Iraq-ICARDA-Australia Project (ACIAR CIM/2004/024):

Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq

First Technical Report
April 2005 - October 2006

Technical results from information presented at the project reporting and planning meeting 1-5 October 2006

at

International Center for Agricultural Research in the Dry Areas

ICARDA

Aleppo, Syria

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1. Introduction

Ninevah Governorate in Iraq is considered a rainfed area; most of the agriculture depends totally on rainfall. According to the amount of rainfall received it is classified into high (HRA) medium (MRA) and low (LRA) rainfall areas. In order to develop agriculture in the Governorate, an extension and research project is being undertaken in collaboration with the Ministry of Agriculture and the Ninevah Directorate of Agriculture (MOA and DOA), the University of Mosul (UM), the International Center for Agricultural Research in the Dry Area (ICARDA) as well as several Australian institutions (University of Adelaide, University of Western Australia/Centre for Legumes in Mediterranean Agriculture, Department of Agriculture of Western Australia). Collaborating institutions and scientists are listed in Section 6.

The aim of the project is to improve cereal and legume production in the rainfed areas in Ninevah Governorate in Iraq, through the introduction of improved varieties for each rainfall area along with improved crop management technologies, to increase productivity, profitability and resource conservation of local cropping systems. The final goal is to encourage farmers to adopt these technologies in order to improve livelihoods. The project has a demonstration component to evaluate and promote best-bet varieties and technologies, and a research component to evaluate the adaptation of new varieties/lines as well as the suitability of new conservation cropping technologies. The demonstration program is conducted by DOA and the research program by MOA Ninevah and UM.

1.1. Summary of project achievements 2005-06

This report presents technical results from demonstrations and research conducted during the first cropping season (2005-06) under the Iraq-ICARDA-Australia Project (ACIAR CIM/2004/024). The project is evaluating better crop germplasm and management for improved production of wheat, barley, pulse and forage legumes to improve cereal and legume production in the rainfed areas of Ninevah Governorate in Iraq. Similar reports are planned for subsequent cropping seasons over the 2005-08 duration of the project to document project findings and provide a technical base to support the final project goal of encouraging farmers to adopt well-adapted technologies in order to improve livelihoods.

The project is being implemented collaboratively through the Ministry of Agriculture and the Ninevah Directorate of Agriculture (MOA and DOA), the University of Mosul (UM), the International Center for Agricultural Research in the Dry Area (ICARDA) and three Australian institutions (University of Adelaide, University of Western Australia/Centre for Legumes in Mediterranean Agriculture, Department of Agriculture of Western Australia).

The project workplan for 2005-06 was developed at three meetings at ICARDA in June, July and September 2005 with ICARDA, Iraqi and Australian scientists. Project implementation was overseen by the Ninevah Implementation Committee, set up by MOA to manage the project, which met 18 times to discuss and coordinate Iraqi activity.

The demonstration program was implemented in 12 locations in the four main agroclimatic zones as planned. This compared farmer and improved crop management with 2-3 local and improved varieties. Often, improved varieties and management increased crop yields. However, rainfall and varietal performance varied widely between sites and, obviously, much more testing needs to be undertaken to determine the better-adapted varieties and technologies. To take an example from bread wheat, the most important grain crop in northern Iraq, the variety Cham 6 gave the highest grain yield in several

locations but was the shortest compared with other varieties, indicating a desirable high harvest index. The highest bread wheat grain yields were from Abo Ghraib 3 in Rabia (279mm rainfall), Cham 6 in Al Shikhan (805mm) and Cham 4 in Al Koush (512mm), perhaps indicating that Abo Ghraib 3 was the most drought tolerant variety. Farmer field days were held at all locations and farmers were interested in results and in obtaining some seed of better-performing lines.

In the ambitious Iraqi research program, 30 of the 80 planned research trials evaluating better adapted lines/varieties and management technologies were conducted. Operations were impossible due to land disputes and insecurity on several research station sites. Nevertheless, on the Mosul station, many new lines of the tested cereal and legume crops yielded better than local check varieties and are of interest for inclusion in next year's demonstrations.

