ns}	70438.93 ^{ns}
PP * D *	2	4.11 ^{ns}	16.44*	25.94 ^{ns}	0.0931 ^{ns}	0.052 ^{ns}	0.317 ^{ns}	0.115 ^{ns}	0.0832 ^{ns}	3997.4 ^{ns}	181.76 ^{ns}
C * D *	2	58.33**	18.77*	668.5**	1.498*	0.721**	0.096 ^{ns}	0.451 ^{ns}	6.581 ^{ns}	1816228.3**	75410.32 ^{ns}
PP * D * C	2	14.11 ^{ns}	2.77 ^{ns}	16.09 ^{ns}	0.415 ^{ns}	0.028 ^{ns}	0.025 ^{ns}	0.477 ^{ns}	3.0195 ^{ns}	97816.8 ^{ns}	6056.87 ^{ns}
Error (b) (b)	20	9.194	3.88	7.823	0.32	0.042	0.256	0.187	5.67	236565.1	50820.05
C.V % ()	—	15.91	1.63	3.252	2.32	3.128	1.399	10.169	7.555	4.946	7.066

* and **: Significant 5% and 1% probability levels, respectively.

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ns: Non- significant

: ns

Table 2. Mean comparison of petalled and apetalous rapeseed cultivars in different plant densities

Cultivar	Plant density (Plant m ⁻²)	Branch number per plant (N)	Plant height(cm)	Number of silique per plant (N)	Number of grain per silique (N)	Silique length (cm)	Oil content (%)	1000 grain weight (g)	Harvest index (%)	Biological yield (Kg/ha)	Grain yield (Kg/ha)
(Hyola 401)	33	17.0 cd	113.5 e	90.3 b	23.7 c	6.3 cd	35.76 c	4.50 ab	31.47 b	8737.9 d	2749.8 d
	67	20.0 bc	124.2 c	73.6 d	24.6 a	6.7 b	36.66 ab	4.79 a	36.55 a	11736.9 b	4289.6 b
	133	11.2 e	131.7 a	14.2 e	23.1 c	6.2 d	35.94 c	4.52 ab	24.1 d	7372.6 e	1774.7 f
(Hylite 201)	33	21.3 b	111.0 f	121.4 a	24.7 b	6.5 bc	36.09 bc	3.37 c	31.6 b	10654.2 c	3359.7 c
	67	31.0 a	116.7 d	81.8 c	26.4 a	7.6 a	36.77 a	4.21 b	38.26 a	12727.9 a	4869.8 a
	13	13.8 de	126.8 b	17.4 e	23.6 c	6.2 d	35.91 c	4.14 b	27.17 c	7716.3 e	2096.4 e
Main effect of cultivar	(Hyola 401)	16.1 b	123.1 a	59.4 b	23.8 b	6.4 b	35.87 a	4.60 a	30.70 a	9571.8 b	2938.1 b
	(Hylite 201)	22.1 a	118.2 b	73.5 a	24.9 a	6.8 a	35.66 a	3.90 b	32.35 a	10641.4 a	3441.9 a

Means, in each column and treatment, followed by the same letter (s) are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

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(Ali *et al.*, 1996)

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Table 3. Mean comparison of plant traits in petaloid and apetalous rapeseed in square (S) and rectangular (R) planting pattern

Combination treatment	No. of Branch number per plant	Plant height(cm)	No. of silique per plant	No. of grain per silique	Silique length (cm)	Oil content (%)	1000 grain weight (g)	Harvest index (%)	Biological yield (Kg/ha)	Grain yield (Kg/ha)
(S)										
(Hyola 401)	16.66 b	122.44 ab	58.37 b	23.94 b	6.5 b	36.36 al	4.6 a	30.26 b	9606.8 b	2906.9 b
(Hylite 201)	22.44 a	115.78 c	73.89 a	24.92 a	6.8 a	36.84 a	4.0 b	32.89 a	10642.0 a	3944.3 a
(R)										
(Hyola 401)	15.22 b	123.78 a	60.36 b	23.62 b	6.3 b	35.88 bc	4.6 a	31.13 ab	9536.0 b	2969.2 b
(Hylite 201)	21.67 a	120.56 b	73.19 a	24.89 a	6.7 a	35.66 c	3.8 b	31.8 ab	10643.4 a	3384.6 a
S.P.P	19.67 a	119.11 b	66.13 a	24.43 a	6.63 a	36.60 a	4.3 a	31.57 a	10144.8 a	3203.1 a
R.P.P	18.44 a	122.16 a	66.77 a	24.26 a	6.5 a	35.78 b	4.2 a	31.47 a	10095.7 a	3176.9 a
Main effect of planting pattern										

Means, in each column, with the same letter are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

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Table 4. Mean comparison of plant traits in square (S) and rectangular (R) planting pattern in different plant densities

