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Science for resilient livelihoods in dry areas

2024 ICARDA global barley breeding program International Nurseries

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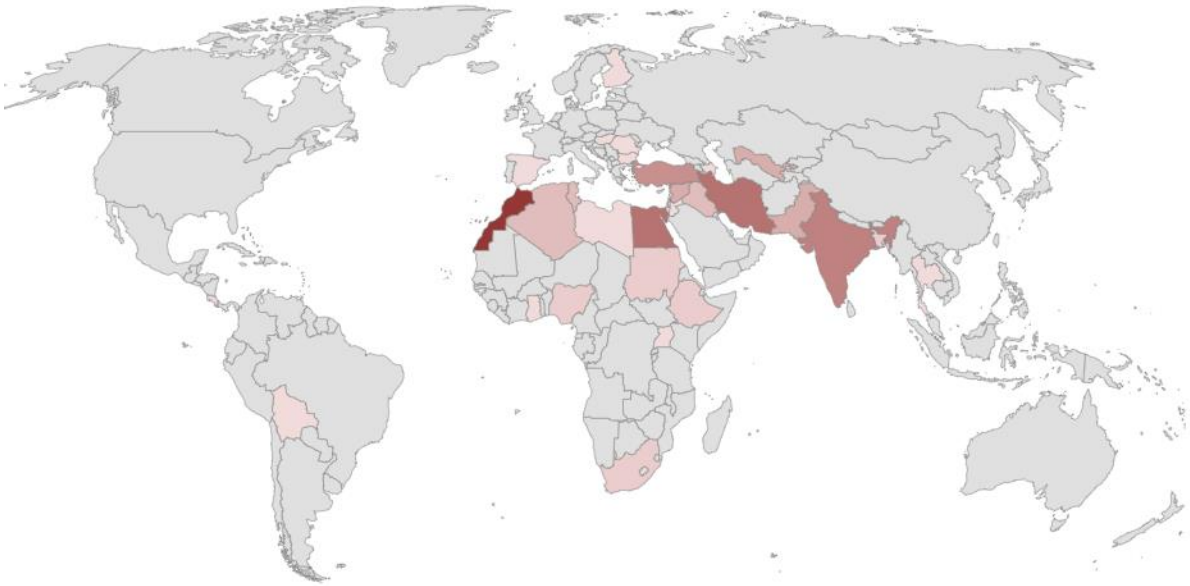

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Introduction

ICARDA has the CGIAR global mandate to breed barley varieties for the developing World. As such, more than 250 spring and winter 2-row, 6-row and naked barley varieties of ICARDA origin have been released in 46 countries, 51 of them in the last 10 years. Besides direct releases, there is large evidence of the impact of ICARDA germplasm in both developed and the developing World's breeding programs.

For the 2023/24 cropping season, the ICARDA Global Barley Breeding Program assembled 3 new nurseries, two yield trials and one observation nursery, that represent the best elite germplasm of all four MegaProduct Lines the program works on: Feed Barley for Arid and Semi-Arid regions, Food and Fodder Barley, Feed and Forage Barley for Favorable Environments and Malt and Fodder Barley.

A total of 142 sets of the nurseries have been distributed upon demand to 28 countries in North America, South America, Europe, the Mediterranean Basin, East, West and South Africa and West, Central and South Asia.

2024 Barley International Nurseries

The Global Barley Breeding program, following the recommendations of the CGIAR Excellence in Breeding (EiB) Platform, the program has adopted a strategy based on the systematic use of product profiles and on rapid development of new genotypes that maintain the successful traits of existing key varieties (benchmarks) and incorporate new traits including tolerance to new stresses and better end-use quality.

The product profiles designed in collaboration with the NARS are then grouped in 4 Product Lines:

Feed Barley for Arid and Semi-Arid regions: consisting in mostly 6-row barley advanced genotypes with high grain and straw productivity and stability from mild to severe drought conditions. The lines are selected in trials from the hot and dry semi-desertic regions of North Africa to the cold and dry West Asian highlands and the short, hot and dry rabi season in Central India.

Food and Fodder Barley: consists in advanced drought tolerant and mostly hull-less genotypes combining high grain size and yield with enhanced nutritional quality (β-glucan, Iron and Zinc content) and straw production. These lines are particularly adapted to mountainous areas.

Feed and Forage Barley for Favorable Environments: consisting in barley advanced genotypes combining high grain and biomass production, diseases and lodging resistance. Lines with early vigor and regeneration capacity to be used for grazing are also included.

Malt and Fodder Barley: consisting in mostly 2-row barley advanced genotypes combining high grain size and stability, malting quality in agreement with international industrial standards with disease and lodging resistance and high straw production.

Following the product profile strategy, new breeding schemes have been designed to deliver new genotypes that meet the requirements of a product profile in the shortest possible time to maximize impact in farmers' fields. To deliver on this strategy, the breeding program is strengthening the traditional extensive use of the barley landrace and wild relative collections hosted at ICARDA genebank to find new sources of traits of interest in collaboration with pre-breeders, physiologists, pathologists, entomologists, agronomists and food technologists among other disciplines. Additionally, the use of genotypic data both for parent selection and genomic predictions; the use of biotic (aphids, leaf rust, yellow rust, net blotch, powdery mildew and scald among others) and abiotic (drought, heat, salinity and cold) stress hot-spot testing locations in 4 countries from Morocco to India and a precise end-use product classification (ICARDA has a fully functional quality laboratory with micro-malting unit, equipment for malting quality traits determination (friability, malt extract, FAN, Diastatic power, β-glucan and others), ICP for micro-element content determination, direct and indirect (NIR-based) feed quality determination of grain and straw, etc.) (Malt [micro-malting process], Food [hull-less, β-glucans, Fe and Zn content] and Feed and Forage quality determination).

The program will distribute for the 2023/24 season 3 IN sets consisting in two yield trials and one observation nursery of genetically diverse advanced genotypes targeting the 4 Product Lines:

The **2024 International Barley Yield Trial for Arid and Semi-Arid regions** (24-IBYT-ASA): This trial contains 24 genetically diverse barley genotypes (including two international checks and one local/national one) targeting two product lines: Feed Barley for Arid and Semi-Arid environments and Food and Fodder Barley It is suggested to grow the IBYT-ASA in 2 replications with 6 rows and 2.5 meters long plot in the layout provided under low input conditions.

The **2024 International Barley Yield Trial for Feed Forage and Malt** (24-IBYT-FFM) in Favorable Environments: This trial contains 24 genetically diverse barley genotypes (including two international checks and one local/national one) targeting two product lines: Feed and Forage Barley for Favorable Environments and Malt and Fodder Barley. It is suggested to grow the IBYT-FFM in 2 replications with 6 rows and 2.5 meters long plot in the layout provided under optimum input conditions.

The **2024 International Barley Observation Nursery** (24-IBON): This trial consists in approximately 120 advanced barley genotypes representing the genetic diversity of the Breeding Program. The nursery includes barley lines targeting the four main Product Lines and can be conducted as 2 rows of 2.5 meters plot in augmented design as per the layout provided.

The 2024 International Barley Yield Trial for Arid and Semi-Arid regions (24-IBYT-ASA)

Trial and distribution

The 24-IBYT-ASA trial contains 24 genetically diverse barley genotypes (including two international checks and one local/national one) targeting two product lines: Feed Barley for Arid and Semi-Arid environments (Feed4Drylands) and Food&Fodder Barley. It is suggested to grow the IBYT-ASA in 2 replications with 6 rows and 2.5 meters long plot in the layout provided under low input conditions.

