Coleoptile length of wheat varieties

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Coleoptile length is an important characteristic to consider when planting a wheat crop, especially in drier seasons when sowing deep to reach soil moisture. The coleoptile is the pointed protective sheath that encases the emerging shoot as it grows from the seed to the soil surface (Figure 1). For wheat seed to emerge successfully from the soil, the seed should never be planted deeper than the coleoptile length. Sowing varieties with short coleoptile lengths too deep can cause poor establishment, as the shoot will emerge from the coleoptile underground and it may never reach the soil surface.

Coleoptile length has been found to be influenced by several factors including variety, seed size, temperature, low soil water and certain seed dressings, such as those with the active ingredient of triadimenol (Figure 2) or flutriafol. Growers should always read the label of any wheat seed dressing fungicide to see what effect it may have on coleoptile length.

The semi-dwarf habit genes found in many commercial wheat varieties have also been associated with shorter coleoptile length.

Generally, taller varieties will have longer coleoptiles. However, there is still considerable genetic variation for coleoptile length within the semi-dwarf wheat varieties grown in Australia.

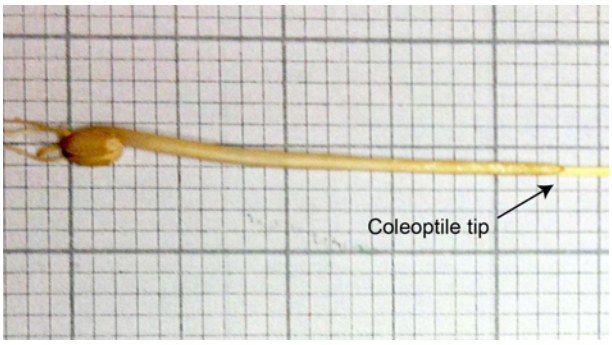

Figure 1: Germinated seed showing coleoptile.

The coleoptile lengths were measured on a range of varieties that are grown in Australia and have been evaluated as part of the National Variety Trials (NVT) program.

Coleoptile lengths of varieties were measured using seed from the NVT program in the years 2007 and 2008. The NVT is divided into an early sown set of genotypes and trials and a main season sown set of genotypes and trials.

Seed from three early sown and seven main season sown trials were tested for coleoptile length. These trials were chosen on the basis of having satisfied the normal grain quality receival standards for screenings, test weight and falling number.

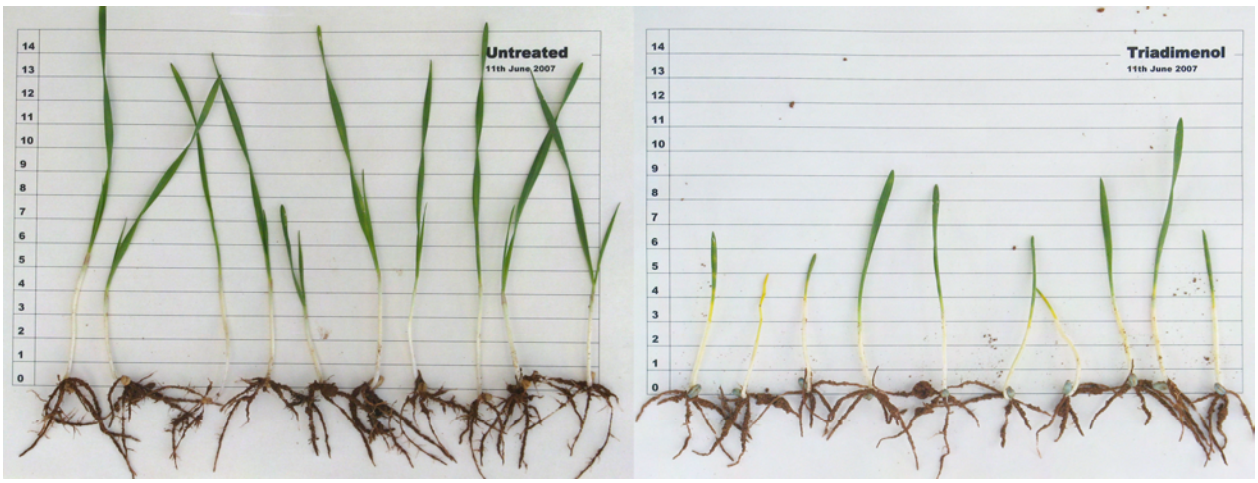

Figure 2: Untreated seed compared with seed treated with the fungicide triadimenol showing the effects on coleoptile length, seed emergence and early plant growth from a seed fungicide demonstration at Temora in 2007.

