Tritordeum

Farming Dossier

tritordeum
VIVAGRAN

Index

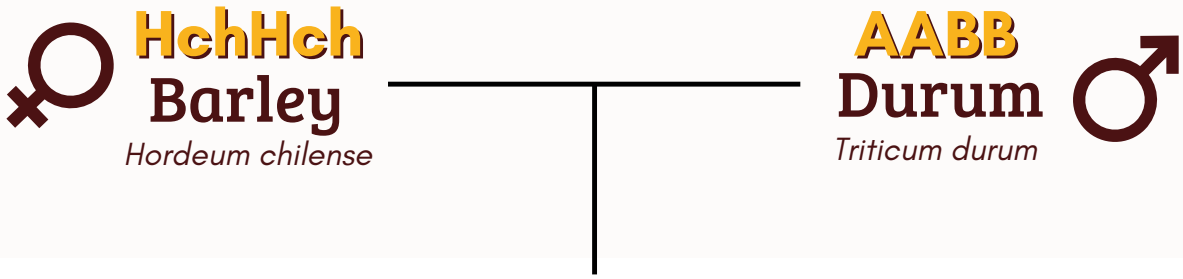
Tritordeum

the golden cereal

Tritordeum is a novel cereal resulting from the hybridization of **durum wheat** (*Triticum durum*) and **wild barley** (*Hordeum chilense*).

Developed through traditional breeding methods, it combines desirable traits from both parents, offering enhanced nutritional value and adaptability to various environmental conditions.

Notably, Tritordeum is **non-GMO** and holds promise for sustainable agriculture.



Phenotype

Looks more like wheat than barley

Tritordeum's phenotype reflects its unique hybrid origin, combining key traits from durum wheat and wild barley. Agronomically, it displays a **robust and semi-erect growth habit**, with **broad, deep-green leaves** and compact, slightly **bearded spikes**.

The **Tritordeum spike** is showing **wheat-like structure** with some subtle barley influences.
Here's a precise description:

Type:

- **Bilateral**, determinate spike (similar to durum wheat), meaning it stops growing after the terminal spikelet forms.

Spikelets per spike:

- **Typically 20 to 26 spikelets** per spike, arranged alternately along the rachis (central axis).

Spikelet arrangement:

- **Two-rowed structure**: One fertile spikelet is present per rachis node on opposite sides, resembling wheat, rather than the six-rowed or two-rowed barley forms.
- Spikelets are sessile (attached directly without pedicels) and alternate on the rachis.

Florets per spikelet:

- **Each spikelet contains 2 to 5 florets**, though usually only 2 to 4 develop into fully formed grains under field conditions.

Awns:

- **Long awns** (bristles) are common and vary in length depending on the cultivar (e.g., Aucan vs. Bulel).
- Awns are straight to slightly curved and contribute to ear photosynthesis.

Color:

- **The spike often shows a golden color at maturity**, a result of the high lutein and carotenoid content in the grains.

Shape:

- **Generally cylindrical**, compact to medium-dense, resembling durum wheat spikes more than barley's lax or nodding spikes.

Phenotype

Looks more like wheat than barley

Tritordeum is a vigorous crop that **produces a high amount of above-ground biomass**, making it well-suited for both food and non-food applications.

Unlike uniform wheat fields, Tritordeum displays **spikes emerging at slightly different heights, typically ranging from 80 to 110 cm**, contributing to a more irregular but dense canopy. This growth pattern reflects its wild barley heritage and supports its adaptability to diverse environments, while also enabling efficient light capture and resilience under stress conditions.

Tritordeum is distinguished by a **longer grain filling period** compared to traditional wheat. This extended phase allows the plant to accumulate more starches, nitrogen and nutrients in the developing grain.

