

**(*Brassica napus* L.)**



.....

. ( )  
 Ô Ô Ô Ô  
 Ô Ô Ô  
 Ô Ô Ô Ô Ô.(î)  
 Ô  
 Ô Ô  
 Ô .( )

Ô Ô Ô Ô Ô Ô  
 Ô ( ) Ô Ô Ô  
 Ô( ) Ô ( ) ( ) ( )  
 .  
 Ô  
 Ô Ô Ô Ô Ô  
 .( ) Ô Ô Ô

Ô .( ) Ô  
 Ô Ô Ô  
 Ô  
 Ô Ô. Ô  
 Ô Ô Ô Ô Ô  
 Ô Ô Ô.( ) Ô

Ô Ô  
 Ô Ô Ô  
 Ô Ô Ô Ô Ô .( ) Ô  
 Ô Ô Ô  
 Ô  
 Ô Ô Ô Ô Ô  
 Ô Ô .( ) Ô Ô Ô  
 Ô Ô Ô Ô  
 Ô Ô Ô Ô

Ô Ô Ô Ô Ô Ô Ô  
 Ô  
 Ô Ô Ô Ô Ô  
 Ô Ô ) Ô Ô  
 Ô Ô Ô Ô Ô ( )  
 Ô Ô Ô Ô Ô  
 Ô Ô Ô

Ô Ô Ô  
 .( ) Ô Ô Ô Ô Ô  
 Ô Ô Ô Ô  
 Ô Ô  
 Ô Ô Ô .( )  
 Ô Ô Ô Ô Ô Ô Ô  
 Ô Ô Ô.(î)

Ô Ô Ô Ô Ô  
 Ô  
 Ô

Ô Ô Ô Ô  
 Ô Ô Ô Ô Ô  
 Ô Ô Ô  
 Ô Ô Ô



.....

$\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$  .( )  
 $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$   
 $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$  ( )

$\hat{\theta}$   $\hat{\theta}$  (  $\hat{\theta}$  )  $\hat{\theta}$   
 $\hat{\theta}$  ( )  
 .( )

$\hat{\theta}$  ( ) SAS  
 $\hat{\theta}$   
 $\hat{\theta}$  . LSD

EXCEL

$\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$  .(  $\hat{\theta}$  )  $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$  )  
 $\hat{\theta}$   $\hat{\theta}$  ( )  
 $\hat{\theta}$   $\hat{\theta}$  -  $\hat{\theta}$   
 $\hat{\theta}$  -  $\hat{\theta}$  (  $\hat{\theta}$  )  
 .( )  $\hat{\theta}$   $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$

( )							
-							
-							
/ a	a	b	a	/ a	/ b	a	
/ b	b	a	b	/ b	/ a	a	
-							
/ a	a	b	a	/ a	/ a	a	
/ b	b	a	a	/ b	/ a	a	

LSD

..... / /									
( ) -									
-									
a	a	a	a	a	/	a	a	b	a
b	b	b	b	b	/	b	b	a	b
-									
a	a	a	a	a	/	a	a	b	a
b	b	a	b	b	/	b	b	a	b
-									
LSD									

$\hat{\theta}$        $\hat{\theta} \hat{\theta}$     $\hat{\theta}$   
 $\hat{\theta}$     $\hat{\theta}$   $\hat{\theta}$     $\hat{\theta}$   $\hat{\theta}$        $\hat{\theta}$   $\hat{\theta}$       .(i)  
 $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$   
 $\hat{\theta}$        $\hat{\theta}$       .( )  
 $\hat{\theta}$   $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$       .( )  
 $\hat{\theta}$        $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$       ( )  
 $\hat{\theta}$       ( )  
 $\hat{\theta}$   $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$   
 $\hat{\theta}$     $\hat{\theta}$        $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$   
 $\hat{\theta}$        $\hat{\theta}$   $\hat{\theta}$   
 $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$   
 $\hat{\theta}$   
 $\hat{\theta}$     $\hat{\theta}$       -  
 $\hat{\theta}$    -    $\hat{\theta}$       .( )  
 $\hat{\theta}$   $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$  .( )  
 $\hat{\theta}$        $\hat{\theta}$        $\hat{\theta}$        $\hat{\theta}$   
 $\hat{\theta}$       /   /    $\hat{\theta}$     $\hat{\theta}$    -  
 $\hat{\theta}$       /   /    $\hat{\theta}$     $\hat{\theta}$    -  
 $\hat{\theta}$   
 $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$     $\hat{\theta}$