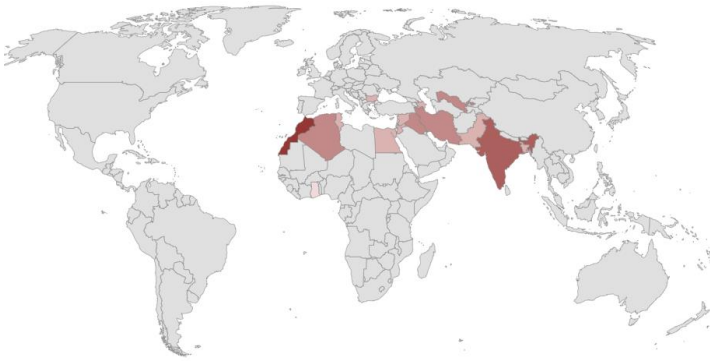

Figure 1 Distribution of the 24-IBYT-ASA

Twenty-three sets of the 24-IBYT-ASA nursery were distributed in 2023 to 16 countries in Europe, Africa and Asia (Figure 1)

Feed Barley for Arid and Semi-Arid Environments

The lines selected from the Feed Barley for Arid and Semi-Arid environments (Feed4Drylands) MegaProduct Profile consist in 17 genotypes, 11 of them of 6row type and 6 of 2row type (Table 7) and 3 naked barley genotypes (entries 22, 23 & 24) of the Food&Fodder MegaProduct Profile, 2 of 6row and 1 of 2row types.

The feed lines were selected based on their superior yield and biomass production as well as good stability that can ensure productivity under severe drought events as well as under more favorable conditions. To determine their productivity under different drought conditions the genotypes were tested in different drought prone environments in replicated yield trials at field stations in Morocco, Egypt, India and Lebanon are used (Figure 2).

Figure 2 Field stations used to test the genotypes selected as part of the Feed Barley for Arid and Semi-Arid environments.

The lines showed different specific adaptation to the different environments (Table 1). This can be attributed at the objective of developing the best possible drought tolerant lines but adapted to the different drought conditions (i.e. cold and dry, hot and dry, terminal drought, severe drought,...).

Table 1 Grain and straw yield performance of 18 elite genotypes of the Feed Barley for Arid and Semi-Arid pipeline and 5 commercial checks tested in 6 locations (see codes in Figure 2) including Gemmeiza in Egypt. The values are normalized to the maximum performance. Wricke's stability index is also shown. The top 5 rank for each variable is highlighted in green.

	Grain yield (normalized index to MAX)						Aboveground biomass (normalized index to MAX)						Stability	
GID	AMH	ANN	EGY	KFR	MCH	SEA	AMH	ANN	EGY	KFR	MCH	SEA	GY	Biomass
16861	0.46	0.86	0.87	0.92	0.88	0.83	0.83	0.95	0.82	1.00	0.99	0.94	2.58	36.41
16868	0.94	0.89	0.61	0.88	0.98	0.94	0.91	0.94	0.57	0.57	0.95	0.97	2.62	12.48
16869	0.93	0.82	0.76	0.75	0.95	0.96	0.89	0.90	0.78	0.75	0.96	0.97	1.09	4.02
16908	NA	0.83	0.77	0.76	0.91	0.98	0.84	0.91	0.75	0.68	0.92	0.99	0.41	3.28
16981	0.70	NA	0.78	0.80	0.93	0.98	0.88	0.96	0.71	0.80	0.94	0.99	0.53	2.17
16984	0.29	0.90	0.68	1.00	0.93	0.94	0.81	0.95	0.66	0.78	0.97	0.98	4.03	7.03
17036	0.48	0.81	1.00	0.77	0.92	0.84	0.81	0.90	1.00	0.81	1.00	0.94	4.32	45.35
17055	0.76	0.83	0.90	0.75	1.00	0.90	0.81	0.89	0.85	0.70	0.95	0.99	2.97	16.84
17097	0.76	NA	0.83	0.91	0.87	0.97	0.89	NA	0.74	0.60	0.89	0.97	3.85	15.08
17101	0.65	0.87	0.79	0.80	0.87	1.00	0.79	0.91	0.78	0.57	0.91	1.00	0.48	15.63
17118	0.74	0.82	0.62	0.79	0.91	1.00	0.82	0.87	0.57	0.67	0.91	0.96	1.05	2.71
17138	1.00	1.00	0.79	0.83	0.93	0.93	0.80	0.99	0.76	0.64	0.94	1.00	2.12	8.02
17155	0.77	0.97	0.83	0.70	0.84	0.89	1.00	1.00	0.75	0.64	0.91	0.97	1.99	10.04
17165	0.66	0.90	0.92	0.86	0.85	0.93	0.91	0.93	0.87	0.65	0.89	0.97	1.61	22.61
17191	0.68	0.94	0.76	0.81	0.99	0.97	0.87	0.94	0.74	0.79	0.96	0.99	0.93	2.50
17203	0.69	0.90	0.66	0.73	1.00	0.94	0.83	0.93	0.65	0.71	1.00	0.98	2.42	4.55
17232	0.90	0.95	0.88	0.68	0.74	0.83	0.95	0.97	0.83	0.77	0.84	0.95	5.42	21.99
24019	0.33	0.88	0.68	0.98	0.84	0.98	0.66	0.93	0.65	0.77	0.89	0.97	3.56	5.92
Furat-03	0.76	0.88	0.72	0.87	0.83	0.86	0.93	0.92	0.73	0.79	0.89	0.96	1.03	5.11
Ksaiba	0.80	0.83	0.78	0.85	0.94	0.97	0.88	0.90	0.74	0.74	0.93	0.99	0.55	1.64
Rihane-03	0.73	0.82	0.61	0.62	0.80	0.88	0.86	0.89	0.62	0.62	0.88	0.94	0.47	2.09
Taffa	0.73	0.83	0.70	0.90	0.84	0.97	0.82	0.91	0.68	0.75	0.92	0.98	1.13	1.74
Tissa	0.62	0.83	0.73	0.74	0.85	NA	0.83	0.93	0.67	0.85	0.92	0.91	1.26	13.41
Repeatability	0.74	0.39	0.89	0.95	0.55	0.46	0.62	0.25	0.93	0.85	0.32	0.23	NA	NA

In addition to the yield and biomass performance, disease resistance was assessed in 4 locations in Morocco using natural infection of Powdery Mildew (*Blumeria graminis*), Spot Form of Net Blotch (*Pyrenophora teres f. maculata*), Net Form of Net Blotch (*Pyrenophora teres f. teres*) and Leaf Rust (*Puccinia hordei*). In 2021, the drought resulted in relatively low disease pressure. Despite this, genotypes like GID: 17191 were found to be resistant or moderately resistant to all diseases (Figure 3).

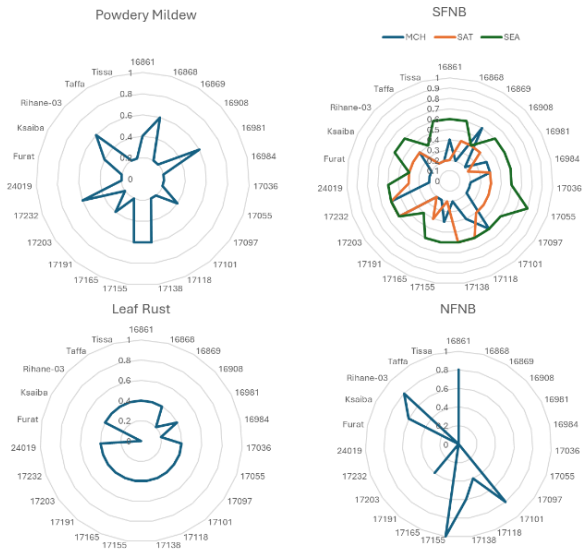

Figure 3 Radar plot depicting the reaction of the 18 elite genotypes and the 5 commercial checks to 4 diseases (Powdery Mildew, Spot Form of Net Blotch, Net Form of Net Blotch and Leaf Rust)). The data was collected from trials carried out in 2021 in Marchouch (MCH), Sidi el Aidi (SEA), Sidi Allal Tazi (SAT) and Annoceur (ANN). The results are shown as Inmune: 0; Resistant: 0.2; Moderately resistant: 0.4; Moderately susceptible: 0.6; Suscepible: 0.8; and Highly Susceptible: 1.

Food and Fodder Barley

In addition to the Feed Barley for Arid and Semi-Arid Areas, the IBYT-ASA also includes 3 elite lines from the Food and Fodder breeding pipeline. These lines are high yielding and drought tolerant hull-less barleys (Table 2) with high end-use and nutritional quality.

Table 2 Grain and straw yield performance ranking of 3 elite genotypes of the Food and Fodder breeding pipeline and 3 commercial hull-less checks tested in 5 locations (see codes in Figure 2). Wricke's stability ranking is also shown. The rankings show the genotypes from highest production (Rank 1) to lowest (Rank 23) and from highest stability (Rank 1) to lowest (Rank 23). The top genotype for each variable is highlighted in green.