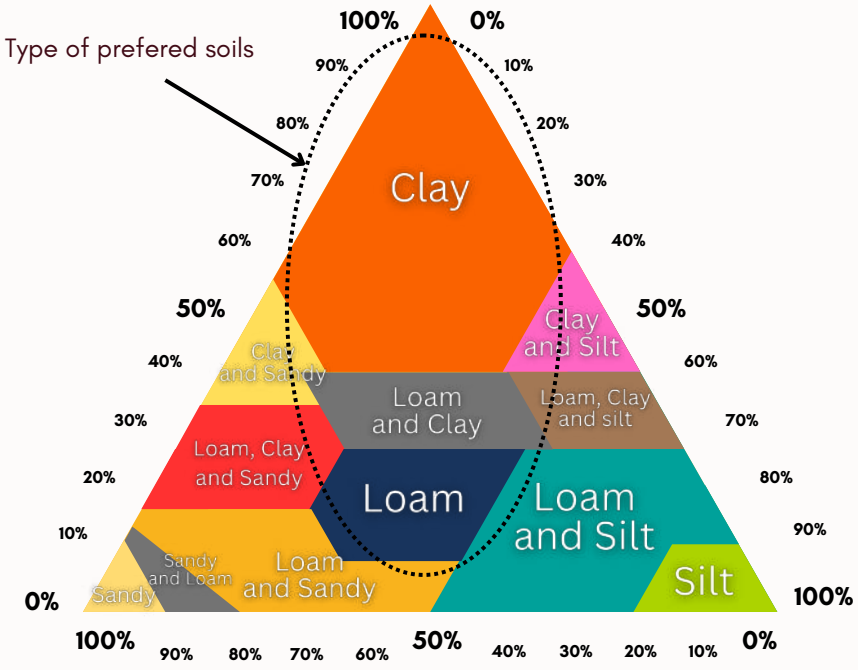
Agronomic Profile

Adaptability in soil, terrain, climate

Tritordeum was developed in the Mediterranean region, specifically in the south of Spain (Córdoba). Its origins in this climate shaped its **adaptation to hot, dry conditions with irregular rainfall**—traits typical of durum wheat growing regions. As a result, Tritordeum thrives in environments characterized by mild winters, early springs, and terminal drought, showing strong performance where other cereals may struggle.

Soil and Terrain

Tritordeum prefers well-drained soils with a **neutral to slightly alkaline pH**. It obtains its highest productions in Calcisols and Vertisols type of soils, although its adaptation is extensive like most of the wheats.



Feature	Calcisol	Vertisol
Key Trait	Lime accumulation ($CaCO_3$)	Expanding clay, deep cracks
Climate	Arid to semi-arid	Seasonal wet-dry cycles
Texture	Loamy to clayey	Very clayey
Fertility	Moderate to high	High, but hard to manage
pH	Alkaline	Neutral to alkaline