In linked research at ICARDA on new technologies, trials were undertaken evaluating zero-tillage of chickpea and wheat, and the performance of a range of Australian varieties/lines of oats, peas, canola and other oilseeds, with potential for adaptation and use in Iraq. Zero-tillage and some varieties of these new crops showed great promise. The trials were shown to and discussed with several groups of visiting Iraqi scientists and seed collected for 2006/07 testing.

As could be expected, there were many problems implementing the project given the political and security situation in Iraq. Demonstration and research activities were constrained by heavy rain at planting, security concerns, land disputes, lack of machinery, and funding and transport shortages. It was also a disadvantage that in-country field visits by ICARDA and Australian collaborators to inspect and interact on trials/demonstrations were not possible

Nevertheless, considering constraints, the project has gone very well since commencement on 1 May 2005 due to: the enthusiasm, industry, flexibility and dedication of Iraqi collaborators; the strong interest and support of ICARDA and Australian collaborators; and the proximity of ICARDA. This is evidenced by the detailed reports that follow on the wide range of activities undertaken by the project and initial indications of some promising better-adapted varieties and more productive and sustainable conservation cropping technologies for the rainfed cropping farmers of Iraq.

2. General demonstration management

In the demonstration program, a series of preliminary meetings were held to discuss the program and assign eleven DOA agricultural sections to implement field demonstrations. Working teams were formed including all specialties to manage the field demonstrations from sowing to harvest. The evaluation involved comparisons of different varieties of durum wheat, bread wheat, barley, pulses (fababean, chick pea, lentil) and forage legumes under traditional farmer (control) management, and improved (demonstration) management. An area of one hectare (= 4 Iraqi donum) was allocated for each variety/management comparison. The amount of fertilizer added was determined according to soil analysis. Plowing for improved management was carried out using a chisel plough followed by disc plough and for farmer management by disc plough only. Sowing was carried out using modern sowing and fertilizing equipment. Rainfall at demonstration sites is presented in Table 2.1 below.

The crops and forages evaluated at various rainfall areas/locations are listed below. The location of demonstration sites is indicated in Appendix 1 and the crop management for each site is detailed in Appendix 3.

- LRA locations: annual rainfall lower than 200 mm
  - Hatra
    - barley (Zanbaka , Tadmor , Aswad local black)
    - forage legumes (*V. sativa* IPA2001 and 713) + barley
  - Tell Abta
    - barley (Zanbaka , Tadmor , Aswad local black)
    - forage legume (*V. sativa* IPA2001/ *V. dasycarpa* cv.Couhak) + barley
  - Mahalabia
    - forage legumes (*V. sativa* IPA2001, *V. narbonensis* cv.Velox) + barley

- MRA locations: annual rainfall 200-400mm
  - Telkief , Hamdanya , Bashiqa
    - durum wheat (Sham 5, Karonia , Om Rabia 5)
    - bread wheat (Cham 6, Adnanya , Tell Affer 3, Abo Ghraib 3, IPA 99)
    - barley (Rihane 3 , Furat 1, Gezira 1, Aswad local)
    - chickpea (Ghab 1/2/3/4, Dijla)
    - lentil (IPA98, Idleb 3, Baraka)
    - forage legumes (V. sativa IPA2001/ V. dasycarpa cv.Couhak, V. narbonensis cv.Velox, Lathyrus sativus 587/Alibar)

- HRA locations: annual rainfall over 400mm
  - Rabiaa, Al Kosh, Al Shikhan
    - durum wheat (Waha, Cham 3, Karonia)
    - bread wheat (Abo Ghraib 3, Cham 6 , Cham 4)
    - faba bean (faba bean ILB, Akwadlje)
    - chick pea (IPA510, Dijla, Ghab)

- Supplementary Irrigation (SI) locations
  - Rabiaa, Homedat, Namroud
    - durum wheat (Cham 1 , Cham 3, Om Rabia 5, Karonia)
    - wheat (Cham 4, Cham 6, Abo Ghraib 3, Adnanya , Tell Affer 3)

