



**MOUNTAIN
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**Deliverable achievement report
D3.2.1 Analyze field performances
across research station locations
for management practices**

To identify the best management practices to improve agronomic performances, ten (10) genotypes of 2 crops (Durum and Barley), including two checks (Commercial and landrace), were planted at four research stations (Morocco, Tunisia, Algeria, and Lebanon), with various agro-ecological interventions and following the standard management procedures of the station.

Genotypes were planted in three replicates using alpha lattice design with three replicates. Algeria was unable to receive the project seeds in the first year, and these were replaced by other breeding accessions already available. Tunisia was affected by a severe drought with only 69 mm total rainfall and nearly 3 months without any moisture. As such the trial was completely lost. In Lebanon, trials had good establishment and development, as it was the case in Morocco until the hailstorm occurred lately in the cycle.

Table 1: Research station trials: 2022-2023 cropping season

Country	Location	Sowing date	Harvesting date
Morocco	Annoceur	Nov 25 th 2022	June 7 th 2023
Algeria	Setif	Dec 29 th 2022	July 18 th 2023
Tunisia	El Kef	Dec 5 th 2022	Lost
Lebanon	Tal Amara	Dec 13 th 2022	June 14 th 2023

Field performances Analysis across research station locations

Morocco (Annoceur)

Twelve barley and Durum wheat genotypes (Table.2) were planted in three replicates alpha lattice at Annoceur experimental station into two trials. The first trial was conducted following standards procedures of the station, the second followed the agro-ecological practices bellow:

- Direct seeding using Seed driller (Zurn D83) at seed rate of 80 kg/ha for barley and 100 kg/ha for durum wheat
- Reasoned fertilisation based on soil analysis. NPK was applied before sowing at rate of 20 kg/ha N and 60 P and 20 K. Total of 40 kg N/ha cover fertiliser was fractioned, 20 kg/kg at tillering and 20 kg/ha at heading stages.
- Intercropping grain-legumes and cereals; Vetch (*Vicia sativa*) was sown between durum wheat and barley rows

Table 2: List of barley and durum wheat genotypes (Morocco)

Crop	Pedigree	Name	GID
DURUM	.	Karim	Na
DURUM	.	Oued Zenati	Na
DURUM	Sebatel1/7/Ossl1/Stj5/5/Bidra1/4/BezazSHF//SD 19539/Waha/3/Stj/Mrb3/6/Icajihan1	Sebajihan	800034160
DURUM	Shaba//Geromtel1/Icasyr1	Shabassem	800034166
DURUM	Amedakul1/TriticumdicocoidesSyriancollection/ /Loukos	Nachit	800043267
DURUM	Korifla/AegSpeltoidesSyr//Mrb5	Jabal	800018569
DURUM	Icasyr1/3/Gcn//Stj/Mrb3	Zagharin2	800043194
DURUM	F413J.S./3/ARTHUR71/LAHN//BLK2/LAHN/4/QUA RMAL	Faraj	800028288
DURUM	Ghzael/Icaqinzen	Ghzael/Icaqinzen	800064933
DURUM	180500 87	180500 87	800064560
DURUM	Kenzera//ITAig:90724/Durex	Kenzera//ITAig:907 24/Durex	800065394

DURUM	Farkassem/Sissem	Farkassem/Sissem	800064810
BARLEY	Zanbaka/H.spont.41-2/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/7/Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda-01/4/WI2291/3/Api/CM67//L2966-69/6/Lignee527/Chn-01//Arar/Rhn-03	SICB12-0382-OTR-OTR-05KF-015AREC-5AREC-OKF	24766
BARLEY	WI3257/4/ALISO/CI3909-2//HB602/3/MOLA/SHYRI//ARUPO*2/JET/5/Atahualpa/IraqiBlack	ICB09-0290-OAP-OAP-020KF-8TR-OAUB-0MR-0MR	24781
BARLEY	Chifaa	Chifaa	4395
BARLEY	SLB15-05/4/H.spont.96-3/3/Roho//Alger/Ceres362-1-1/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB09-0843-OAP-OAP-0MC-2MC	13330
BARLEY	Moroc9-75//WI2291/WI2269/5/SLB15-05/4/H.spont.96-3/3/Roho//Alger/Ceres362-1-1	ICB09-0866-OAP-OAP-0MC-2MC	13336
BARLEY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1		22761
BARLEY	80.5162/MSEL//GLORIA-BAR/IAR.H.485/6/ATACO/BERMEJO//HIGO/3/CAL I92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO	HIICB12-290-OTR-OTR-0MR-0MR-1MR	.
BARLEY	DATCHA//MSEL/ND21117	ICM1213CJ28-33CJ-010CH-05CJ-4CH-0MR	.
BARLEY	UC 1047 / 11HB44	UCD013-012-OCD-OCD-0CD-0MR-2MR	.
BARLEY	UC 1266 // L94/BCD-TTA/3/UC1280	UCD014-121-OCD-OCD-0MR-0MR-1MR	.
BARLEY	.	Amalou	Na
BARLEY	.	Rabat 071	Na

RESULTS

During the crop cycle, recorded rainfall was 381 mm (Figure 1)). This amount was fairly well distributed throughout the winter months. However, only 13 mm was received for both March and April. The months of May and June, on the other hand, experienced abundant rainfall estimated at almost 40% of the total rainfall. A hailstorm occurred in early June, just before harvest causing significant crop losses.