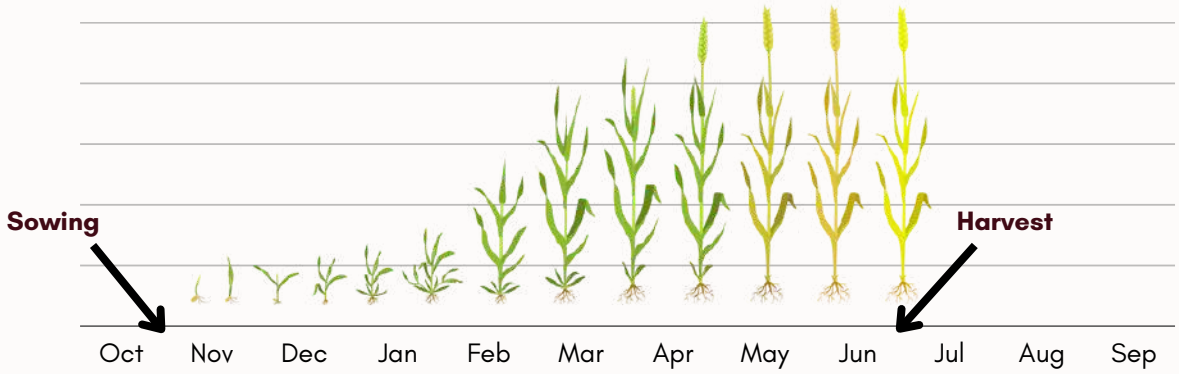
Agronomic Profile

Adaptability in soil, terrain, climate

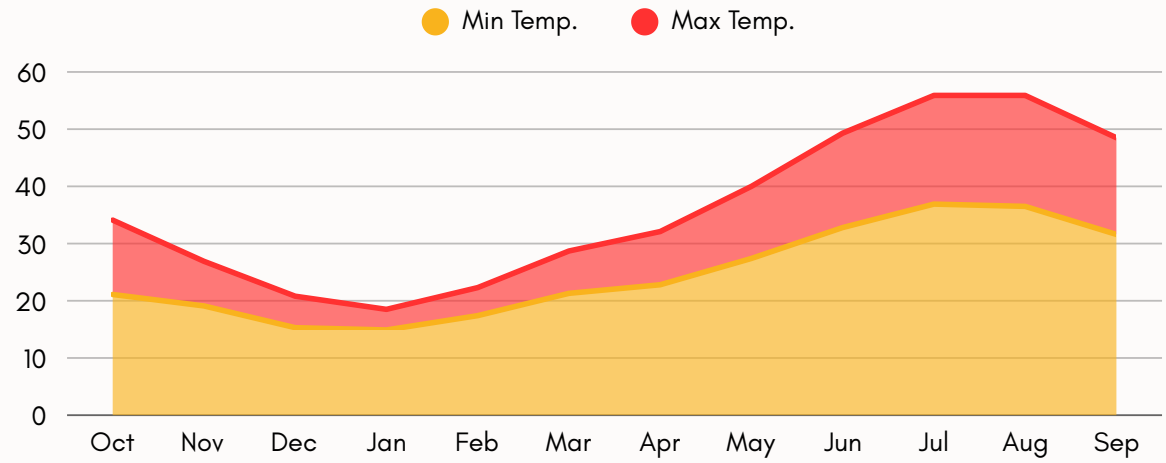
Climatic conditions

Tritordeum's commercial varieties were bred and selected in Córdoba, Spain.

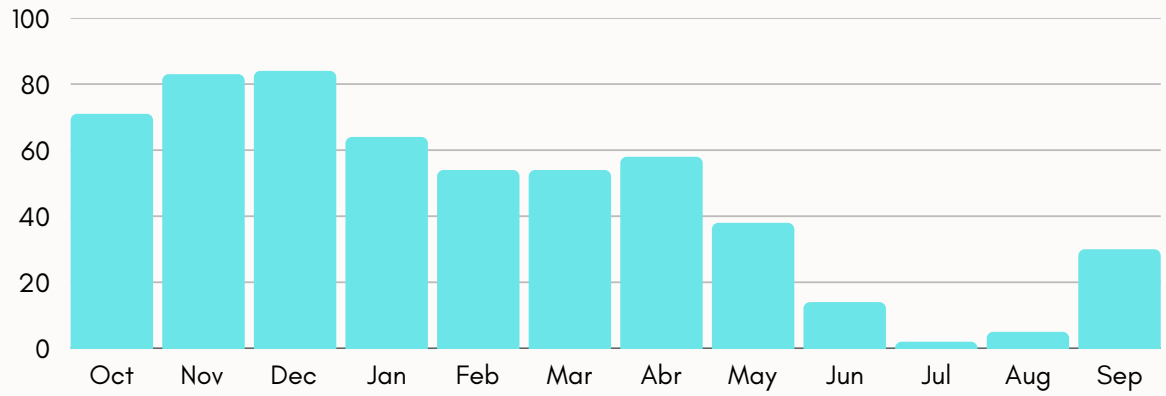
Tritordeum growing cycle:



Min and Max temperatures in celcius in Córdoba, Spain:



Average rainfall in mm in Córdoba, Spain:

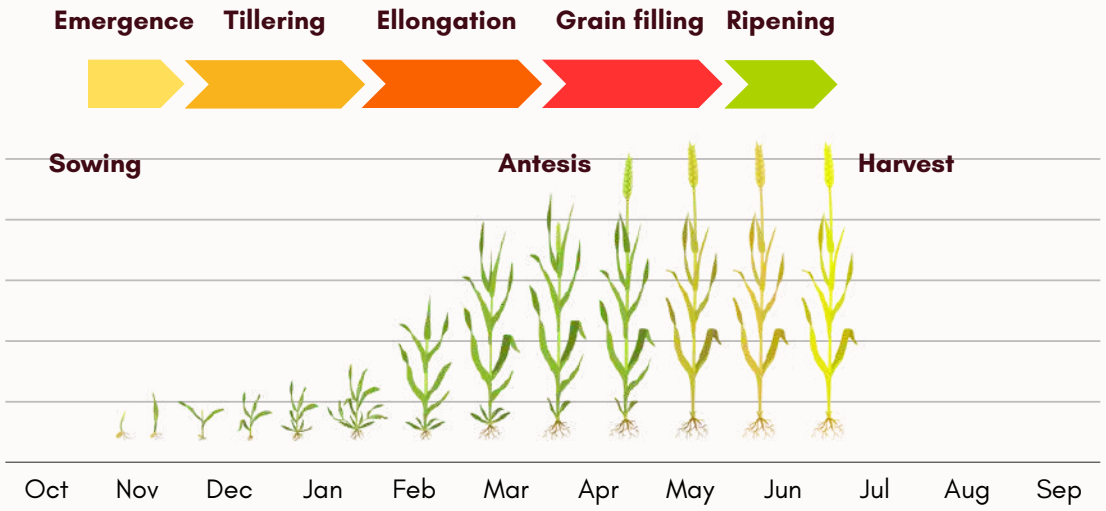


Agronomic Profile

Adaptability in soil, terrain, climate

Other characteristics

Tritordeum growing cycle:



Winter sowing window: 15th Oct. to 15th Nov.
Spring sowing window: 15th Feb. to 15th Mar.