..... / /

( ) -

---



---

-

---

a	a	a	a	a	/ a	a	a	a
b	b	c	a	b	/ b	b	b	b
c	c	d	b	c	/ c	c	c	bc
d	d	b	c	d	/ c	d	d	c
e	d	c	d	e	/ d	d	c	c
a	a	a	a	a	/ a	a	b	a
b	a	a	a	b	/ b	a	a	a

-

---

a	a	a	a	a	/ a	a	c	a
b	b	b	b	b	/ b	b	d	b
c	c	c	c	c	/ c	c	cd	c
d	d	d	e	d	/ c	d	b	d
e	e	d	d	e	/ d	e	a	e
a	a	a	b	a	/ a	a	b	a
b	a	a	a	b	/ b	b	a	a

LSD -

-

---

( )	( )	( )
/ a	/ b	a
/ a	/ a	b
/ a	/ b	/ a
/ a	/ b	/ a
/ a	/ a	b
/ a	/ b	/ b

---

LSD





.....  
Ô Ô Ô Ô  
Ô Ô  
Ô  
Ô Ô Ô  
Ô Ô Ô Ô  
Ô  
Ô

Ô Ô  
Ô Ô  
Ô Ô  
Ô Ô  
Ô Ô Ô Ô Ô Ô  
Ô Ô

Ô  
Ô Ô  
Ô Ô Ô Ô Ô Ô  
Ô Ô Ô

Ô Ô  
Ô  
Ô Ô  
Ô Ô Ô Ô  
Ô Ô

- ..... / /
1. Angadi, S.V., H.W. cutforth, P.R. Miller, B.G. McConkey, M.H. Entz, A. Brandt and K.M. Olkmar. 2000. Response of three Brassica species to high temperature stress during reproductive growth. *Can. J. Plant Sci.*, 80: 693-701.
  2. Asseng, S. and A.F. van Herwaarden. 2003. Analysis of the benefits to wheat yield from assimilates stored prior to grain filling in a range of environments. *Plant and Soil.*, 256: 217-229.
  3. Blum, A. 1998. Improving wheat grain filling under stress by stem reserve mobilization. *Euphytica.*, 100: 77-83.
  4. Blum, A. 2005. Drought resistance, water use efficiency and yield potential-are they compatible, dissonant or mutually exclusive?. *Aus. J. Agric. Res.*, 56: 1159-1168.
  5. Borrell, A.K. and G.L. Hammer. 2000. Nitrogen dynamics and the physiological basis of stay-green in sorghum. *Crop Sci.*, 40: 1295-1307.
  6. Chapman, J.F., R.W. Daniels and D.H. Scarisbrick. 1984. Field studies on <sup>14</sup>C assimilate fixation and movement in oilseed rape (*B. napus* L.). *J. Agric. Sci. Camb.*, 102: 23-31.
  7. Chongo, G. and P.B.E. McVetty. 2001. Relationship of physiological characters to yield parameters in oilseed rape (*B. napus* L.). *Can. J. Plant Sci.*, 81: 1-6.
  8. Demotes-Mainard, S. and M.H. Jeuffroy. 2001. Partitioning of dry matter and nitrogen to the spike throughout the spike growth period in wheat crops subjected to nitrogen deficiency. *Field Crops Res.*, 70: 153-165.
  9. Ehdaie, B. and J.G. Waines. 2001. Sowing date and nitrogen rate effects on dry matter and nitrogen partitioning in bread and durum wheat. *Field Crops Res.*, 73: 47-61.
  10. Faraji, A. 2003. Effects of sowing date and plant density on canola cultivars. *Iran. J. Crop Sci.*, 5: 64-73.
  11. Faraji, A. and A. Soltani. 2007. Evaluation of yield and yield components of canola spring genotypes in two years with different climate conditions. *Seed and Plant J. Agric. Res.*, 23: 191-202.
  12. Faraji, A., N. Latifi, A. Soltani and A.H. Shirani Rad. 2008. Effects of high temperature stress and supplemental irrigation on flower and pod formation in two canola (*B. napus* L.) cultivars at Mediterranean anclimate. *Asian J. Plant Sci.*, 7: 343-351.
  13. Faraji, A., N. Latifi, M.A. Aghajani and K. Rahnama. 2006. Effects of some agronomy factors on phenology stages, vegetative characters and incidence of sclerotinia stem rot in two genotypes of canola in Gonbad area. *J. Agric. Sci. Natur. Resour.*, 13: 56-68.
  14. Gan, Y., S.V. Angadi, H. cutforth, D. Potts, V.V. Angadi and C.L. McDonald. 2004. Canola and mustard response to short periods of temperature and water stress at different developmental stages. *Can. J. Plant Sci.*, 84: 697-704.
  15. Giunta, F. and R. Motzo. 2004. Sowing rate and cultivar affect total biomass and grain yield of spring triticale grown in a Mediterranean-type environment. *Field crops Res.*, 87: 179-193.
  16. Habekotte, B. 1997. Evaluation of seed yield determining factors of winter oilseed rape (*B. napus*) by means of crop growth modeling. *Field Crops Res.*, 54: 137-151.
  17. Hall, A.E. 1992. Breeding for heat tolerance. *Plant Breed. Rev.*, 10: 129-168.