	Grain yield (normalized index to MAX)					Aboveground biomass (normalized index to MAX)					Stability
GID	AMH	ANN	KFR	MCH	SEA	AMH	ANN	KFR	MCH	SEA	GY
17369	0.76	1.00	0.98	0.90	0.87	0.96	0.94	0.84	0.99	0.97	0.66
17402	0.83	0.94	0.60	0.86	0.85	1.00	1.00	0.81	0.99	1.00	0.58
58393	0.93	0.96	1.00	0.88	1.00	0.89	0.98	0.75	0.97	1.00	0.60
Assiya	0.69	0.89	0.90	1.00	0.90	0.86	0.94	0.82	1.00	0.96	0.97
Atahualpa	0.85	0.87	0.64	0.76	0.63	0.86	0.98	1.00	0.96	0.85	0.77
Chifaa	1.00	0.91	0.70	0.77	0.84	0.82	0.95	0.69	0.95	0.94	1.07
Repeatability	0.66	0.66	0.96	0.75	0.78	0.73	0.49	0.88	0.17	0.36	NA

In addition to the yield and biomass performance, disease resistance was assessed in 4 locations in Morocco using natural infection of Powdery Mildew (*Blumeria graminis*; ANN), Spot Form of Net Blotch (*Pyrenophora teres f. maculata*; MCH, SEA, SAT) and Leaf Rust (*Puccinia hordei*; SAT). Issued from a collaboration with Rajasthan Agricultural Research Institute (Durgapura; India), the lines were also evaluated against Yellow Rust (*Puccinia striiformis f. sp hordeii*). The genotypes evaluated were Resistant or Moderately resistant to the diseases in the environments tested (Figure 4).

Figure 4 Radar plot depicting the reaction of the 18 elite genotypes and the 5 commercial checks to 4 diseases (Powdery Mildew, Yellow Rust, Spot Form of Net Blotch and Leaf Rust)). The data was collected from trials carried out in 2021 in Marchouch (MCH), Sidi el Aidi (SEA), Sidi Allal Tazi (SAT) and Annoceur (ANN) and in Durgapura in India. The results are shown as Inmune: 0; Resistant: 0.2; Moderately resistant: 0.4; Moderately susceptible: 0.6; Suscepible: 0.8; and Highly Susceptible: 1.

Barley is considered a nutritious crop due to its high concentrations of β-Glucan – that has been shown to reduce diabetes and associated complications as well as promote wound healing and alleviate ischemic heart injury (Chen and Raymond, 2008)**.** The lines were tested for their β-glucan content in 2 locations in Morocco, a sub-optimal rainfed location (Marchouch) and arid station (Sidi el Aidi). The results showed values similar to or superior to most checks. Particularly, line 17402 showed high β-glucan under both conditions (Figure 5)

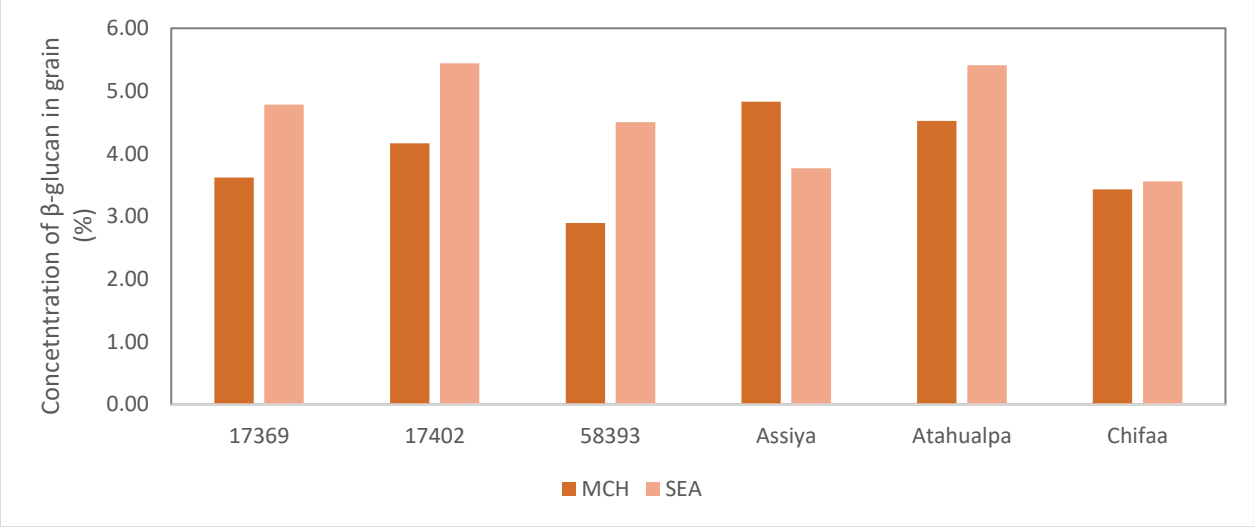

Figure 5 Bar plot of the β-glucan content of 3 elite naked barley lines from ICARDA and 3 checks. The bars represent the content at 2 locations in Morocco, a sub-optimal rainfed location (Marchouch; dark red bars) and an arid station (Sidi el Aidi; light red bars).

The 2024 International Barley Yield Trial for Feed Forage and Malt for Favorable Environments (24-IBYT-FFM)

Trial and distribution

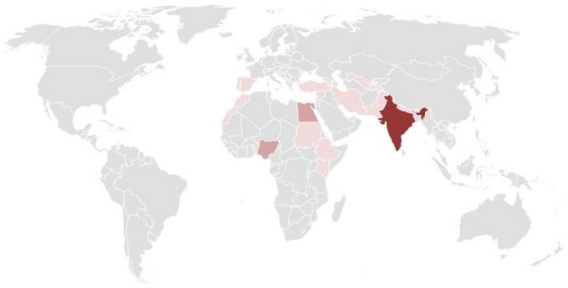

Figure 6 Distribution of the 24-IBYT-FFM

This trial contains 24 genetically diverse barley genotypes (including two international checks and one local/national one) targeting two product lines: Feed and Forage Barley for Favorable Environments and Malt&Fodder Barley. It is suggested to grow the IBYT-FFM in 2 replications with 6 rows and 2.5 meters long plot in the layout provided under high input conditions.

Twenty-two sets of the 24-IBYT-FFM nursery were distributed in 2023 to 14 countries in America, Europe, Africa and Asia (Figure 3)

Feed and Forage for Favorable Environments

The lines selected from the Feed and Forage Barley for Favorable Environments (Feed&Forage) MegaProduct Profile consist in 13 genotypes, 11 of them of 6row type and 2 of 2row type (Table 8). The lines were selected after two years of multi-location testing in research stations in North Africa and West and South Asia. The main traits selected are superior yield and straw production, wide and specific adaptation to targeted agroecologies, early vigor and forage production, disease resistance and grain and straw quality. The testing locations consist of generally medium to high rainfall or irrigated environments with or without sporadic drought events, cold and heat stresses and long and short cycles.

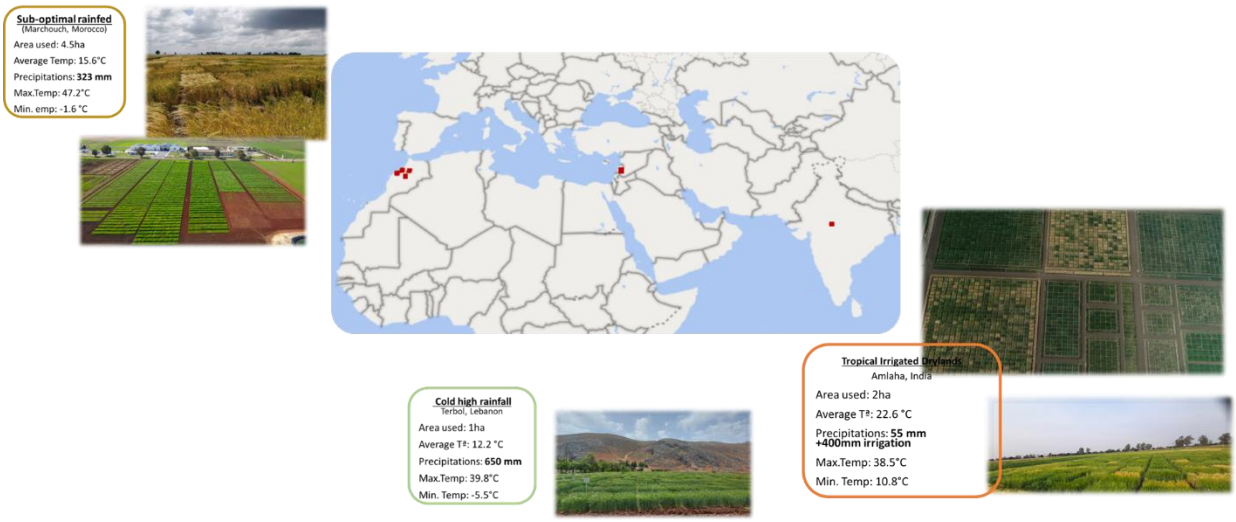

Figure 7 Field stations used to test the genotypes selected as part of the Feed and Forage Barley and Malt and Fodder environments. The locations were Marchouch (Morocco; MCH), Terbol (Lebanon; TER) and Amlaha (India; AMH).