Tritordeum is an alternative crop species, which does not require a strict vernalization

Sowing density in dryland: 125 to 150 kg /hectare
Sowing density in irrigation: 150 to 180 kg /hectare

Higher sowing densities to those recommended may result in lower yields

Row Spacing and Depth: Rows spaced at 15–20 cm with a sowing depth of 3–5 cm are optimal for uniform emergence.

The tillering capability of Tritordeum is better than wheat, but not as good as barley.

Time to antesis: 125 to 135 days

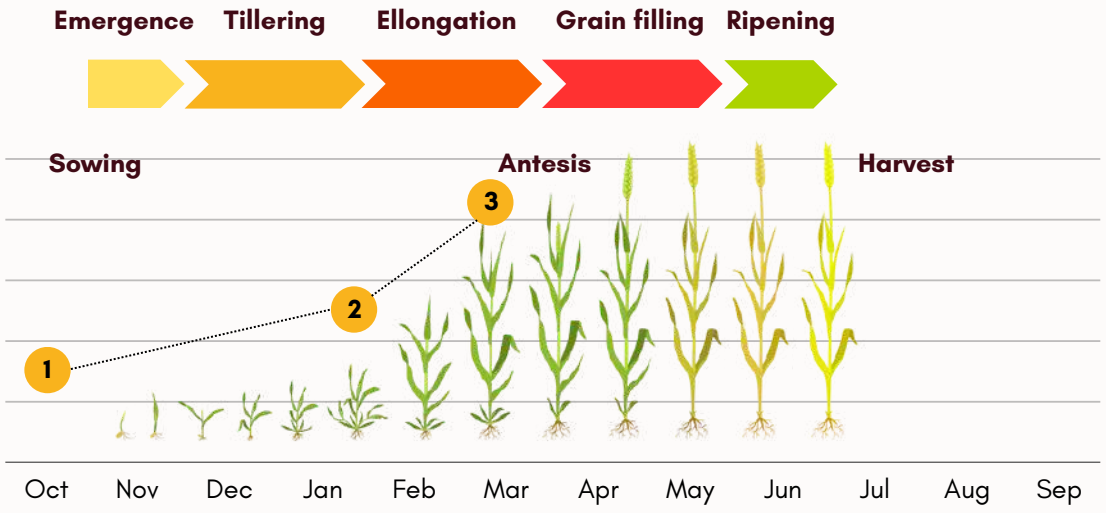
Typical harvest window: June and July

Agronomic Profile

Crop management

Fertilization

Tritordeum growing cycle:



1	**Backgroung application**:	20%
2	**End of tillering**:	60%
3	**Before heading**:	20%
		100%

Given that the NPK extraction per ton of harvest is approximately 30-15-20, a 5-ton yield would require 150 Nitrogen Units (UN), 75 Phosphorus Units (UP), and 100 Potassium Units (UK).

Agronomic Profile

Crop management

Water Management

Tritordeum is noted for its water-use efficiency, performing well under rainfed conditions in suitable climates. In areas with prolonged dry spells, supplemental irrigation during critical growth stages (e.g., flowering and grain filling) can enhance yields. Its drought tolerance reduces the need for extensive irrigation, conserving water resources.

Crop Protection

Tritordeum demonstrates resistance to several common cereal diseases, including rusts and septoria. However, regular field monitoring is essential to detect and manage potential pest infestations or disease outbreaks promptly.

Crop protections used are typically those in use for winter wheats/barleys. Vivagran performs regularly trials to test new formulas to ensure that we see no phyto-toxicity, and can recommend what brands/products to use to farmers. In the following sections, we present the seed treatments, herbicids, fungicids, insecticids tested and recommended for Tritordeum.