2.1. Rainfall in Ninevah 2005/06 season

Table 2.1 Growing season rainfall at demonstration and research sites 2005/06*

Locations	Months								
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Tel–Abta	-	8	7	85	100	10	62	-	272.0
Mahalabia	-	30	21	165	114	16	88	-	434.0
Hatra	-	15.5	11	64	84	4	59	-	237.5
Hamdanyia	-	5	28	142	184	27	162	-	548.0
Bashiqa	-	20	34	103	108	10	74	-	349.0
Telkeif	-	24.5	43	142	142	21.5	89.5	-	462.5
Namroud	-	25	17.5	102	112.5	10	114	9	390.0
Rabiaa	-	14	25	91.5	82.5	12	52	-	277.0
Homedat	-	18	27	124	119	23	80	-	391.0

Zammar	-	18	27	111	101	17	67	-	341.0
Mosul Centre	-	6	37	145	126	23	101	-	438.0
Al Shekhan	-	27	104	253	225	22	221	-	852
Al Kosh	-	23	57.5	143.5	134	28.5	119	-	505.5

(*Source: Ninevah Agricultural Directorate)

3. Demonstration reports

Summary of demonstration results

The highest grain yields in the test locations were obtained from the following varieties:

- LRA
  - Barley - Zanbaka
- MRA
  - Barley - Rihane 3
  - Bread wheat - Cham 6
  - Durum wheat - Karonia
- HRA
  - Bread wheat - Cham 6 in Al Shikhan, Cham 4 in Al Koush, Abo Ghraib 3 in Rabia
  - Durum wheat - Karonia
- SI
  - Bread wheat - Tel Affer 3 , Cham 6
  - Durum wheat - Om Rabia 5 , Cham 3

Interesting findings:

- there was good agreement between grain yield/m^2 from quadrants and total grain yield from machine harvesting for all varieties/locations
- there was good correlation between grain yield and yield components as indicated by the following equation: Grain yield/m^2 = number of spikes/m^2 x number of grains/spike x 1000 seed weight/1000
- the bread wheat variety Cham 6 gave the highest grain yield in several locations but was the shortest compared with other varieties. This indicates a high harvest index
- the highest bread wheat grain yields were from Abo Ghraib 3 in Rabia, Cham 6 in Al Shikhan and Cham 4 in Al Koush. The annual rainfall was 279mm in Rabia, 512mm in Al Koush and 805mm in Al Shikhan, indicating that Abo Ghraib 3 was the most drought tolerant variety.

3.1 Cereals

The principal scientist involved in this research was Dr Abdul Sattar Rajbu, DOA, Mosul, Ninevah, Iraq.

3.1.1 Materials and methods

The tables in Appendix 3 show details of the varieties used in the demonstrations (improved management) and in the control (farmer management) treatments according to locations and planted area, including details of all activities such as plowing, amount of seed sown, date of sowing, fertilizer application, weed control, etc. The farmer was supplied with the same varieties used in the demonstrations treatments.

The following crop measurements were collected from four random $1m^2$ replicates (unless otherwise specified) and averaged for each demonstration plot:

1. plant height (cm) of 10 plants (Ht cm)
2. spike length (cm) of 10 spikes (Spk cm)
3. straw biomass (g/m^2) (Straw g/m^2
4. number of spikes/m^2 (Spk no/m^2)
5. number of seeds/spike of 10 spikes (Seeds no./spk)
6. weight of 1000 grains (g) (Seeds g/1000)
7. specific weight (kg/hectoliter) (Spec Wt kg/hl)
8. weight of grains (g/m^2) (Grain wt g/m^2)
9. grain yield (kg/hectare) from machine harvesting of the total area (Grain yield kg/ha)