The lines showed different specific adaptation to the different environments (Table **3**). This can be attributed at the objective of developing the best possible lines adapted to high production environments. However, highly stable lines such as 23830 can also be found.

Table 3 Grain and straw yield performance of 13 elite genotypes of the Feed and Forage Barley for Favorable Envirs. pipeline and 3 commercial checks tested in 3 locations (see codes in Figure 7). The values are normalized to maximum performance. Wricke's stability index is also shown. The top 3 rank for each variable is highlighted in green.

	Grain yield (normalized index to MAX)			Straw yield (normalized index to MAX)			Stability	
GID	**AMH**	**MCH**	**TER**	**AMH**	**MCH**	**TER**	**GY**	**Biomass**
23820	0.73	0.80	1.00	0.73	0.80	1.00	3.99	3.51
23828	0.75	1.00	0.86	0.75	1.00	0.86	5.10	6.91
23830	0.74	0.91	0.98	0.74	0.91	0.98	1.56	6.20
23842	0.71	0.95	0.84	0.71	0.95	0.84	2.17	1.91
23908	0.68	0.86	0.93	0.68	0.86	0.93	0.52	17.72
23910	0.95	0.88	0.97	0.95	0.88	0.97	0.68	4.39
23912	0.56	1.00	0.83	0.56	1.00	0.83	6.48	54.82
23955	0.81	0.93	0.83	0.81	0.93	0.83	3.70	8.64
23971	1.00	0.93	0.91	1.00	0.93	0.91	0.74	3.29
23977	0.62	0.81	0.99	0.62	0.81	0.99	3.45	15.34
23981	0.87	NA	0.85	0.87	NA	0.85	5.10	9.77
24001	0.94	0.90	0.86	0.94	0.90	0.86	1.78	2.47
24008	1.00	0.89	0.87	1.00	0.89	0.87	2.04	0.40
Ksaiba	0.69	0.86	0.90	0.69	0.86	0.90	0.06	1.92
Taffa	0.83	0.81	0.93	0.83	0.81	0.93	0.62	0.59
V-Morales	0.74	0.85	0.95	0.74	0.85	0.95	0.45	0.50
Repeatability	0.74	0.39	0.89	0.62	0.25	0.93	NA	NA

This pipeline targets humid environments where the disease pressure is often high. For this we have tested the lines 3 locations in Morocco using natural infection of Powdery Mildew (*Blumeria graminis*; MCH, SEA, SAT), Spot Form of Net Blotch (*Pyrenophora teres f. maculata*; MCH, SEA, SAT) and Leaf Rust (*Puccinia hordei*; SAT). Issued from a collaboration with Rajasthan Agricultural Research Institute

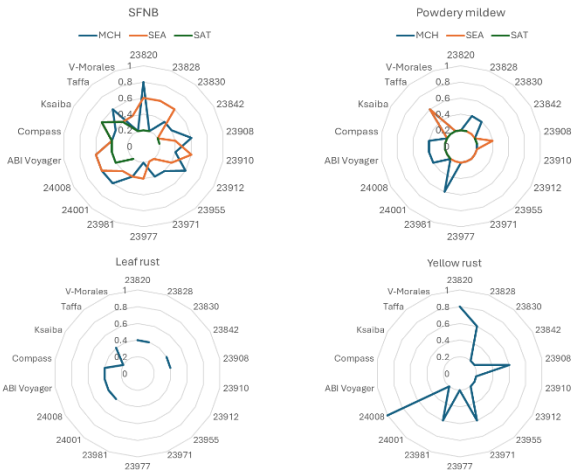

Figure 8 Radar plot depicting the reaction of the 13 elite genotypes and 5 commercial checks to 4 diseases (Powdery Mildew, Yellow Rust, Spot Form of Net Blotch and Leaf Rust). The data was collected from trials carried out in 2021 in Marchouch (MCH), Sidi el Aidi (SEA), Sidi Allal Tazi (SAT) and Annoceur (ANN) and in Durgapura in India. The results are shown as Inmune: 0; Resistant: 0.2; Moderately resistant: 0.4; Moderately susceptible: 0.6; Suscepible: 0.8; and Highly Susceptible: 1.

(Durgapura; India), the lines were also evaluated against Yellow Rust (*Puccinia striiformis f. sp hordeii*). Several lines showed resistance to most of the diseases tested, particularly 23842, 23955 and 23977 showed resistance or moderate resistance to all diseases tested.

Feed quality is a major trait for farmers in the Developing World, and specially for the predominant crop-livestock farming system. For it, we tested the lines for their straw feed quality using NIRS calibrations developed by ICARDA Animal Nutrition team (Dr. J. Wamatu).

Table 4 Straw quality performance measured with NIRS from milled straw samples collected in Marchouch in 2021. The values are normalized to maximum performance

	Straw quality in Marchouch (Normalized to MAX)		
	NDF	**Hemicelulose (%)**	**Celulose (%)**
23820	0.99	0.98	0.97
23828	0.99	0.99	0.97
23830	0.99	0.97	0.96
23842	0.99	0.99	0.98
23908	1.00	0.93	1.00
23910	1.00	0.96	0.99
23912	1.00	0.97	0.99
23955	0.99	0.97	0.98
23971	1.00	0.98	0.99
23977	1.00	0.98	0.99
23981	0.99	0.94	0.99
24001	1.00	0.98	0.99
24008	0.99	0.97	0.97
Ksaiba	1.00	0.97	0.99
Taffa	1.00	0.97	0.99
V-Morales	1.00	0.97	0.99
Repeatability	0.28	0.65	0.43

In absolute values, minimal differences in major feed quality traits could be seen between the lines (Table 4).

Malt and Fodder Barley

The lines selected from the Malt and Fodder Barley MegaProduct Profile consist in 8 genotypes, all of them of 2row type (Table 7). The lines were selected after two years of multi-location testing in research stations in North Africa and West and South Asia. The main traits selected are superior yield and straw production, specific adaptation to targeted agroecologies and high stability, disease resistance and grain caliber and malting quality. The testing locations consist of generally medium to high rainfall or irrigated environments with or without sporadic drought events, cold and heat stresses and long and short cycles.

Table 5 Grain and straw yield performance of 8 elite genotypes of the Malt and Fodder barley pipeline and 3 commercial checks tested in 3 locations (see codes in Figure 7). The values are normalized to maximum performance. Wricke's stability index is also shown. The top 3 rank for each variable is highlighted in green.

	Grain yield (normalized index to MAX)			Straw Yield (normalized index to MAX)			Stability
GID	AMH	MCH	TER	AMH	MCH	TER	GY
23772	0.74	0.91	0.94	0.93	NA	1.00	0.45
23782	0.84	0.97	0.78	0.94	NA	0.72	0.42
23784	0.65	0.93	0.77	0.92	NA	0.73	0.29
23765	0.75	0.94	0.90	0.88	NA	0.58	0.21
23772	0.78	1.00	0.86	0.87	NA	0.50	1.04
23805	0.90	NA	0.97	0.90	NA	0.65	1.34
23809	1.00	0.95	0.89	0.87	NA	0.73	0.01
23811	0.96	0.94	1.00	0.87	NA	0.84	0.49
Furat-03	0.60	0.82	0.54	NA	NA	0.52	
V-Morales	0.97	0.90	0.95	0.77	NA	0.64	
Repeatability	0.8	0.43	0.96	0.63	0.01	0.86	NA

ICARDA elite malt and fodder barley lines performed well in all environments (Table 5). Lines like 23811 and 23809 showed high grain yields in all 3 environments while line 23772 showed both good grain yield and straw yields.