Seed Treatments

Commercial Name	Dosis (g or l /ha)	Active Material	Suitable for...
PREMIS (BASF)	100-200 cc/Qm	triticonazol-2,5 p/v FS	Conventional farming
RAXIL PLUS (BAYER)	80-150 cc/Qm - 10-15 ml/100 kg	tebuconazol-2,5 p/v FS	Conventional farming
VITAVAX Flow (UPL Ltd.)	250-450 cc/Qm	carboxina-20 + tiram-20	Conventional farming
VINCIT MINIMA (FMC)	150-250 mL/Qm	flutriafol 2,5 p/v	Conventional farming
KINTO PLUS (BASF)	120-150 ml/100 kg	33,3 g/l de fludioxonil, 33,3 g/l de fluxapiroxad y 33,3 g/l de triticonazol	Conventional farming
MAS RAIZ ECO (SERVELASA)	1,5 L/ 1000 kg	see spec	Organic farming
PRE-SEM (SERVELASA)	2 - 2,5L/ 1000kg	see spec	Organic farming

Agronomic Profile

Crop management

Crop Protection

The effectiveness of the treatment is scored from 0 to 5.
5 = very effective / 0 = ineffective

Wide Leaf Herbicids

Commercial Name	Dosis (g or l /ha)	Authorized in...	Absorbed by...	Active Material	 Thistle	 Lagina, Florida	 Fumaria	 Lapa	 Daisy flower	 Poppy flower	 Speedwell flower
GRANSTAR 50 SX (DUPONT)	22,5-37,5 g	Durum, Rye	Root, Leaf	tribenuron-50	3	5	2	2	3	5	1
TRIMMER (DUPONT)	10-25 g	Durum, Rye, Oat	Root, Leaf	tribenuron-75	3	5	2	2	3	5	1
GRANSTAR SUPER (DUPONT)	40-60 g	Durum, Rye	Root, Leaf	tifensulfuron-25 + tribenuron-25	3	5	3	2	3	5	3
HARMONY 50 SX (DUPONT)	45-75 g	Durum, Rye, Oat	Root, Leaf	tifensulfuron-50	0	5	3	2	3	4	3
POSTA SX (BAYER)	45-67,5 g	Durum, Rye	Root, Leaf	tifensulfuron-33,3 + tribenuron-16,7	3	5	3	2	3	5	3
BIATHLON 4D (BASF)	100-150 g	Wheat, Barley, Rye, Triticale	Leaf	tritosulfuron 50 + florasulam 5	3	4	3	2	3	4	3
RACING TF (NUFARM)	50-75 g	Durum, Rye	Root, Leaf	metsulfuron-7 + tifensulfuron-68	4	5	5	3	5	5	3

Narrow Leaf Herbicids

Commercial Name	Dosis (g or l /ha)	Authorized in...	Absorbed by...	Active Material	 Crazy oat	 Fox tail	 Bromo	 Raygrass	 Bird seed	 Vulpia
AUROS (SYNGENTA)	4-6 l	Durum, Rye	Root	prosulfocarb-80	1	3	0	5	1	1
AXIAL (SYNGENTA)	0,5-0,6 l	Durum, Rye	Leaf	pinoxaden-10	5	5	0	4	5	0
TRAXOS (SYNGENTA)	0,15-0,3 l	Durum	Leaf	clodinafop-propargil-24+pinoxaden-10	5	5	0	3	5	0
TOPIK (SYNGENTA)	0,175 l	Durum	Leaf	clodinafop-propargil-24	5	5	0	4	3	0

Agronomic Profile

Crop management

Crop Protection

Fungicids

The effectiveness of the treatment is scored from 0 to 5.