Cycle duration

Days to heading varied from 150 to 153 days for DW, and from 124 to 134 days for barley. No significant differences were revealed between genotypes and practices for both species.

Yield and components

Even the hailstorm occurred in early June, the yield and its components were estimated from one harvested linear meter in each plot for durum wheat and barley in each management.

Results are reported in table 3.

Statistical analysis revealed significant differences between agro ecological and standard management procedure in the case of durum wheat for majority of traits. Whereas, for barley, these differences were significant only for biomass and spike/m².

Indeed, the Agro ecological practices allowed about 50% gain of grain and biomass yields for Durum wheat and 30% gain for barley biomass.

Table 3: Yield and components averages for Agro-ecological and conventional management and ANOVA results.

Crops Management/Traits	Durum Wheat				Barley			
	Grain yield (T/ha)	Biomass T/ha	Spikes/m ²	TKW (g)	Grain yield (T/ha)	Biomass T/ha	Spikes/m ²	TKW (g)
Agro Ecological management	2.70 ± 0.23	1.84 ± 1.69	356.21 ± 1.06	35.79 ± 0.32	1.61 ± 0.13	11.44 ± 0.61	281.77 ± 16.72	52.1 ± 11.57
Conventional management	1.45 ± 0.14	0.78 ± 0.05	233.38 ± 12.70	34 ± 1.08	1.40 ± 0.8	7.22 ± 0.31	193.33 ± 7.99	40.45 ± 1.84
Source of variation:								
• Management	***	***	***	NS	NS	***	***	NS
• Genotypes	***	**	***	NS	NS	*	NS	NS

Lebanon (Tal Amara)

Twelve barley and Durum wheat genotypes (Table. 4) were sown on the 13th of December 2022, at Tal Amara experimental station in three replicates alpha lattice involving two sets. The first trial was conducted following conventional procedure; the second followed the agro-ecological practices as mentioned below:

- Targeted NPK use
- Minimum tillage; 5 rails plowing
- Rotation with legumes
- Reduce nitrogen use
- Manual weeding

Table 4: List of barley and durum wheat genotypes (Lebanon)

Crop	Pedigree	Name
Durum	MARGHERITA	Local Commercial check
Durum	99314	Local Landrace
Durum	Sebatel1/7/Ossl1/Stj5/5/Bidra1/4/BezaizSHF//SD19539/Waha/3/Stj/Mrb3/6/Icajihan1	Sebajihan
Durum	Cham5/Tae.ig:41578//Mrab5/3/Mrab5	Stones
Durum	Amedakul1/TriticumdicoccoidesSyriancollection//Loukos	Nachit
Durum	Korifla/AegSpeltoidesSyr//Mrb5	Jabal
Durum	Icasyr1/3/Gcn//Stj/Mrb3	Zagharin2
Durum	F413J.S./3/ARTHUR71/LAHN//BLK2/LAHN/4/QUARMAL	Faraj
Durum	Ghzael/Icaqinzen	MtH22-05
Durum	180500 87	MtH22-01
Durum	Kenzera//ITAig:90724/Durex	MtH22-09
Durum	Farkassem/Sissem	MtH22-04

Crop	Pedigree	Name
Barley	80.5162/MSEL//GLORIA-BAR/IAR.H.485/6/ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO	HIICB12-290-OTR-OTR-OMR-OMR-1MR
Barley	Local Commercial Check	
Barley	Local Landrace	
Barley	SLB15-05/4/H.spont.96-3/3/Roho//Alger/Ceres362-1-1/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB09-0843-0AP-0AP-OMC-2MC
Barley	Zanbaka/H.spont.41-2/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/7/Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda-01/4/WI2291/3/Api/CM67//L2966-69/6/Lignee527/Chn-01//Arar/Rhn-03	SICB12-0382-OTR-OTR-05KF-015AREC-5AREC-OKF
Barley	Chifaa	Chifae
Barley	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	P.STO
Barley	Moroc9-75//WI2291/WI2269/5/SLB15-05/4/H.spont.96-3/3/Roho//Alger/Ceres362-1-1	ICB09-0866-0AP-0AP-OMC-2MC
Barley	WI3257/4/ALISO/CI3909-2//HB602/3/MOLA/SHYRI//ARUPO*2/JET/5/Atahualpa/IraqiBlack	ICB09-0290-0AP-0AP-020KF-8TR-0AUB-OMR-OMR
Barley	DATCHA//MSEL/ND21117	ICM1213CJ28-33CJ-010CH-05CJ-4CH-OMR
Barley	UC 1266 // L94/BCD-TTA/3/UC1280	UCD014-121-0CD-0CD-OMR-OMR-1MR
Barley	UC 1047 / 11HB44	UCD013-012-0CD-0CD-0CD-OMR-2MR