3.1.2 Results

3.1.2.1 Barley

3.1.2.1a Barley in low rainfall areas (LRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Seeds g/1000	Spec Wt kg/hl	Grain Wt g/m^2	Grain Yield kg/ha
Hatra	Demo	Aswad*	35.1	4.9	100.0	251	12.4	35.6	63.8	127.5	930
		Tadmor	31.9	4.3	69.0	236	13.4	43.4	62.7	87.1	790
		Zanbaka	40.9	5.4	119.2	375	14.5	34.7	67.9	144.2	980
		Mean	35.9	4.8	96.0	287	13.4	37.9	64.8	119.5	900
	Control	Aswad	40.6	5.5	159.0	409	15.5	36.1	67.8	147.7	868
		Tadmor	32.5	4.6	113.0	465	13.6	43.2	69.1	158.1	960
		Zanbaka	43.9	4.6	138.4	319	11.8	32.7	64.3	148.1	740
		Mean	39.0	4.9	136.8	397	13.6	37.3	67.1	151.3	856
Tel Abta	Demos	Aswad	37.2	4.5	87.3	241	12.3	36.5	64.4	90.1	715
		Tadmor	35.6	4.3	94.8	235	13.1	42.1	69.8	120.6	741
		Zanbaka	43.2	4.7	103.3	331	12.9	34.3	66.9	126.6	1014
		Mean	38.6	4.5	95.2	269	12.8	37.6	67.0	112.4	823
	Control	Aswad	38.2	5.0	76.5	225	13.7	39.0	68.2	90.6	780
		Tadmor	35.6	4.1	61.9	220	12.6	45.0	71.9	89.9	663
		Zanbaka	42.7	4.9	67.0	264	12.4	37.2	66.7	98.2	806
		Mean	38.8	4.7	68.5	236	12.9	40.4	68.9	92.9	749

* Aswad is a local black barley variety

Results and discussion of barley in LRA:

Results are presented in Table 3.1.2.1a. Zanbaka had the highest plant height, spike length and straw biomass compared to other varieties in Al Hatra and Tel Abta under both demonstration and control treatments, while the local black barley variety had the highest spike length and straw biomass and Zanbaka the tallest plants for both locations.

Under demonstration conditions, Zanbaka had higher spike number/m^2 for both locations and Tadmor was the highest in weight/1000 grains. In the control, Tadmor had the highest number of spikes/m^2 and weight/1000 grains at Al-Hatra, while Zanbaka showed the highest number of spikes/m^2 and Tadmor

had the highest weight of 1000 grains in Tel Abta. Local black barley had the highest grain number/spike for both locations.

Zanbaka gave the highest values in specific weight, grain weight and yield in the demonstration treatment while Tadmor showed the highest value in all characters under the control at Hatra. In Tel Abta, Zanbaka had the highest grains/m^2 and grain yield and Tadmor the highest specific weight in demonstration and control treatments.

The means from demonstration treatments were higher than controls for straw biomass, spikes/m^2 and grains/m^2 in Tel Abta only and for grain yield in both locations.