5 = very effective / 0 = ineffective

Commercial Name	Dosis (g or l /ha)	Authorized in...	Deadline...	Active Material	Fusarium	Helminto sporium	Mildew	Ramularia	Rhynco-sporium	Brown Rust	Yellow Rust	Septoria	Tapesia
VARIOS	0,8 - 1	Barley, Wheat	35 days	azoxistrobin 25		3	1		1	5	5	3	
AZOSHY	1	Oat, Barley, Rye, Wheat, Triticale		azoxistrobin 25		3			1	5	5	3	1
TRIUNFO MAX	1	Barley, Wheat	35 days	azoxistrobin 20 + tebuconazol 20	3	3			2	5	5	3	
AVIATOR XPRO	0,6-1 / 0,8-1,25	Oat, Barley, Wheat, Triticale		bixafen 7,5 + protioconazol 15	4	5	4		5	5	5	5	
SAKURA	1,2	Wheat	55 days	bromuconazol 16,7 + tebuconazol 10,7	3					5	5	3	
CYFLAMID	0,5	All cereals	60 days	ciflufenamid 5,13			5						
IMTREX	2	Oat, Barley, Rye, Wheat, Triticale	35 days	fluxapiroxad 6,25		5	1	5	5	4		5	4
LIBRAX	2	Barley, Wheat, Triticale	35 days	fluxapiroxad 6,25 + metconazol 4,5	4	5	2		5	5		5	
PRIAXOR EC	1 - 1,5	Oat, Barley, Rye, Wheat, Triticale	35 days	fluxapiroxad 7,5 + piraclostrobin 15		5	3	5	5	5	5	5	
CARAMBA EC	1	Oat, Barley, Wheat	35 days	metconazol 9	4		2		4	5	4	4	
FLEXITY	0,5	Oat, Barley, Wheat, Triticale	35 days	metrafenona 30			5						4
COMET 200 & MODEM	1,1	Oat, Barley, Rye, Wheat, Triticale	35 days	piraclostrobin 20		3			4	5	5		
CABRIO	1	Barley, Wheat	42 days	piraclostrobin 25		3	1		4	5	5	2	
VARIOS	1	Barley, Wheat		procloraz 45	1	1	1		3			3	3
ELATUS ERA LR/ ELATUS ERA	0,5 - 1	Oat, Barley, Rye, Wheat, Triticale		protioconazol 15 + benzovindiflupyr 7,5		5		5	5	5	5	5	
PROSARO & ABILIS	1	Oat, Barley, Rye, Wheat, Triticale	35 days	protioconazol 12,5 + tebuconazol 12,5	4	5	4		5	5	5	5	
SPARTA, LICTOR E	1,25	Oat, Barley, Rye, Wheat, Triticale		tebuconazol 20		4	4			5	5	3	
SONG	1	Oat, Barley, Rye, Wheat, Triticale	35 days	tebuconazol 25		4	4			5	5	3	
ULYSSES	0,6	Oat, Barley, Rye, Wheat, Triticale	35 days	tebuconazol 43	3	4	4		2	5	5	3	
BUZZ ULTRA DF	0,33	Wheat	35 days	tebuconazol 75			4			5	5	3	

Resistance of Tritordeum

Diseases	Level of Resistance
Fusarium	Moderate
Helminto sporium	Moderate
Mildew	High
Ramularia	Moderate
Rhyncosporium	Moderate
Brown Rust	High
Yellow Rust	High
Septoria	High
Tapesia	Moderate

Yellow rust resistance

Agronomic Profile

Crop management

Crop Protection

Others

Foot rot / Take-all

Field observations and trials indicate that Tritordeum exhibits tolerance to foot rot pathogens, especially under Mediterranean conditions where drought and poor soil structure can exacerbate symptoms in wheat.

Black stem rust

Tritordeum shows moderate to good tolerance to black rust (stem rust), though it is not completely immune.

Ergot

Tritordeum shows some susceptibility, though typically lower than rye, and comparable to durum or bread wheat under similar conditions.

Insecticids





Commercial Name	Dosis (g or l /ha)	Active Material	Tick	Aphids	Calamobius	Beetles	Moths
DELTAPLAN (BAYER)	0,03-0,05 %	DELTAMETRIN 2,5% ((ESP I)) [EC] P/V	yes	yes			
AUDACE (CHEMINOVA AGRO)	0,03-0,05 %	DELTAMETRIN 2,5% ((ESP I)) [EC] P/V	yes	yes			
DECIS EXPERT (BAYER)	0,0625 l /ha	DELTAMETRIN 10% [EC] P/V		yes	yes	yes	
DECIS EC 100 (BAYER)	0,0625 l /ha	DELTAMETRIN 10% [EC] P/V		yes	yes	yes	
DECIS (BAYER)	0,03-0,05 %	DELTAMETRIN 2,5% ((ESP I)) [EC] P/V	yes	yes			
RITMUS (PROBELTE)	0,03-0,05 %	DELTAMETRIN 2,5% [EC] P/V (ESP.)		yes		yes	
DELTA EC (SAPEC AGRO)	0,3-0,5 l/ha	DELTAMETRIN 2,5% [EC] P/V		yes			yes
KILSEC (SYNGENTA)	0,1%	PIRIMICARB 50% [WG] P/P					

Agronomic Profile

Crop management

Guidelines for Harvesting Tritordeum

Harvesting Tritordeum requires careful attention to timing, combine settings, and threshing efficiency to ensure optimal grain quality and minimal losses. While similar in some respects to durum wheat, Tritordeum has its own unique characteristics that demand specific adjustments.