Table 1: National Variety Trials used for coleoptile length measurement.

Trial Acronym	Series	State	Location	Year	Irrigated	Latitude	Longitude
WEaA08BENE2	Early	NSW	Benerembah	2008	Yes	-34.43	146.07
WEaA08GILG2	Early	NSW	Gilgandra	2008	No	-31.60	148.70
WEaA08OAKL2	Early	NSW	Oaklands	2008	No	-35.49	146.06
WMaA07GERO2	Main season	NSW	Gerogery	2007	No	-35.90	146.94
WMaA07WARI2	Main season	NSW	Wagga Wagga	2007	Yes	-34.94	146.92
WMaA08BENE2	Main season	NSW	Benerembah	2008	Yes	-34.43	146.07
WMaA08CUND6	Main season	WA	Cunderdin	2008	No	-31.73	117.19
WMaA08GILG2	Main season	NSW	Gilgandra	2008	No	-31.60	148.71
WMaA08OAKL2	Main season	NSW	Oaklands	2008	No	-35.49	146.06
WMaA08SPRS4	Main season	QLD	Springsure	2008	No	-23.90	148.39

Only varieties which at the time were commercially available were tested. Seed samples for each screening experiment were sourced from a single NVT field trial (Table 1). Seed samples were collected from each plot and cracked grain and any impurities were removed prior to testing.

The seeds were germinated in moistened filter paper 'cigars', which were placed in a darkened, temperature-controlled cabinet (Figure 3). The length of the coleoptile was measured after 14 days at 21^{o} C. Individual seeds with a coleoptile length of less than 4 cm were not considered viable and were recorded as missing data.

Figure 3: Seeds germinating in temperature controlled cabinet.

Results

Estimates of the mean coleoptile length of the early sown varieties ranged from 5.2 cm for Whistler to 7.3 for Beaufort (Table 2). The mean coleoptile length of 19 of the 28 varieties tested (70%) were within the 1 cm range between 5.8 and 6.8 cm. Only Beaufort in the early sown series of trials had a coleoptile length greater than 6.8 cm.

Estimates of mean coleoptile length for the main season varieties ranged from 5.3 cm for Bolac to 7.2 cm for Zulu (Table 3). This difference of 1.9 cm represents a relatively small effect of variety on coleoptile length. The mean coleoptile length of 64 of the 81 varieties tested (79%) were within the 1 cm range between 5.8 and 6.8 cm.

The differences between the experiment with the shortest mean coleoptile length, WMaA07GERO2, and the experiment with the longest coleoptile length, WMaA07WARI2, was 1.5 cm. Seed source is obviously a very important determinant of coleoptile length.

More information

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Table 2: Coleoptile length and predicted mean coleoptile length of early sown wheat varieties grown at 3 sites in NSW during 2008.

	Trial acronym			
Variety	**WEaA08BENE2**	**WEaA08GILG2**	**WEaA08OAKL2**	**Predicted mean coleoptile length (cm)**
Amarok	6.1	5.8	5.8	5.9
Barham	6.9	6.2	6.3	6.5
Beaufort	7.6	7.0	7.4	7.3
Bolac	5.8	5.3	5.0	5.4
Chara	5.8	5.7	5.5	5.7
Currawong	6.6	6.0	6.3	6.3
EGA Bounty	6.4	6.0	6.1	6.2
EGA Burke	5.9	5.7	5.6	5.7
EGA Eaglehawk	6.5	5.5	5.4	5.8
EGA Gregory	6.0	5.6	5.6	5.8
EGA Wedgetail	5.9	5.3	4.9	5.4
EGA Wills	6.4	5.9	6.0	6.1
EGA Wylie	6.6	6.3	6.4	6.4
Ellison	6.4	6.0	6.0	6.1
Frelon	6.9	6.4	6.7	6.7
Giles	6.6	6.2	6.1	6.3
Lincoln	5.9	5.8	5.9	5.9
Naparoo	6.1	5.8	5.8	5.9
Rosella	6.3	5.8	5.7	6.0
Sentinel	6.2	5.7	5.9	5.9
Strzelecki	6.2	6.0	5.7	5.9
Sunbri	6.6	6.3	6.3	6.4
Sunsoft 98	5.7	5.6	5.5	5.6
Sunvale	6.6	6.3	6.4	6.4
Sunzell	6.2	5.9	6.0	6.0
Thornbill	5.7	5.3	5.0	5.3
Whistler	5.4	5.2	4.9	5.2
Wylah	5.8	5.4	5.2	5.5
Mean	6.3	5.9	5.9	6.0
Standard Error	0.20	0.22	0.20	
DF	68	57	72	
Lsd (p=0.05)	0.57	0.48	0.62	

Table 3: Coleoptile length and predicted mean coleoptile length of main season sown wheat varieties grown at 7 sites in Australia during 2007 and 2008.