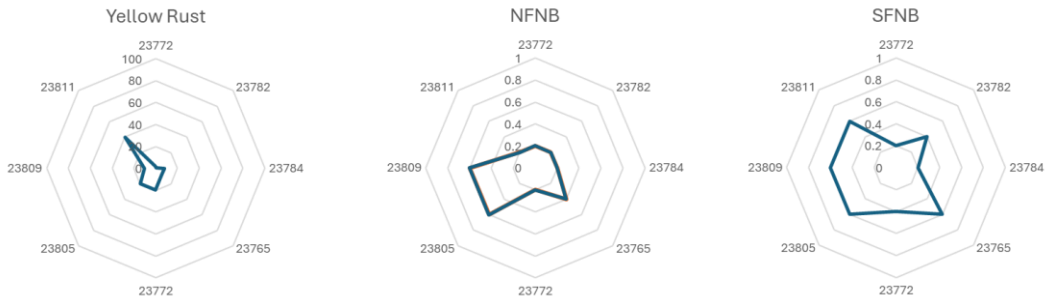

Figure 9 Radar plot depicting the reaction of the 8 elite genotypes to 3 diseases (Yellow Rust, Spot Form of Net Blotch and Net Form of Net Blotch). The data was collected from trials carried out in 2021 in Marchouch (MCH) and Durgapura (India). The results are shown as Inmune: 0; Resistant: 0.2; Moderately resistant: 0.4; Moderately susceptible: 0.6; Suscepible: 0.8; and Highly Susceptible: 1. For yellow rust the coefficient of infection obtained from 3 readings is shown.

In addition to the performance and adaptations testing, these lines were also tested for disease reaction in hotspots in Morocco and India. The results showed good levels of resistance to Spot Form of Net Blotch (*Pyrenophora teres f. maculata*; MCH), Net Form of Net Blotch (*Pyrenophora teres f. teres*; MCH) and Yellow Rust (*Puccinia striiformis f. sp hordeii*; India). Particularly lines 23772 and 23784 showed high levels of resistance to all 3 diseases.

Often more important than performance itself for malt barley is malt quality. We tested our elite lines for morphological, chemical and under micro-malting in 2021 and 2022. The results showed that ICARDA elite lines have consistently high grain weights, even under dry conditions like Marchouch in 2020/21 (Table 6), particularly line 23809. Four of the 8 lines showed high bold grain (>2.5mm width) proportions (>90%) under dry conditions, surpassing well known international malt barley checks. The concentration of B-glucan in grain was in general high due to the conducive environmental conditions, however, the elite ICARDA lines showed similar or lower B-glucan concentration than well known international checks. Finally, the micromalting results showed good germination energies for all the lines studied and also high friability and low soluble protein for the international checks. However, many ICARDA lines behaved similarly such as 23782 or 23784.

Table 6 Thousand Kernel weight measured at three locations (see codes in Figure 7) for the 8 elite malt barley lines and 5 checks. The proportion of bold (>2.5mm width) and thin (<1.8mm width) grains measured with the Sortimat and the B-glucan content measured with the NIRS is also shown. The Germination Energy during malting, the concentration of soluble protein in the malt and the percentage of transformed malt are shown. The top 3 rank for each variable is highlighted in green when higher values are desirable for malt quality and in red when they are undesirable.

	TKW			Grain quality (MCH)			Malt quality		
GID	AMH	MCH	TER	BoldGrain	ThinGrain	BetaGlucan (%)	GE	Friability (%)	Soluble Protein (%)
23772	42.2	50.7	40.8	93.2	1.42	6.64	97.3	64.0	12.0
23782	42.3	49.3	40.6	85.0	2.99	5.44	97.6	72.3	11.9
23784	46.0	50.6	45.3	91.0	2.31	5.35	97.8	65.7	12.0
23765	39.7	50.5	41.8	83.1	3.78	6.17	97.3	64.7	11.9
23772	38.0	51.7	45.2	90.6	2.82	5.84	97.9	67.0	12.1
23805	38.5	39.7	37.7	56.7	11.41	6.19	97.4	61.2	11.9
23809	42.7	56.2	47.6	92.9	1.82	6.43	97.4	67.7	12.1
23811	41.3	37.7	37.6	51.3		6.47	96.7	62.6	11.9
Furat-03	41.5	55.6	43.7	94.3	1.87	5.62	NA	NA	NA
V-Morales	40.7	51.4	48.0	93.1	1.77	5.45	96.7	74.5	11.8

The 2024 International Barley Observation Nursery (24-IBON)

Trial and distribution

This trial consists in 138 advanced barley genotypes representing the genetic diversity of the Breeding Program displayed in a replicated check design with 4 checks, 3 international and one local (Table 9). The nursery includes barley lines targeting the four main MegaProduct Lines and can be conducted as 2 rows of 2.5 meters plot in augmented design as per the layout provided.
Thirty-two sets of the 24-IBON nursery were distributed in 2023 to 19 countries in South America, Europe, Africa and Asia (Figure 5).

Figure 10 Distribution of the 24-IBON in 2023

Table 7. List of entries in the 2024 International Barley Yield Trial for Feed Forage and Malt (24-IBYT-FFM)

GID	Cross	Pedigree	MPP	RT
3742	Local Check	Check		
23805	DOÑA JOSEFA/3/CEV 96060/MSEL//CANELA	ICM1314CJ6-42CJ-010CH-0MR	Malt&Fodder	2R
23809	DOÑA JOSEFA//CANELA/ICARO	ICM1314CJ9-74CJ-010CH-0MR	Malt&Fodder	2R
23772	DATCHA//MSEL/ND21117	ICM1213CJ28-32CJ-010CH-05CJ-10CH-0MR	Malt&Fodder	2R
23811	VARBERG//Canela	HIICB12-056-0TR-0TR-0MR-0MR-3MR	Malt&Fodder	2R
23772	DATCHA//MSEL/ND21117	ICM1213CJ28-33CJ-010CH-05CJ-4CH-0MR	Malt&Fodder	2R
23765	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	RSI/ICJ11-12B003S-18CJ-05CH-05CJ-2CH-0CJ-0MR	Malt&Fodder	2R
23784	CANELA/DEFRA//SHAKIRA	HIICB12-210-0TR-0TR-0MR-0MR-5MR	Malt&Fodder	2R
23971	TRADITION/DWR28	HIICB15-0051-0TR-0MR-0MR-0MR-7MR	Feed&Forage	6R
60648	Vmorales	Check		6R
24008	LEGACY/CHAMICO//ATAH92/GOB/3/RD2552	HIICB15-0191-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
23910	Moronera/alanda-01	HIICB15-0577-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
24001	TRADITION/RD2552	HIICB15-0047-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
23981	Frontier/Alanda	HIICB15-0054-0TR-0MR-0MR-0MR-6MR	Feed&Forage	6R
23955	DWRUB52/RD2552	HIICB15-0030-0TR-0MR-0MR-0MR-10MR	Feed&Forage	6R
23828	ISHI//L94/BCD-TTA/3/ ISHI	UCD014-053-0CD-0CD-0MR-0MR-3MR	Feed&Forage	6R
23830	22IBYT7/ / UC 1047/ UC 1108	UCD014-034-0CD-0CD-0MR-0MR-6MR	Feed&Forage	6R
23782	LOGAN-BAR/MSEL//AZAF/4/AF9216/3/ZHEDAR#1/SHYRI//OLMO	HIICB12-042-0TR-0TR-0MR-0MR-2MR	Malt&Fodder	2R
23820	Sebastian/RD2668	HIICB15-0142-0TR-0MR-0MR-0MR-4MR	Feed&Forage	6R
60652	Rihane-03	Check		6R
23842	Tocada/DWRUB52	HIICB15-0215-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23908	ND17268/NDB1173	HIICB15-0431-0TR-0MR-0MR-0MR-7MR	Feed&Forage	6R
23977	MERIT 57/PL 172	HIICB15-0296-0TR-0MR-0MR-0MR-3MR	Feed&Forage	6R
23912	Zeppelin /4/MERIT,B//CLE150/W89.11369/3/CANELA	ICM1415CJ59-0CH-0CH-0MR-0MR-4MR	Feed&Forage	2R