Optimal timing

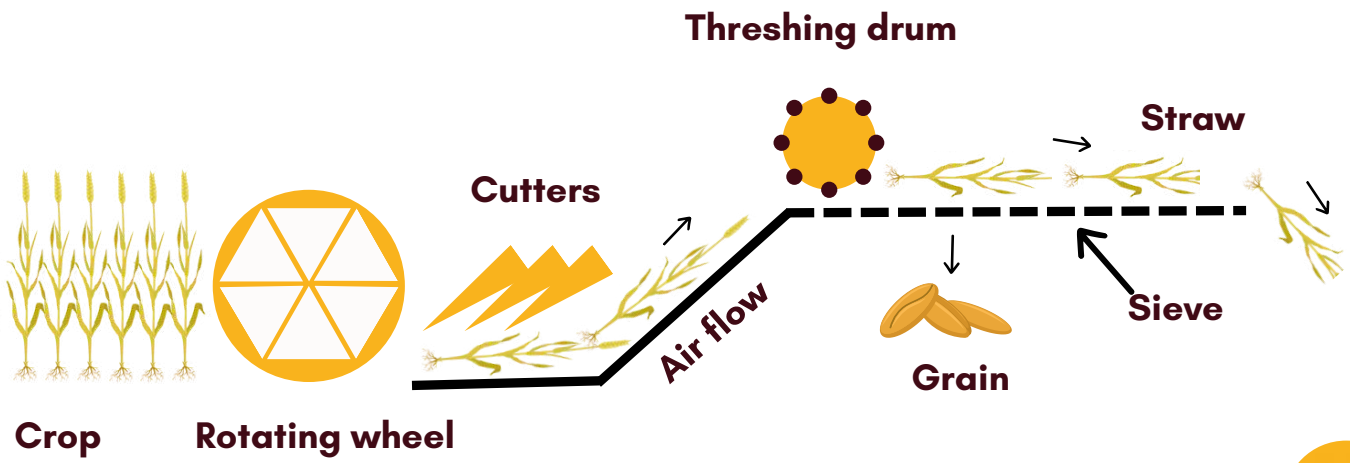
- Begin harvesting when the crop is dry, ideally in the afternoon, when morning dew has evaporated.
- **Target grain moisture should be below 12%**. The ideal range is 9-11%, as lower moisture improves threshing efficiency and grain separation.

Threshing characteristics

- **Tritordeum glumes are tougher than wheat**, which makes threshing easier at lower moisture levels.
- Threshing is generally more difficult than bread wheat, and closer to rye or triticale, depending on the Tritordeum variety.
- If harvesting starts too early or with improper settings, expect poor threshing or spike/grain breakage.

Combine settings and calibration

- Proper calibration of the combine is crucial. In comparison to bread wheat:
  - **Adjust height of cutters**
  - **Slower air-flow**
  - **Check for sieve: should be 1,6-1,8mm maximum.**



Agronomic Profile

Yield and resistance

Yiels expectations

Conventional farming

Rainfed (dryland) conditions: Expected yield ranges from 3.5 to 5 tons per hectare.
Irrigated conditions: Expected yield ranges from 5 to 8 tons per hectare.

Under intensive irrigation and high fertilization, applying a growth regulator once or twice may be advisable to reduce the risk of lodging (plants falling over).

Organic farming

Rainfed conditions: Expected yield ranges from 1.5 to 3 tons per hectare.
Irrigated conditions: Expected yield ranges from 2.5 to 4 tons per hectare.

Resistance to abiotic stresses

Drought/Heat resistance

- Maintains ear photosynthesis
- Equally or better yielding than durum wheat

Cold resistance

- Good cold and frost resistance, for temperatures above -10°C

Salinity resistance

- Produced more biomass than durum wheat in all treatments of water salinity (1.8, 12, and 17 dS m^-1)
- Indicates better water use efficiency and ion balance under stress conditions.

Water logging resistance

- Exceptional anoxia tolerance makes it a valuable crop for cultivation in areas with frequent waterlogging or flooding.
- Ability to thrive in low-oxygen environments.