3.1.2.1b Barley in medium rainfall areas (MRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Seeds g/1000	Spec Wt kg/hl	Grain wt gm/m^2	Grain yield kg/ha
Tel Kief	Demos	Furat1	66.0	4.7	219.4	288	37.3	34.2	52.4	117.2	1960
		Gezira1	53.9	4.9	158.2	322	33.8	27.7	58.1	185.4	2160
		Rihane3	63.7	4.7	179.6	286	39.6	38.2	57.5	258.5	2200
		Aswad	55.2	6.0	175.6	444	15.4	34.4	63.7	132.3	2120
		Mean	59.7	5.1	183.2	335	31.5	33.6	57.9	173.4	2110
	Control	Furat1	58.8	4.6	226.5	316	31.0	35.0	60.3	126.2	1920
		Gezira1	46.9	4.1	132.6	305	28.5	28.3	57.5	152.7	2080
		Rihane3	58.6	3.7	182.4	261	32.2	49.0	60.8	213.0	2140
		Aswad	54.6	6.1	141.8	361	16.5	36.2	68.4	207.1	2100
		Mean	54.7	4.6	170.8	311	27.1	37.1	61.7	174.8	2060
Hammdanya	Demos	Furat1	52.6	5.3	278.2	423	42.5	36.8	48.0	325.9	1120
		Gezira1	44.3	3.7	223.8	513	25.0	31.7	58.7	223.3	1016
		Rihane3	53.5	3.7	427.3	673	26.9	37.3	57.4	335.8	1400
		Aswad	43.1	4.9	264.9	711	12.0	35.1	64.1	215.7	1040
		Mean	48.3	4.4	298.6	580	26.6	35.2	57.0	275.2	1144
	Control	Furat1	57.4	4.5	394.8	477	31.6	37.4	50.8	229.4	976
		Gezira1	39.2	3.9	160.6	310	27.1	30.1	58.5	113.1	976
		Rihane3	61.3	4.2	424.5	477	34.9	41.9	53.8	460.5	1274
		Aswad	43.7	4.9	238.5	615	12.6	39.7	61.	189.8	960
		Mean	50.4	4.4	304.6	470	26.6	37.2	56.0	248.2	1047
Baashiqa	Demos	Furat1	51.5	3.6	416.0	384	25.9	39.9	55.3	189.1	1620
		Gezira1	50.0	4.3	243.5	407	23.7	30.3	59.3	168.6	1610
		Rihane3	38.7	2.5	128.3	536	20.3	39.3	65.1	433.3	1660
		Aswad	49.4	5.3	142.7	485	14.8	38.6	68.5	133.4	1200
		Mean	47.4	3.9	232.6	453	21.2	37.0	62.0	231.1	1523
	Control	Furat1	-	-	-	-	-	-	-	-	1230
		Gezira1	-	-	-	-	-	-	-	-	1300
		Rihane3	53.3	4.0	149.5	310	35.4	41.8	55.6	243.8	1320
		Aswad	46.6	4.4	183.1	567	12.6	37.4	67.5	187.1	1020
		Mean	49.9	4.2	166.3	438	24.0	39.6	61.5	215.4	1218

Results and discussion of barley in MRA

Results are presented in Table 5.1.2.1b. In Tel Kief, Furat-1 had the highest plants and straw biomass under both demonstration and control, while local black barley Aswad had longer spike length. Local black barley was higher in spikes number/m^2 for both demonstration and control while the variety Rihane-3 was highest for seeds/spike and seed weight.

In Hamdanya, Rihane-3 had the tallest plants and the highest straw biomass under both demonstration and control. Local black barley was highest in spikes/m^2 and Rihane-3 in weight/1000 seeds for both field demonstration and control, while the Furat-1 was highest in grains/spike under demonstration and Rihane-3 in control.

In Baashiqa, Furat-1 gave taller plants and higher straw biomass under demonstration, while the local black barley gave longer spikes. Rihane-3 had the highest spike number/m^2 and Furat-1 was highest in both seed number/spike and weight/1000 seeds under demonstration.

In the three locations, local black barley was highest in specific weight in both field demonstration and control treatments, while Rihane-3 gave the highest grain weight/m^2 and total grain yield.

Means under demonstration were higher than the control for height, spike length and straw biomass in Telkief, while in Hamdanya , the means for both demonstration and control were generally similar. The demonstration mean was higher than control for spike number/m^2 and grain yield in all locations and the two means were similar for seeds/spike and grain weight. In Hammdanya, the demonstration mean was higher for grains weight/m^2 compared with the control.