Table 8. List of entries in the 2024 International Barley Yield Trial for Arid and Semi-Arid regions (24-IBYT-ASA)

GID	Cross	Pedigree	MPP	RT
3742	National check			
17191	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/AC-6629	ICB14-0204-0TR-015AUB-020TR-10AREC-1KF-0KF-0MR	Feed4Drylands	6R
17232	Nadawa/Rhn-03//Mtn-01/6/Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml	ICB14-0264-0TR-015AUB-020TR-4AREC-4KF-0KF-0MR	Feed4Drylands	6R
17203	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/DWRUB-52	ICB14-0217-0TR-015AUB-020TR-9AREC-2KF-0KF-0MR	Feed4Drylands	6R
17055	AwBlack/Aths//Rhn-08/3/Malouh/4/GIZA131	ICB14-0007-0TR-015AUB-020TR-2AREC-1KF-0KF-0MR	Feed4Drylands	6R
17118	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/Alanda01	ICB14-0053-0TR-015AUB-020TR-2AREC-3KF-0KF-0MR	Feed4Drylands	6R
17165	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/AC-6629	ICB14-0153-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Feed4Drylands	6R
17138	Arbayan-01//As46/Aths/3/Barjouj/4/DWRUB-52	ICB14-0107-0TR-015AUB-020TR-3AREC-5KF-0KF-0MR	Feed4Drylands	6R
17155	Arbayan-01//As46/Aths/3/Barjouj/5/GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares	ICB14-0124-0TR-015AUB-020TR-6AREC-5KF-0KF-0MR	Feed4Drylands	6R
60754	Rihane-03			6R
17097	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Furat-3	ICB14-0026-0TR-015AUB-020TR-7AREC-1KF-0KF-0MR	Feed4Drylands	6R
17101	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/HARMAL	ICB14-0027-0TR-015AUB-020TR-9AREC-2KF-0KF-0MR	Feed4Drylands	6R
16868	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Feed4Drylands	2R
16869	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-1AREC-2KF-0KF-0MR	Feed4Drylands	2R
16981	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Feed4Drylands	2R
17036	Frontier/VMorales	HIICB15-0058-0TR-0MR-0MR-0MR-1MR	Feed4Drylands	2R
16861	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/ATAHUALPA	ICB14-0064-0TR-015AUB-020TR-2AREC-2KF-0KF-0MR	Feed4Drylands	2R
24019	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/WI3167	SICB12-0331-0TR-0TR-030KF-015AREC-5AREC-0KF	Feed4Drylands	2R
16984	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-6AREC-4KF-0KF-0MR	Feed4Drylands	2R
60755	Furat 03			
16908	Fedora/Express//Rhn-03/3/DWRUB-52	ICB14-0099-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Feed4Drylands	2R
17402	UC1263 X L94/BCD-TTA//UC1231L	UCD014-210-0CD-0CD-0MR-0MR-7MR	Feed&Food	2R
17369	UC 1266 // L94/BCD-TTA/3/UC1264	UCD014-081-0CD-0CD-0MR-0MR-6MR	Food&Fodder	2R
58393	UC 1047 / 11HB44	UCD013-012-0CD-0CD-0CD-0MR-2MR	Food&Fodder	6R

Table 9. List of entries in the 2024 International Barley Observation Nursery (24-IBON)