18. Harper, F.R. and B. Berkenkamp. 1975. Revised growth-stage key for *B. campestris* and *B. napus*. *Can. J. Plant Sci.*, 55: 657-658.
19. Jensen, C.R., R.O. Mogensen, G. Mortensen, J.K. fieldsend, G.F.J. Milford, M.N. Andersen and J.H. Thaga. 1996. Seed glucosinolate, oil and protein contents of field grown rape (*B. napus*) effected by soil drying and evaporative demand. *Field Crops Res.*, 47: 93-105.
20. Koocheki, E., E. Zand, M. Bannayan, P. Rezvani Moghaddam, A. Mahdavi Damghani, M. Jami Al-Ahmadi and S.R. Vesal. 2005. Plant Echo physiology. *Ferdowsi Univ. Mashhad Press*, 951 pp.
21. Kumar, R., A.K. Sarawgi, C. Ramos, S.T. Amarante, A.M. Ismail and L.J. Wade. 2006. Partitioning of dry matter during drought stress in rainfed lowland rice. *Field Crops Res.*, 96: 455-465.
22. Mahan, J.R., B.L. McMicheal and D.F. Wanjura. 1995. Methods for reducing the adverse effects of temperature stress on plants: A review. *Environ. Exp. Bot.*, 35: 251-258.
23. Major, D.J., J.B. Bole and W.A. Charnetski. 1978. Distribution of photosynthates after  $^{14}\text{CO}_2$  assimilation by stems. Leaves and pods of rape plants. *Can. J. Plant Sci.*, 58: 783-787.
24. Mendham, N.J., P.A. Shipway and R.K. Scott. 1981. The effects of delayed sowing and weather on growth, development and yield of winter oilseed rape (*B. napus*). *J. Agric. Sci. Camb.*, 96: 389-416.
25. Plaut, Z., B.J. Butow, C.S. Blumenthal and C.W. Wrigley. 2004. Transport of dry matter into developing wheat kernels and its contribution to grain yield under post-anthesis water deficit and elevated temperature. *Field Crops Res.*, 86: 185-198.
26. Prystupa, P., R. Savin and G.A. Slafer. 2004. Grain number and its relationship with dry matter, N and P in the spikes at heading in response to N×P fertilization in barley. *Field Crops Res.*, 90: 245-254.
27. Rahnema, A.A. 2002. Evaluation of canola cultivars with drought tolerance indices. Results of canola agronomic research. Seed and Plant Improvement Institute. *Oilseed Crops Res. Dep.*, 147 pp.
28. Rossato, L., P. Laine and A. Qurry. 2001. Nitrogen storage and remobilization in *Brassica napus* L. during the growth cycle: nitrogen fluxes within the plant and changes in soluble protein patterns. *J. Exp. Bot.*, 52: 1655-1663.
29. Sadras, V.O. 2006. The N:P stoichiometry of cereal, grain legume and oilseed crops. *Field Crops Res.*, 95: 13-19.
30. Sanchez, A.C., P.K. Subudhi, D.T. Rosenow and H.T. Nguyen. 2002. Mapping QTLs associated with drought resistance in sorghum (*Sorghum bicolor* L. Moench). *Plant Mol. Bio.*, 48: 713-726.
31. SAS Institute. 1989. SAS/STAT user's guide, Version 6, 4th editions, SAS Inst., Inc., Cary, NC.
32. Soltani, A. and S. Galeshi. 2002. Importance of rapid canopy closure for wheat production in a temperate sub-humid environment: experimentation and simulation. *Field Crops Res.*, 77: 17-30.
33. Svecnjak, Z. and Z. Rengel. 2006. Canola cultivars differ in nitrogen utilization efficiency at vegetative stage. *Field crops Res.*, 97: 221-226.
34. Walton, G., N. Mendham, M. Robertson and T. Potter. 1999. Canola, Phenology, Physiology and Agronomy. Proceedings of the 10<sup>th</sup> international Rapeseed Congress, Canberra, Australia.