	Trial acronym							
Variety	WMaA07 GERO2	WMaA07 WARI2	WMaA08 BENE2	WMaA08 CUND6	WMaA08 GILG2	WMaA08 OAKL2	WMaA08 SPRS4	Predicted mean coleoptile length (cm)
AGT Katana	5.8	7.2	6.1	5.9	6.2	5.5	5.9	6.1
Annuello	5.7	6.9	6.0	5.8	6.1	5.5	5.8	6.0
Arrino	6.0	7.4	6.3	6.1	6.5	5.7	6.1	6.3
Axe	5.3	6.3	5.7	5.5	5.8	5.1	5.6	5.6
Barham	6.4	7.8	6.8	6.5	6.8	6.0	6.5	6.7
Baxter	6.2	7.7	6.5	6.3	6.6	5.9	6.3	6.5
Binnu	6.3	7.8	6.6	6.4	6.8	6.0	6.4	6.6
Bolac	5.0	6.1	5.4	5.2	5.5	4.8	5.3	5.3
Bullet	5.8	7.2	6.1	5.9	6.3	5.5	6.0	6.1
Bumper	5.6	7.0	5.9	5.7	6.1	5.4	5.8	5.9
Calingiri	5.2	6.5	5.6	5.4	5.7	5.0	5.5	5.6
Carinya	5.5	7.0	5.9	5.6	5.9	5.1	5.7	5.8
Cascades	6.2	7.6	6.5	6.3	6.6	5.9	6.3	6.5
Catalina	6.2	8.3	6.6	6.3	6.6	5.8	6.3	6.6
Chara	5.6	6.8	6.0	5.8	6.1	5.4	5.8	5.9
Clearfield Jnz	5.4	6.9	5.7	5.5	5.9	5.2	5.6	5.7
Correll	6.8	8.4	7.0	6.8	7.2	6.5	6.8	7.1
Crusader	5.9	7.0	6.3	6.0	6.4	5.6	6.0	6.2
Cunningham	6.0	7.4	6.3	6.1	6.4	5.7	6.1	6.3
Dakota	6.3	7.6	6.6	6.4	6.7	5.9	6.4	6.6
Derrimut	5.1	6.7	5.5	5.3	5.6	4.8	5.4	5.5
Diamondbird	5.8	7.2	6.0	5.9	6.2	5.5	5.9	6.1
Drysdale	5.7	6.9	5.9	5.8	6.1	5.5	5.8	6.0
EGA Bonnie Rock	5.7	7.0	6.0	5.8	6.1	5.4	5.8	6.0
EGA Burke	5.7	7.0	6.0	5.8	6.1	5.4	5.8	6.0
EGA Eaglehawk	6.2	7.6	6.5	6.3	6.6	5.9	6.3	6.5
EGA Gregory	5.6	6.8	5.9	5.7	6.1	5.4	5.8	5.9
EGA Hume	5.7	7.0	6.0	5.8	6.1	5.4	5.8	6.0
EGA Kidman	5.8	7.2	6.1	5.9	6.2	5.4	5.9	6.1
EGA Stampede	5.6	6.7	5.9	5.7	6.1	5.5	5.8	5.9
EGA Wentworth	5.8	7.2	6.1	5.9	6.3	5.6	6.0	6.1
EGA Wills	6.1	7.4	6.4	6.2	6.5	5.9	6.2	6.4
EGA Wylie	6.2	7.6	6.4	6.2	6.6	5.9	6.2	6.5
Ellison	6.2	7.9	6.5	6.3	6.7	6.2	6.3	6.6
Espada	5.8	7.6	6.1	5.9	6.3	5.4	6.0	6.2
Fang	6.1	7.6	6.4	6.2	6.6	5.8	6.2	6.4
Fortune	5.3	6.6	5.6	5.4	5.8	5.1	5.5	5.6
Gascoigne	5.7	7.0	6.0	5.8	6.1	5.4	5.8	6.0
GBA Hunter	5.7	6.6	5.9	5.8	6.1	5.6	5.8	5.9
GBA Ruby	5.6	6.8	5.8	5.7	6.1	5.5	5.8	5.9
GBA Sapphire	6.2	8.3	6.5	6.3	6.6	5.8	6.3	6.6
Giles	6.1	7.6	6.3	6.1	6.5	5.6	6.2	6.3
Gladius	5.5	7.3	5.8	5.6	6.0	5.2	5.7	5.9
Guardian	6.1	7.7	6.3	6.2	6.5	5.6	6.2	6.4