GID	Cross	Pedigree	MPP	RT
23763	BICHY2000//GOB/HUMAI10/3/SHAKIRA	HIICB12-221-0TR-0MR-0MR-0MR-4MR	Malt&Fodder	2R
23782	LOGAN-BAR/MSEL//AZAF/4/AF9216/3/ZHEDAR#1/SHYRI//OLMO	HIICB12-042-0TR-0TR-0MR-0MR-2MR	Malt&Fodder	2R
23811	VARBERG//Canela	HIICB12-056-0TR-0TR-0MR-0MR-3MR	Malt&Fodder	2R
23809	DOÑA JOSEFA//CANELA/ICARO	ICM1314CJ9-74CJ-010CH-0MR	Malt&Fodder	2R
23766	PFC9215/3/ZHEDAR#1/SHYRI//OLMO/4/SHENMAI NO.3/MSEL	HIICB12-476-0TR-0TR-0MR-0MR-3MR	Malt&Fodder	2R
23772	DATCHA//MSEL/ND21117	ICM1213CJ28-32CJ-010CH-05CJ-10CH-0MR	Malt&Fodder	2R
23772	DATCHA//MSEL/ND21117	ICM1213CJ28-33CJ-010CH-05CJ-4CH-0MR	Malt&Fodder	2R
23805	DOÑA JOSEFA/3/CEV 96060/MSEL//CANELA	ICM1314CJ6-42CJ-010CH-0MR	Malt&Fodder	2R
23793	L94//Msel/11MQ54	UCD13-003-0UCD-0UCD-0MR-0MR-8MR	Malt&Fodder	2R
23765	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	RSI/ICJ11-12B003S-18CJ-05CH-05CJ-2CH-0CJ-0MR	Malt&Fodder	2R
23784	CANELA/DEFRA//SHAKIRA	HIICB12-210-0TR-0TR-0MR-0MR-5MR	Malt&Fodder	2R
23796	UC1322/MP103MQ	UCD13-012-0UCD-0UCD-0MR-0MR-7MR	Malt&Fodder	2R
23789	PFC9215/3/ZHEDAR#1/SHYRI//OLMO/4/Sebastian	HIICB12-257-0TR-0MR-0MR-0MR-8MR	Malt&Fodder	2R
23760	MAGALY//Sebastian	HIICB12-170-0TR-0MR-0MR-0MR-9MR	Malt&Fodder	2R
23790	UMBRELLA//SHAKIRA	HIICB12-095-0TR-0MR-0MR-0MR-7MR	Malt&Fodder	2R
23765	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	RSI/ICJ11-12B003S-9CJ-05CH-05CJ-4CH-0CJ-0MR	Malt&Fodder	2R
23761	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	HIICB12-290-0TR-0TR-0MR-0MR-1MR	Malt&Fodder	2R
23788	JB FLAVOUR//CONCHITA	HIICB12-132-0TR-0MR-0MR-0MR-5MR	Malt&Fodder	2R
23810	LOGAN-BAR/MSEL//AZAF/3/MERIT,B/AF9216//CANELA	UCD13-003-0UCD-0UCD-0MR-0MR-8MR	Malt&Fodder	2R
	Rihane-03	Check		
23849	UC1280 X L94/BCD-TTA//ISHI	UCD014-208-0CD-0CD-0MR-0MR-2MR	Feed&Forage	6R
24008	LEGACY/CHAMICO//ATAH92/GOB/3/RD2552	HIICB15-0191-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
23908	ND17268/NDB1173	HIICB15-0431-0TR-0MR-0MR-0MR-7MR	Feed&Forage	6R
23839	MORALES / UC 933	UCD014-039-0CD-0CD-0MR-0MR-6MR	Feed&Forage	6R
23842	Tocada/DWRUB52	HIICB15-0215-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23830	22IBYT7/ / UC 1047/ UC 1108	UCD014-034-0CD-0CD-0MR-0MR-6MR	Feed&Forage	6R
23971	TRADITION/DWR28	HIICB15-0051-0TR-0MR-0MR-0MR-7MR	Feed&Forage	6R
23828	ISHI//L94/BCD-TTA/3/ ISHI	UCD014-053-0CD-0CD-0MR-0MR-3MR	Feed&Forage	6R
23863	UC1280//L94/BCD-TTA/3/ISHI	UCD014-0086-CD-0CD-0MR-0MR-10MR	Feed&Forage	6R
23930	UC 1116 / 22IBYT7	UCD014-036-0CD-0CD-0MR-0MR-3MR	Feed&Forage	6R
23981	Frontier/Alanda	HIICB15-0054-0TR-0MR-0MR-0MR-6MR	Feed&Forage	6R
24001	TRADITION/RD2552	HIICB15-0047-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
23955	DWRUB52/RD2552	HIICB15-0030-0TR-0MR-0MR-0MR-10MR	Feed&Forage	6R
23942	UC 1266 // L94/BCD-TTA/3/UC1263	UCD014-109-0CD-0CD-0MR-0MR-9MR	Feed&Forage	6R
23813	LWG 5054 / UC 1116	UCD014-028-0CD-0CD-0MR-0MR-8MR	Feed&Forage	6R
23888	CELEBRATION/DWRUB52	HIICB15-0125-0TR-0MR-0MR-0MR-4MR	Feed&Forage	6R
23973	Harrington/Arta//Malt 1/3/RD2592	HIICB15-0156-0TR-0MR-0MR-0MR-4MR	Feed&Forage	6R
23857	BRS195/ND19098-1//RD2668	HIICB15-RA-0658-0TR-0MR-0MR-0MR-1MR	Feed&Forage	6R
23912	Zeppelin /4/MERIT,B//CLE150/W89.11369/3/CANELA	ICM1415CJ59-0CH-0CH-0MR-0MR-4MR	Feed&Forage	2R
	V-Morales	Check		
23820	Sebastian/RD2668	HIICB15-0142-0TR-0MR-0MR-0MR-4MR	Feed&Forage	6R
23939	Harrington/Arta//Malt 1/3/RD2552	HIICB15-0155-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23920	BRS195/ND19098-1//DWRUB52	HIICB15-RA-0659-0TR-0MR-0MR-0MR-9MR	Feed&Forage	2R
23910	Moronera/alanda-01	HIICB15-0577-0TR-0MR-0MR-0MR-8MR	Feed&Forage	6R
23822	UC1231L //L94/BCD-TTA/3/UC1280	UCD014-123-0CD-0CD-0MR-0MR-7MR	Feed&Forage	6R
23868	UC 1231 // RIHANE / MORALES	UCD014-013-0CD-0CD-0MR-0MR-8MR	Feed&Forage	6R
23834	TRADITION/RD2668	HIICB15-0052-0TR-0MR-0MR-0MR-4MR	Feed&Forage	2R
23852	UC1231L//L94/BCD-TTA/3/UC1267	UCD014-130-0CD-0CD-0MR-0MR-9MR	Feed&Forage	6R
23866	Sebastian/DWRUB52	HIICB15-0143-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23883	UC 1266 // L94/BCD-TTA/3/UC1266	UCD014-235-0CD-0CD-0MR-0MR-8MR	Feed&Forage	2R
23875	Scarlett/RD2592	HIICB15-0013-0TR-0MR-0MR-0MR-8MR	Feed&Forage	2R
23977	MERIT 57/PL 172	HIICB15-0296-0TR-0MR-0MR-0MR-3MR	Feed&Forage	6R
23844	BISON 216.4/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/7/EXPLORER	ICM1415CJ102-0CH-0CH-0MR-0MR-6MR	Feed&Forage	2R
23922	UC 1115 / UC 1047	UCD014-035-0CD-0CD-0MR-0MR-1MR	Feed&Forage	6R
23919	UC1231L //L94/BCD-TTA /3/UC1231L	UCD014-062-0CD-0CD-0MR-0MR-8MR	Feed&Forage	6R
23851	Sebastian/Nawair-01	HIICB15-0129-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23858	Kenia/DWRUB52	HIICB15-0505-0TR-0MR-0MR-0MR-5MR	Feed&Forage	2R
23847	Pasadena/RD2668	HIICB15-0528-0TR-0MR-0MR-0MR-6MR	Feed&Forage	2R
23928	ND17268/RD2660	HIICB15-0435-0TR-0MR-0MR-0MR-5MR	Feed&Forage	6R
	Local Check	Check		
23903	PATTI//UC 1116/UC 1047	UCD014-024-0CD-0CD-0MR-0MR-5MR	Feed&Forage	6R
23959	UC 1116 / IBYT // UC 1108	UCD014-045-0CD-0CD-0MR-0MR-1MR	Feed&Forage	6R
23855	Piroline/NDB1173	HIICB15-0415-0TR-0MR-0MR-0MR-6MR	Feed&Forage	2R
23969	UC1263 X L94/BCD-TTA//UC1231L	UCD014217--0CD-0CD-0MR-0MR-8MR	Feed&Forage	6R
23880	MSEL/LOGAN-BAR/CONCHITA	HIICB15-0175-0TR-0MR-0MR-0MR-7MR	Feed&Forage	2R
23816	Tocada/Manal	HIICB15-0203-0TR-0MR-0MR-0MR-6MR	Feed&Forage	2R