- ..... / /
35. Yang, J.C., J.H. Zhang, Z.Q. Wang, Q.S. Zhu and W. Wang. 2001. Remobilization of carbon reserves in response to water deficit during grain filling of rice. *Field Crops Res.*, 71: 47-55.
  36. Zhang, H.P., X.Y. Wang, M.Z. You and M. Liu. 1999. Water-yield relations and water use efficiency of winter wheat in the Northchina plain. *Irrig. Sci.*, 19: 37-45.
  37. Zhang, H., N.C. Turner and M.L. Poole. 2004. Yield of wheat and canola in the high rainfall zone of south-western Australia in years with and without a transient perched water table. *Aus. J. Agric. Res.*, 55: 461-470.

---

## Estimating of Planting and Supplemental Irrigation on Dry Matter Distribution In Canola Cultivars (*Brassica napus* L.)

A. Faraji<sup>1</sup>

### Abstract

In the area with terminal heat and drought stress such as Gonbad, allocation of produced dry matter to reproductive organs is of great importance. In order to evaluate the effect of different temperature and moisture regimes on dry matter distribution and harvest index of canola an experiment was conducted at Agricultural Research Station of Gonbad during 2005-2007. The experiment was a RCBD arranged in a split-plot in two conditions, i.e. supplemental irrigation and rainfed. Five sowing dates (6 Nov., 6 Dec., 4 Jan., 5 Feb. and 5 Mar.) were selected as main plots and two cultivars (Hyola401 and RGS003) were chosen as subplots. In both years of the experiment, at the beginning of seed filling period, the mean accumulated dry matter in reproductive organs, green leaves and stem at supplemental irrigation was more than that of rainfed conditions. There was not any difference for stem accumulated dry matter between the beginning of flowering and seed filling. The considerable differences between these two stages were a decrease in relative proportion of accumulated dry matter in green leaves and an increase in accumulated dry matter in reproductive organs. Supplemental irrigation did not significantly affect the mean harvest index, but it increased seed yield, due to an increase in aboveground dry matter. In all treatments, seed yield of Hyola401 hybrid was more than that of RGS003, due to higher harvest index. The relations of sowing date and supplemental irrigation with dry matter distribution, can be used in crop modeling.

**Keywords:** Canola, Dry matter distribution, Harvest index, Sowing date, Supplemental irrigation

---

1- Assistant Professor, Agricultural and Natural Resources Research Center of Golestan