

()

(*Triticum turgidum* L. var. Durum Desf.)

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(/ / : / / :)

() ()

(UV-A, B, C)

C A

(/ /) (/ /)

(/ /) (/ /)

/ /) (/) **II**

(

C B A

) (/ /)

(/ /

) ()

CO2 (

II

CO₂
a
a
(Schutz & Fangmeier, 2001)
(Fangmeier, 1996)
(Agrawal, 1992)
(2000) Nagues & Baker
UV
II
Fv/Fm II
II
(2000) Nagues & Baker
UV Fv/Fm
RWC
UV
(Petrovoulou et al., 1995;
Teramura et al., 1990)
(Balakumar et al., 1993)
UV
UV CO₂ (Sullivan, 1997)
UV
(1997) Sullivan
(SLA)
CO₂ UV
CO₂
() UV
(Tosserams et al., 2001)

(Shao et al.,
CO₂ .2005)
(Reeves et al., 1999)
CO₂
(Ainaworth et al.,
CO₂ .2004)
(Rogers et al., 1997)
II
(Correia et al., 2005)
(SLA)¹
(Slover & Munday, 1990)
²(RWC)
(Teulat et al., 1997)
UV (2001) Alexieva et al.
(RWC)
(1999) Pessarkli
CO₂
(Donnelly et al., 2000)

1. Specific Leaf Area
2. Relative Water Content

(CO₂ UV)

(: :)
 UV-C Philips TUV 30W/G30T8; UV-B)
 UV-A (Philips 40W/12

(Nogues & Baker, 2000)

(/ C°)
 ()

(%)	(%)	شن (%)	سپلت (%)	رس (%)	()
/	/				
/	/				

()
 ()
 ()
 (UV-A, B, C)

UV
 ppm CO₂
 CO₂
 Testo)

×
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 ()
)
 ()

RWC
 (Ritchie et al., 1990)

$$\%RWC = \left\{ \frac{(W_t - W_d) / (W_t - W_0)}{W_t - W_0} \right\} \times 100$$
 (ppm)

(Chlorophyll Meter, Minolta, SPAD-520, Japan)

(1973) Bates

$$I = \frac{I_0 \times (1 - e^{-k \cdot I_0})}{k \cdot I_0}$$

II

II
 (PAM-2000, H Wals GmbH, Effeltrich, Germany)

$$F_v/F_m = \frac{F_m - F_0}{F_m}$$

II

$$F_v = F_m - F_0$$

(Skriver & Munday, 1990; Tossierams et al., 2001)

(SAS Institute Inc., 1997) SAS

(Steel et al., 1998)

()

DNA

(Krizek et al., 1998; Ormord & Hale, 2000)

UV

) II

(

(

)

.()

.(Krizek et al., 1998)

UV

UV

.()

.(Ballare et al., 1995)

C A

UV

) II

.(Tosserams et al., 2001)

(

(

)

(2002) Hopkins et al. .

/

UV

/

/

/

UV

(2003) Nasibi et al.

/

C

/

UV

C B

.()

UV-B

UV

.()

UV-B

UV

Fv/Fm

/	ns	/	ns	/	ns	/	ns	/	ns	/	ns	/	ns	/	ns
/	**	/	**	/	**	/	**	/	**	/	ns	/	ns	/	**
/	ns	/	ns	/	ns	/	ns	/	**	/	ns	/	**	/	**
/	**	/	**	/	**	/	**	/	**	/	ns	/	**	/	ns
/	**	/	**	/	ns	/	ns	/	ns	/	**	/	ns	/	ns
/	ns	/	*	/	ns	/	ns	/	ns	/	**	/	**	/	ns
/	**	/	**	/	ns	/	**	/	ns	/	ns	/	ns	/	ns
/	**	/	**	/	ns	/	ns	/	ns	/	ns	/	ns	/	ns
/		/		/		/		/		/		/		/	
/		/		/		/		/		/		/		/	()

./% %

** * n.s

()		()		(/)		Fv/Fm ()		
/ a	/ a	/ a	/ a	/ a	/ a	/ a	/ a	UV-A
/ a	/ ab	/ a	/ b	/ a	/ ab	/ b	/ b	UV-B
/ b	/ b	/ a	/ c	/ b	/ b	/ c	/ b	UV-C
/ a	/ a	/ a	/ a	/ a	/ a	/ a	/ b	(ppm)
/ a	/ a	/ a	/ a	/ b	/ b	/ b	/ a	(ppm)
/ a	/ a	/ a	/ a	/ a	/ a	/ a	/ a	
/ b	/ b	/ b	/ b	/ a	/ b	/ b	/ b	

(P≤0.05)

()

(Hopkins et al., 2002; Krizek et al., 1998)

()
)
 () ()
 () (/) ()
 ppm

(Pessarkli, 1999)

()
 CO₂ (1997) Sullivan

(1998) Noguez et al.

UV

UV (2001) Alexieva et al. UV (SLA) CO₂

RWC

RWC ()

UV

()

() () (2001) Alexieva et al. . UV

() .()

()

() (UV-C) A .() C ppm

A .() .() B

/ C /

() (C A) .()

.(Castrillo & Turujillo, 1994) UV

CO₂

(Majumdar et al., 1991) .(Teramura et al., 1990; Ziska & Teramura, 1992)

.(Ashraf et al., 1994) CO₂ (2001) Tosserams et al. UV

.(Agrawal, 1992) UV CO₂ (Sullivan, 1997; Tosserams et al., 2001)

UV-B .(Agrawal, 1992)

.(Zhang & Kirkham, 1996)

UV

UV

Fv/Fm	(ppm)	
/ a		UV-A
/ a		
/ b		UV-B
/ c		
/ d		UV-C
/ d		

(P≤0.05)

ppm

(Smith et al., 2000)

()

Fv/Fm		
/ a	/ a	UV-A
/ c	/ c	
/ b	/ b	UV-B
/ d	/ d	
/ e	/ e	UV-C
/ e	/ e	

(P≤0.05)

ppm

()

(Donnelly et al., 2000)

C

(ppm)
/ a
/ c
/ b
/ bc

(P≤0.05)

A

() /

Fv/Fm

(Arraus et al., 1998)

Fv/Fm

(2000) Nogues & Baker

II

()

A

/

ppm

Fv/Fm

UV

Nogues et al.

UV

(1998)

C

/

ppm

()

C A

()

C B A

ppm

()

()
CO₂

()	()	(ppm)
/ h	/ a	UV-A
/ b	/ ef	
/ g	/ b	
/ d	/ e	
/ h	/ bc	UV-B
/ a	/ g	
/ f	/ c	
/ c	/ fg	UV-C
/ gh	/ c	
/ a	/ h	
/ e	/ d	
/ b	/ g	

(P≤0.05)

(2002) Akbari Moghadam et al.

()

CO₂ CO₂

) a

) (

(

% a

%

%

(Schutz & Fangmeier, 2001)

CO₂

CO₂

(1996) Lutts et al.

(Fangmeier, 1996)

B

ppm

C

(1997) Mattioni et al.

/ /

B A

/

ppm

/

()

A

B

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