Agronomic Profile

Nitrogen use efficiency

NUE trials performed at WUR in 2022

Field trials with 4 Tritordeum varieties and a bread wheat control.
Nitrogen: 160 UN for all varieties.
NIR analyzer: Perten NIR 9500

Variety	Protein (%)		Specific weight (kg/hL)		Moisture (%)	
NIR setting	Wheat	Barley	Wheat	Barley	Wheat	Barley
Coique	18,2	19,5	71,4	71	14,4	13,8
Bluel	17,3	18,3	74,6	74,3	14,4	13,9
Aucan	18,2	19,2	67	67,7	15,2	14,7
HT2003	16,9	17,9	72,7	72,6	15	14,5
Av. Tritordeum	17,6	18,7	71,4	71,4	14,7	14,2
Wheat	12,7		74		14,9	
Difference	4,95		-2,575		-0,15	
	39%		-3%		-1%	

Tritordeum presented a 20% yield penalty vs bread wheat, but almost 40% more protein content.

	yield
Tritordeum	6,4
Wheat	8
Difference	-1,6
	-20%

If we compare the "protein x yield" ratios of both crop species, Tritordeum is able to achieve a 10% increase.

Grain characteristics

Morphology

Morphology

	Tritordeum	Durum Wheat	Barley
Scientific name	x Tritordeum martinii A. Pujadas (Poaceae) nothosp. nov	Triticum turgidum	Triticum aestivum	Secale cereale
Genome	HchHchAABB Hexaploid 42 chromosomes	AABB Tetraploid 28 chromosomes	AABBDD Hexaploid 42 chromosomes	HH Diploid 14 chromosomes
Cycle	Alternative	Winter and Spring varieties	Winter and Spring varieties	Winter and Spring varieties
Hull	No	No	No	Yes
Awns	Yes	Both Typical has awns	Both	Both Typical has awns
Spikelets count	22-26	20-24	22-26	2-row: 20-30 6-row: 60-90
Grain shape	Elongated	slightly elongated	Round	Oblong and elongated
Grain color	Amber	Yellow	light tan to reddish-brown color	light yellow to golden brown

Variety: Bulel

Variety: Amilcar

Variety: Gazul

Variety: Planet

Grain characteristics

Applications

Morphology

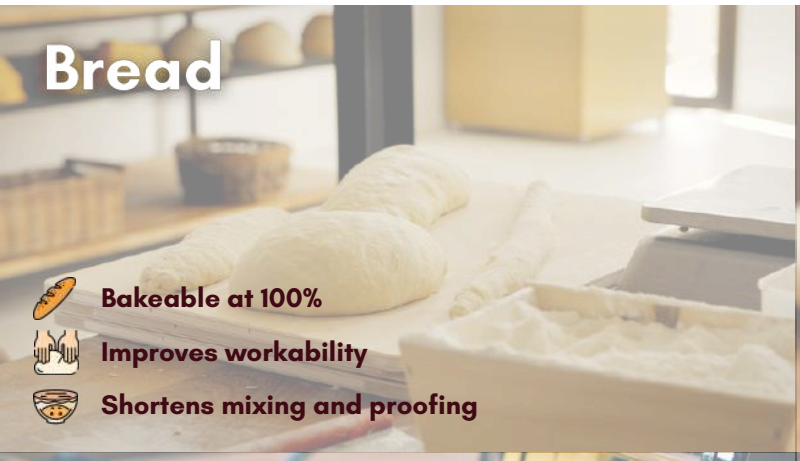
1000 kernels weight: 33-36 gr

Specific weight: 72-75 kg/hL

Typical sieve mesh for cleaning: 1,8 mm

Aspect: can be vitrous or mealy

Applications



Summary

- **Ressembles wheat**
- **Likes Calsisol and Vertisol soils**
- **Adapted to Mediterranean-like climate**
- **No vernalization requirement**
- **Winter-sown gives higher yields**
- **150 UN nitrogen is enough**

- **Crop protection management like wheats, barleys**
- **Excellent resistance to rusts, septoria, mildew**
- **Moderate tolerance to other diseases**
- **Harvester needs adjustments:** tighter cutters, slower airflow, sieve 1,8mm
- **Good resistance to abiotic stresses:** heat, drought, cold, salinity, water logging

- **Elongated, amber, smaller than wheat**
- **Multiple uses**

tritordeum VIVAGRAN

More at: **www.tritordeum.com**

vivagran

Vivagran S.L.
c/ Calabria 35, SA2
08015, Barcelona, Spain
tel: +34 667 234 534

www.vivagran.nl
www.tritordeum.com

CEO:
Etienne Vassiliadis
evassiliadis@vivagran.nl

CFO:
Wiro Nillesen
wnillesen@vivagran.nl

Senior Breeder:
Alba Martinez
amartinez@vivagran.nl