3.1.2.2 Bread wheat

3.1.2.2a Bread wheat in high rainfall areas (HRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grain g/1000	Spec Wt kg/hl	Grain wt gm/m^2	Grain yield kg/ha
Al-Qush	Demo	Cham–6	58.9	5.9	189.2	346.3	29.4	19.6	-	142.3	850
		Cham–4	55.9	6.1	297.5	385.3	29.5	19.2	70.5	197.1	900
		AboGhraib3	62.4	7.4	236.6	306.5	28.7	18.7	76.2	141.6	900
		Mean	59.1	6.5	241.1	346.0	29.2	19.2	73.4	160.3	883
	Control	Cham–6	31.4	6.1	139.5	245.8	31.7	20.8	-	64.0	800
		Cham–4	36.4	5.2	114.1	344.8	21.9	20.6	-	121.3	900
		AboGhraib3	38.5	6.5	98.5	268.0	30.7	15.7	73.0	96.8	800
		Mean	35.4	5.9	117.3	286.2	28.1	19.0	73.0	94.0	833
Rabeea	Demos	Cham–6	54.7	6.9	180.6	269.5	31.2	23.6	78.5	146.9	1280
		Cham–4	52.1	6.1	180.4	276.0	26.9	23.0	78.0	129.3	1152
		AboGhraib3	64.4	7.3	172.3	328.5	30.7	22.7	79.8	156.8	1300
		Mean	57.0	6.8	177.7	291.3	29.6	23.1	78.8	144.3	1244
	Control	Cham–6	51.6	6.6	173.0	243.5	30.3	26.5	-	114.7	1026
		Cham–4	47.2	6.5	168.7	202.3	27.9	22.9	75.8	109.3	880
		AboGhraib3	62.3	7.6	193.8	279.8	36.4	25.0	-	151.8	1044
		Mean	53.7	6.9	178.5	241.8	31.5	24.8	75.8	125.3	983
Shikan	Demos	Cham–6	45.6	5.8	123.7	248.0	28.2	21.9	80.1	130.2	880

		Cham–4	48.6	6.7	135.2	233.0	31.4	19.3	75.5	98.4	600
		AboGhraib3	57.3	7.3	135.9	222.5	33.7	22.5	75.5	122.9	768
		Mean	50.5	6.6	131.6	234.5	31.1	21.2	77.0	117.2	749
	Control	Cham–6	45.8	5.6	108.6	253.3	27.3	21.3	77.6	122.4	960
		Cham–4	46.6	6.5	128.0	234.5	27.5	18.7	72.6	98.5	580
		AboGhraib3	57.4	7.8	117.5	203.8	33.2	22.1	-	106.6	780
		Mean	49.9	6.6	118.0	230.5	29.3	20.7	75.1	109.1	773

Results and discussion of bread wheat in HRA:

Results are presented in Table 3.1.2.2a. Abo Gharib3 was highest in plant height and spike length in all locations and treatments. The highest straw biomass under demonstrations and control respectively were Cham 4 and Cham 6 in Al Qush, Cham 6 and Abo Ghraib 3 in Rabeea, and Abo Ghraib and Cham 4 in Shikan,. The mean of demonstrations for all characters in Al Qush location and in straw biomass in Shikan was higher than control.

Spikes/m^2 was highest in both demonstration and control treatments for Cham 4 in Al Qush, Abo Ghriab 3 in Rabeea and Cham 6 in Shikan. For grains/spike, Cham 6 was highest in demonstrations and control in Al Qush and in demonstrations in Rabeea, while Abo Ghraib 3 was higher in other locations and treatments . Seed weight was highest for Cham 6 in Al Koush and Rabeea and for Abo Ghraib 3 in Al Shikan.

Specific weight showed little pattern between varieties but grain weight/m^2 and grain yield were higher for Cham 4 in Al Qush, Abo Ghraib 3 in Rabieea and Cham 6 in Al Shikan.

Means across all varieties were higher for demonstration than control treatments for height, spikes/m^2, grain weight/m^2 in all locations and for grain yield in all locations except Al Qush.