RESULTS

The climatic conditions were favorable for a good crops growth and development. Plant germination occurred 11 days after sowing, on December 24 of 2022. Plant phenology has not been seriously affected by climatic adversities. Thus, days to heading were 116 in average for barley and 118 for Durum wheat. Significant differences were revealed between agro ecological and conventional practice for this trait only for barley. Days to maturity were in average 145 and 165 days respectively for barley and DW, no management effect was noticed for cycle duration for both species.

However, highly significant effects were shown across genotypes for most traits within agro ecological and conventional management for the two species.

Yield and components

At the Tal Amara site, no significant effect between conventional and agro-ecological practices has been shown for durum wheat, however, the effect has been shown for spike/m² and TKW in barley (Table 5).

Also, there has been a trend of yield superiority in barley under agro ecological management. Statistical analysis revealed significant differences between genotypes for spike/m² and TKW for both durum wheat and barley.

Table 5: Yield and components averages for Agro-ecological and conventional management (Tal Amara 2023)

Management	DURUM WHEAT			BARLEY		
	Grain Yield T/ha	Spike/ m ²	TKW (g)	Grain Yield T/ha	Spike/ m ²	TKW (g)
Agro Ecological management	2,93	399	40,55	3,2027	665,83	43,84
Conventional management	3,25	430	41,28	3,453	652,5	39,92
Source of variation:						
· Management	NS	NS	NS	.	***	**
· Genotypes	**	***	**	***	NS	***

A lgeria

Algeria was unable to receive the project seeds in 2022/2023 cropping season, and these were replaced by nine other genotypes of Durum and nine of barley, already available as shown in table 6. Two trials were conducted at Setif experimental station, the first trial was conducted following conventional procedure; the second followed the agro-ecological practices as mentioned below:

- CA with false seeding and delay in sowing
- Forage rotation (vetch)
- Soil amendment by compost with 63% of OM
- Cover fertilization with 100% organic vermicompost (NPK + OM)
- Manual weeding

Table 6 : List of barley and durum wheat genotypes

Crop	Entry in trial	Variety/Pedigree
Durum	Commercial Check 1 (C.C1)	Bousselam
Durum	C.C2	Boutaleb
Durum	C.C3	Oued El Bared
Durum	C.C4	Ofanto
Durum	C.C5	Waha
Durum	C.C6	Megres
Durum	Nachit	Nachit
Durum	R3.ICA	Icamilmus2/Ammar8/3/Marsyr3//
Durum	local landrace	MBB
Barley	Commercial Check 1 (C.C)	Fouarra
Barley	C.C2	Rahma
Barley	C.C3	Raihane 3
Barley	C.C4	Bahia
Barley	C.C5	Souguer
Barley	C.C6	Saida
Barley	Entry 06	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PE TUNIA 1
Barley	V15.ICAR	Lignee527/NK1272//JLB70-063/3/Rhn-03/6/QB813-2/5/Aths/Lignee686/4/Rhn-03/3/Bc/Rhn//Ky63-1294

Barley	local landrace	Tichedret
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The cumulative rainfall recorded from September to June, was 361.6 mm over 82 days, and only 240 mm was received from sowing (26 December 2022) to harvest (18 July 2023). Rainfall amount was insufficient and irregularly distributed, which affected particularly, the vegetative growth of cereals. 90 mm of water was applied as supplemental irrigation to insure the good run of phenology stages

Yield and components

At Settif location, no significant effect was shown between conventional and agro-ecological management for durum wheat yields and components traits, however, the effect has been revealed in Barley for almost traits, except TKW (Table 6).

Agro ecological management allowed about 20% of gain of grain and straw yields in Barley.

Table 6: Yield and components averages for Agro-ecological and conventional management (Settif 2023)

Management	DURUM WHEAT				BARLEY			
	Grain Yield T/ha	Straw Yield T/ha	Spike/ m ²	TKW (g)	Grain Yield T/ha	Straw Yield T/ha	Spike/ m ²	TKW (g)
Agro Ecological management	3,01	1,94	546,5	44,98	3,21	2,0	364,3	34,46
Conventional management	2,82	1,94	511	45,47	2,57	1,61	311	34,85
Source of variation:								
· Management	NS	NS	NS	NS	*	*	*	NS
· Genotypes	*	***	*	***	*	NS	NS	**