Variety	Trial acronym WMaA07 GERO2	WMaA07 WARI2	WMaA08 BENE2	WMaA08 CUND6	WMaA08 GILG2	WMaA08 OAKL2	WMaA08 SPRS4	Predicted mean coleoptile length (cm)
H46	5.9	7.1	6.2	6.0	6.3	5.6	6.0	6.2
Hartog	5.8	7.2	6.1	5.9	6.3	5.6	6.0	6.1
Hornet	6.3	7.9	6.5	6.4	6.7	6.2	6.4	6.6
Janz	6.3	7.7	6.6	6.3	6.7	5.7	6.3	6.5
Kennedy	5.3	6.3	5.6	5.5	5.8	5.2	5.5	5.6
King Rock	5.8	7.2	6.1	5.9	6.2	5.5	5.9	6.1
Lang	6.3	7.8	6.6	6.4	6.7	5.9	6.4	6.6
Lincoln	5.3	6.7	5.7	5.5	5.8	5.0	5.5	5.6
Livingston	5.8	7.1	6.1	5.9	6.2	5.5	5.9	6.1
Mace	5.9	7.3	6.2	6.0	6.4	5.7	6.0	6.2
Magenta	6.3	7.7	6.5	6.3	6.7	6.0	6.3	6.5
Merinda	5.7	7.0	6.0	5.8	6.2	5.7	5.9	6.1
Peake	5.8	7.3	6.1	5.9	6.2	5.6	5.9	6.1
Preston	6.5	8.0	6.8	6.6	6.9	6.2	6.6	6.8
Pugsley	6.8	8.5	7.0	6.8	7.2	6.4	6.8	7.1
QALBIS	6.1	7.5	6.3	6.2	6.5	5.9	6.2	6.4
Rosella	5.9	7.2	6.2	6.0	6.3	5.6	6.0	6.2
Sentinel	5.8	7.2	6.1	5.9	6.3	5.7	6.0	6.1
Seri 82	6.0	7.5	6.3	6.1	6.5	5.8	6.1	6.3
Strzelecki	5.9	7.4	6.2	6.0	6.4	5.6	6.0	6.2
Sunco	6.0	7.4	6.3	6.1	6.4	5.7	6.1	6.3
Sunstate	5.7	7.0	6.0	5.8	6.2	5.5	5.9	6.0
Sunvale	6.3	7.7	6.6	6.4	6.8	5.9	6.4	6.6
Sunvex	6.7	8.2	7.0	6.7	7.1	6.4	6.7	7.0
Sunzell	5.7	7.0	6.0	5.8	6.1	5.4	5.8	6.0
Tammarin Rock	5.6	7.0	5.9	5.7	6.1	5.4	5.8	5.9
Ventura	5.8	7.4	6.1	5.9	6.2	5.5	5.9	6.1
Waagan	5.9	7.3	6.1	6.0	6.3	5.6	6.0	6.2
Westonia	6.5	8.0	6.7	6.6	6.9	6.2	6.5	6.8
Wyalkatchem	5.1	6.4	5.5	5.3	5.6	5.0	5.4	5.5
Yandanooka	6.0	7.4	6.2	6.1	6.4	5.7	6.1	6.3
Yenda	6.2	7.7	6.4	6.2	6.6	5.9	6.2	6.5
Yitpi	6.7	8.3	7.0	6.8	7.1	6.5	6.7	7.0
Young	5.5	6.8	5.8	5.6	5.9	5.2	5.7	5.8
Zebu	5.5	6.9	5.8	5.7	6.0	5.6	5.7	5.9
Zippy	5.4	6.8	5.7	5.5	5.9	5.2	5.6	5.7
Zulu	7.0	8.2	7.3	7.1	7.4	6.6	7.0	7.2
Mean	5.9	7.4	6.2	6.0	6.4	5.7	6.1	6.1
Standard Error	0.07	0.09	0.06	0.06	0.08	0.06	0.05	
DF	64	65	80	80	44	80	70	
Lsd (p=0.05)	0.38	0.59	0.38	0.54	0.35	0.45	0.40	

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