17081	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/GIZA131	ICB14-0018-0TR-015AUB-020TR-9AREC-3KF-0KF-0MR	Food4Drylands	6R
17108	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/7/3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh	ICB14-0031-0TR-015AUB-020TR-9AREC-1KF-0KF-0MR	Food4Drylands	6R
16869	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-1AREC-2KF-0KF-0MR	Food4Drylands	2R
16872	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	2R
17232	Nadawa/Rhn-03//Mtn-01/6/Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml	ICB14-0264-0TR-015AUB-020TR-4AREC-4KF-0KF-0MR	Food4Drylands	6R
17101	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/HARMAL	ICB14-0027-0TR-015AUB-020TR-9AREC-2KF-0KF-0MR	Food4Drylands	6R
16861	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/ATAHUALPA	ICB14-0064-0TR-015AUB-020TR-2AREC-2KF-0KF-0MR	Food4Drylands	2R
17080	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/GIZA131	ICB14-0018-0TR-015AUB-020TR-8AREC-2KF-0KF-0MR	Food4Drylands	6R
16831	GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB14-0042-0TR-015AUB-020TR-7AREC-2KF-0KF-0MR	Food4Drylands	2R
17053	AwBlack/Aths//Rhn-08/3/Malouh/4/Tichedrette	ICB14-0006-0TR-015AUB-020TR-9AREC-3KF-0KF-0MR	Food4Drylands	6R
17203	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/DWRUB-52	ICB14-0217-0TR-015AUB-020TR-9AREC-2KF-0KF-0MR	Food4Drylands	6R
17162	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/Tichedrette	ICB14-0149-0TR-015AUB-020TR-4AREC-3KF-0KF-0MR	Food4Drylands	6R
17161	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/Tichedrette	ICB14-0149-0TR-015AUB-020TR-4AREC-1KF-0KF-0MR	Food4Drylands	6R
	Rihane-03	Check		
17036	Frontier/VMorales	HIICB15-0058-0TR-0MR-0MR-0MR-1MR	Food4Drylands	2R
16984	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-6AREC-4KF-0KF-0MR	Food4Drylands	2R
17191	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/AC-6629	ICB14-0204-0TR-015AUB-020TR-10AREC-1KF-0KF-0MR	Food4Drylands	6R
17066	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Tichedrette	ICB14-0016-0TR-015AUB-020TR-9AREC-1KF-0KF-0MR	Food4Drylands	6R
16934	Soufara-02/3/RM1508/Por//WI2269/4/Hml-02 /ArabiAbiad//ER /Apm/5/ ((Galleon x Richard)/5)xTilga/6/DWRUB-52	ICB14-0130-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	2R
17238	Celebration/Harmal	HIICB15-0110-0TR-0MR-0MR-0MR-7MR	Food4Drylands	6R
17111	3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh/7/Tichedrette	ICB14-0044-0TR-015AUB-020TR-7AREC-2KF-0KF-0MR	Food4Drylands	6R
17140	Arbayan-01//As46/Aths/3/Barjouj/4/DWRUB-52	ICB14-0107-0TR-015AUB-020TR-9AREC-4KF-0KF-0MR	Food4Drylands	6R
16961	Clipper//WI2291*2/WI2269/3/Furat 2/4/Alanda01	ICB14-0158-0TR-015AUB-020TR-6AREC-3KF-0KF-0MR	Food4Drylands	2R
16894	Roho/4/Zanbaka/3/ER/Apm//Lignee131/7/3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh	ICB14-0095-0TR-015AUB-020TR-7AREC-4KF-0KF-0MR	Food4Drylands	2R
16983	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-4AREC-3KF-0KF-0MR	Food4Drylands	2R
16868	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Food4Drylands	2R
16907	Fedora/Express//Rhn-03/3/DWRUB-52	ICB14-0099-0TR-015AUB-020TR-5AREC-4KF-0KF-0MR	Food4Drylands	2R
24019	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/WI3167	SICB12-0331-0TR-0TR-030KF-015AREC-5AREC-0KF	Food4Drylands	2R
16908	Fedora/Express//Rhn-03/3/DWRUB-52	ICB14-0099-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	2R
17175	Tipper/ICB-102854//Alpha/Durra/3/Tichedrette	ICB14-0173-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	6R
16906	Fedora/Express//Rhn-03/3/DWRUB-52	ICB14-0099-0TR-015AUB-020TR-4AREC-3KF-0KF-0MR	Food4Drylands	2R
17149	Arbayan-01//As46/Aths/3/Barjouj/4/Malouh//Aths/Lignee686	ICB14-0119-0TR-015AUB-020TR-10AREC-3KF-0KF-0MR	Food4Drylands	6R
16982	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-2AREC-2KF-0KF-0MR	Food4Drylands	2R
	V-Morales	Check		
17138	Arbayan-01//As46/Aths/3/Barjouj/4/DWRUB-52	ICB14-0107-0TR-015AUB-020TR-3AREC-5KF-0KF-0MR	Food4Drylands	6R
16957	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA126	ICB14-0152-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Food4Drylands	2R
16967	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	ICB14-0169-0TR-015AUB-020TR-5AREC-1KF-0KF-0MR	Food4Drylands	2R
16960	Clipper//WI2291*2/WI2269/3/Furat 2/4/Alanda01	ICB14-0158-0TR-015AUB-020TR-1AREC-2KF-0KF-0MR	Food4Drylands	2R
17055	AwBlack/Aths//Rhn-08/3/Malouh/4/GIZA131	ICB14-0007-0TR-015AUB-020TR-2AREC-1KF-0KF-0MR	Food4Drylands	6R
17152	Arbayan-01//As46/Aths/3/Barjouj/6/Baishishek/5/Nd10277/Shyri//Nd11231/Shyri/3/Azaf/4/Canela/Gob96Dh	ICB14-0121-0TR-015AUB-020TR-10AREC-4KF-0KF-0MR	Food4Drylands	6R
16978	Tipper/ICB-102854//Alpha/Durra/3/Rihane03	ICB14-0177-0TR-015AUB-020TR-10AREC-3KF-0KF-0MR	Food4Drylands	2R
17011	Malouh//Aths/Lignee686/3/DWRUB-52	ICB14-0227-0TR-015AUB-020TR-7AREC-1KF-0KF-0MR	Food4Drylands	2R
17097	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Furat-3	ICB14-0026-0TR-015AUB-020TR-7AREC-1KF-0KF-0MR	Food4Drylands	6R
16964	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	ICB14-0169-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Food4Drylands	2R
16975	Tipper/ICB-102854//Alpha/Durra/3/Tichedrette	ICB14-0173-0TR-015AUB-020TR-2AREC-2KF-0KF-0MR	Food4Drylands	2R
17164	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA126	ICB14-0152-0TR-015AUB-020TR-8AREC-5KF-0KF-0MR	Food4Drylands	6R
17121	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/AC-6629	ICB14-0061-0TR-015AUB-020TR-6AREC-4KF-0KF-0MR	Food4Drylands	6R
16930	Arbayan-01//As46/Aths/3/Barjouj/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0127-0TR-015AUB-020TR-10AREC-5KF-0KF-0MR	Food4Drylands	2R
17155	Arbayan-01//As46/Aths/3/Barjouj/5/GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares	ICB14-0124-0TR-015AUB-020TR-6AREC-5KF-0KF-0MR	Food4Drylands	6R
17165	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/AC-6629	ICB14-0153-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	6R
17193	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/5/Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH	ICB14-0214-0TR-015AUB-020TR-2AREC-4KF-0KF-0MR	Food4Drylands	6R
17118	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/Alanda01	ICB14-0053-0TR-015AUB-020TR-2AREC-3KF-0KF-0MR	Food4Drylands	6R
16981	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	ICB14-0186-0TR-015AUB-020TR-1AREC-1KF-0KF-0MR	Food4Drylands	2R
	Local Check	Check		
16971	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	ICB14-0169-0TR-015AUB-020TR-8AREC-5KF-0KF-0MR	Food4Drylands	2R
16954	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA131	ICB14-0151-0TR-015AUB-020TR-4AREC-3KF-0KF-0MR	Food4Drylands	2R
17068	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/DWRUB-52	ICB14-0017-0TR-015AUB-020TR-2AREC-3KF-0KF-0MR	Food4Drylands	6R
16829	GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB14-0042-0TR-015AUB-020TR-5AREC-2KF-0KF-0MR	Food4Drylands	2R
17012	Ssn/Bda//Arar/3/F2CC33MS/CI07555/4/Avt/Attiki//M-Att-73-337-1/3/Aths/Lignee686/5/DWRUB-52	ICB14-0236-0TR-015AUB-020TR-4AREC-2KF-0KF-0MR	Food4Drylands	2R
17134	Fedora/Express//Rhn-03/3/Alanda01	ICB14-0098-0TR-015AUB-020TR-6AREC-3KF-0KF-0MR	Food4Drylands	6R
17125	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	ICB14-0073-0TR-015AUB-020TR-10AREC-4KF-0KF-0MR	Food4Drylands	6R
17069	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/DWRUB-52	ICB14-0017-0TR-015AUB-020TR-6AREC-2KF-0KF-0MR	Food4Drylands	6R
17383	UC 1266 // L94/BCD-TTA/3/UC1280	UCD014-121-0CD-0CD-0MR-0MR-1MR	Food&Fodder	6R
17391	UC1231L //L94/BCD-TTA/3/UC1263	UCD014-188-0CD-0CD-0MR-0MR-2MR	Food&Fodder	6R
17402	UC1263 X L94/BCD-TTA//UC1231L	UCD014-210-0CD-0CD-0MR-0MR-7MR	Food&Fodder	2R

17363	UC 1266 //L94/BCD-TTA/3/UC1280	UCD014-070-0CD-0CD-0MR-7MR	Food&Fodder	2R
58393	UC 1047 / 11HB44	UCD013-012-0CD-0CD-0CD-0MR-2MR	Food&Fodder	6R
17376	UC 1266 // L94/BCD-TTA/3/UC1268	UCD014-107-0CD-0CD-0MR-0MR-1MR	Food&Fodder	6R
17406	ISHI X L94/BCD-TTA//UC1263	UCD014-225-0CD-0CD-0MR-0MR-8MR	Food&Fodder	6R
17379	UC 1266 // L94/BCD-TTA/3/UC1268	UCD014-107-0CD-0CD-0MR-0MR-7MR	Food&Fodder	6R
58261	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/BKFMaguelone1604/3/Apro//Sv.02109/Mari/4/Giza 119/5/Shyri	ICB06-1180-4AP-0AP-0TR-3AREC-0TR	Food&Fodder	2R
17389	UC 1266 // L94/BCD-TTA/3/UC1289	UCD014-187-0CD-0CD-0MR-0MR-5MR	Food&Fodder	6R
17369	UC 1266 // L94/BCD-TTA/3/UC1264	UCD014-081-0CD-0CD-0MR-0MR-6MR	Food&Fodder	2R
	Rihane-03	Check		
17385	ISHI X L94/BCD-TTA//UC1263	UCD014-183-0CD-0CD-0MR-0MR-4MR	Food&Fodder	6R
58249	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/Schooner/Babunj//Noor68/Kataf	ICB06-1181-31AP-0AP-0TR-2AREC-0TR	Food&Fodder	2R
17368	UC 1266 // L94/BCD-TTA/3/UC1264	UCD014-081-0CD-0CD-0MR-0MR-4MR	Food&Fodder	2R
58391	Atahualpa/DD-21//DD-21/WI3257	ICB10-0621-0AP-020TR-1AREC-0TR	Food&Fodder	2R
17394	ISHI X L94/BCD-TTA//UC1280	UCD014-200-0CD-0CD-0MR-0MR-3MR	Food&Fodder	6R
	V-Morales	Check		
	Local Check	Check		