Planting pattern	Plant density (plant m ⁻²)	No. of Branch number per plant	Plant height(cm)	No. of siliqua per plant	No. of grain per siliqua	Siliqua length (cm)	Oil content (%)	1000 grain weight (g)	Harvest index (%)	Biological yield (Kg/ha)	Grain yield (Kg/ha)
(S)	33	19.8 b	109.5 e	106.8 a	24.3 a	6.4 b	36.29	3.93 b	31.62 b	9711.2 b	3070.4 b
	67	26.7 a	119.0 c	80.2 b	24.5 a	7.3 a	37.31	4.47 ab	37.52 a	12322.8 a	4594.8 a
	133	12.5 c	128.8 a	15.7 c	23.5 a	6.2 b	36.21 bc	4.48 ab	25.58 c	7600.5 c	1944.2 c
(R)	33	18.5 b	115.0 d	104.9 a	24.1 a	6.3 b	35.55 c	3.95 b	31.46 b	9661.2 b	3039.1 b
	67	24.3 a	121.8 b	79.7 b	25.5 a	7.0 a	36.11 bc	4.53 a	37.29 a	12241.9 a	4564.7 a
	133	12.5 c	129.7 a	15.8 c	23.2 a	6.2 b	35.64 bc	4.18 ab	25.66 c	7521.2 c	1926.9 c
Main effect of plant density	33	19.2 b	112.3 c	105.8 a	24.2 b	6.4 b	35.92 b	3.94 b	31.54 b	9704.7 b	3045.8 b
	67	25.5 a	120.4 b	77.7 b	25.5 a	7.1 a	36.72 a	4.49 a	37.40 a	12243.6 a	4579.7 a
	133	12.5 c	129.3 a	15.8 c	23.3 c	6.2 b	35.93 b	4.33 ab	25.62 c	7554.8 c	1935.6 c

Means, in each column and treatment, with the same letter are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

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(Chay *et al.*, 1989)

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Table 5. Mean comparison of radiation use efficiency in apetalous and petalled rapeseed cultivars in different plant densities

Cultivar	() Plant density (Plant m ⁻²)	() Radiation use efficiency (gmj ⁻¹)
(Hyola 401)	33	2.00 f
	67	2.33 b
	133	2.14 e
(Hylite 201)	33	2.25 c
	67	2.69 a
	133	2.20 d
Main effect of cultivar	(Hyola 401)	2.16 b
	(Hylite 201)	2.38 a

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Means, each column and treatment, followed by the same letter, are not significantly different at 5% probability level-using Duncan's Multiple Range Test.

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Effect of planting pattern and plant density on grain yield and its components of apetalous and petalled rapeseed (*Brassica napus* L.) cultivars

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ABSTRACT

Ozoni Davaji, A., M. Esfahani, H. Sami Zadeh Lahiji and M. Rabiee. 2007. Effect of planting pattern and plant density on grain yield and its components of apetalous and petalled rapeseed (*Brassica napus* L.) cultivars. Iranian Journal of Crop Sciences. 9 (1): 60-76.

Apetalous flowers is an important morphological characteristic in rapeseed (*Brassica napus* L.), which cause response to higher planting population, more light transmission in canopy and radiation use efficiency, higher grain yield. In order to evaluate the effects of plant density and planting pattern on grain yield, yield components of apetalous and petalled rapeseed, a field experiment was conducted in Rice Research Institute of Iran, in 2005-2006 cropping season. The experimental design was arranged in a split plot factorial in a randomized complete block design with three replications. Planting pattern (Rectangular and Square) as the main plots and two rapeseed cultivars (petalled = Hyola 401 and apetalous = Hylite 201) and plant density (33, 67 and 133 plants per square meter) as subplots, respectively. The number of secondary branch per plant, plant height, number of siliques per plant, number of seeds per silique, silique length, oil percentage, thousand grain weight, harvest index, biological yield and grain yield were measured. Results showed that there were significant differences between treatments in measured traits. The average grain yield in apetalous cultivar was 14.6% higher than the petalled cultivar (3441.95 and 2938.06 Kg/ha, respectively). Plant density of 67 plants per unit area was determined to be the optimum plant density for two cultivars (4870 and 4290 Kg/ha respectively). Grain yield and number of siliques per plant in apetalous rapeseed was significantly higher than the petalled rapeseed (10 and 12%, respectively). This superiority was more evident at higher density (133 plants per unit area) i. e. 17.5 and 15.5%, respectively), indicating that apetalous cultivar has higher capability for higher plant population. In spite of non significant differences between harvest indices, right harvest indices of 4.5 and 11% in apetalous rapeseed in 67 and 133 plant densities, showed its higher capability for assimilate transport to grain. It seems that the main reason of superiority of apetalous rapeseed cultivar may be due to higher radiation use efficiency (RUE) compared to petalled cultivar (2.38 vs. 2.16 g.MJ⁻¹, respectively).

Key words: Apetalous, Petalled, Rapeseed (*Brassica napus* L.), Planting pattern, Plant density, Radiation use efficiency (RUE), Grain yield, Grain yield components.

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