3.1.2.2b Bread wheat in medium rainfall areas (MRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec Wt kg/hl	Grain Wt g/m^2	Grain yield kg/ha
Tel Kief	Demo	Tel Affer3	65.7	7.	150.6	377.5	28.4	33.8	82.9	184.8	2060
		Cham-6	46.7	7.90	143.5	223.3	27.6	24.8	79.6	132.1	1820
		IPA-99	49.3	8.0	120.6	192.3	42.5	22.7	78.6	132.3	1550
		AboGraib3	51.6	8.2	117.3	258.8	38.3	26.1	79.5	183.4	2030
		Adnanya	61.1	9.8	126.3	234.8	36.5	28.4	76.5	148.8	1840
		Mean	54.9	8.2	131.7	257.3	34.7	27.1	79.4	156.3	1860
	Control	Tel Affer3	47.8	7.3	163.8	401.5	25.0	32.1	82.4	179.1	2020
		Cham-6	47.0	5.8	140.8	231.3	27.1	22.9	78.8	134.5	1750
		IPA-99	51.2	8.9	103.1	187.3	41.2	19.9	78.4	110.8	1620
		AboGraib3	52.9	8.3	102.1	232.0	38.5	25.8	85.0	173.2	1980
		Adnanya	60.2	8.4	111.6	218.0	30.2	30.1	79.2	121.4	1720
		Mean	51.8	7.7	124.3	254.0	32.4	26.1	80.8	143.8	1818
Hamdania	Demos	Tel Affer3	64.8	6.0	251.3	592.3	19.1	32.1	74.5	237.2	976
		Cham-6	48.8	6.3	197.3	632.3	26.7	29.4	76.5	243.5	1400
		IPA-99	56.9	8.7	278.2	446.8	40.6	25.4	70.9	208.1	596
		AboGraib3	57.0	7.1	224.8	433.8	31.9	25.2	72.8	182.7	556

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec Wt kg/hl	Grain Wt g/m^2	Grain yield kg/ha
		Adnanya	57.7	7.4	237.1	521.0	23.1	31.7	76.8	226.4	664
		Mean	57.0	7.1	237.7	525.2	28.3	28.7	74.3	219.6	838
	Control	Tel Affer3	62.4	6.0	328.5	697.0	16.7	32.0	71.9	207.9	810
		Cham-6	48.1	6.2	230.6	774.8	25.4	29.0	77.1	239.6	1240
		IPA-99	53.8	6.9	259.9	510.3	32.4	26.6	67.9	175.6	548
		AboGraib3	54.5	7.0	181.0	472.3	28.4	25.7	72.5	139.4	476
		Adnanya	57.0	5.5	229.8	557.8	13.9	26.9	72.7	206.8	592
		Mean	55.1	6.3	246.0	602.4	23.3	28.0	72.4	193.9	733
Baashiqa	Demos	Tel Affer3	47.6	4.2	177.1	767.8	8.1	32.6	79.0	100.3	1270
		Cham-6	35.5	5.2	118.2	777.5	14.6	28.4	81.6	110.2	1320
		IPA-99	42.0	4.4	154.9	265.3	15.0	21.7	81.6	79.7	1210
		AboGraib3	43.6	4.3	141.0	572.3	10.1	26.9	78.0	96.8	1250
		Adnanya	48.4	7.2	109.1	477.5	16.9	31.2	83.5	94.5	1220
		Mean	43.4	5.1	140.1	572.1	12.9	28.2	80.7	96.3	1254
	Control	Tel Affer3	50.7	5.0	128.5	366.0	12.9	36.3	-	76.9	1000
		Cham-6	33.7	3.6	97.3	499.0	13.2	25.9	-	106.2	1090
		IPA-99	39.3	5.3	100.6	408.3	20.83	23.1	85.6	83.2	1025
		AboGhraib3	40.8	4.7	99.8	448.0	18.2	27.4	83.2	97.9	1050
		Adnanya	38.9	3.7	72.6	366.8	9.5	32.2	-	77.3	1020
		Mean	40.7	4.4	99.8	417.6	14.9	29.0	84.4	88.3	1037

Result and discussion of bread wheat in MRA:
Results are presented in Table 3.1.2.2b. At Tel Kief, Tel Affer-3 had the highest straw biomass, spikes/m^2, grain weight/m^2 and grain yield for both treatments, and Tel Affer-3 was taller in demonstrations and Adnanya in control. Adnanya had longer spikes in demonstrations and IPA/99 under the control.

In Hamdanya, Tel Affer-3 had the tallest plants and Cham 6 had the highest number of spikes/m^2, grain weight/m^2 and grain yield in both treatments, and spike length was highest for IPA/ 99 in the demonstration and Abu Ghraib-3 in the control treatments. The variety IPA/99 in demonstration and Tel Affer-3 in control had the highest straw biomass.

In Baashiqa, Tel Affer-3 had taller plants and the highest straw biomass, and Cham 6 the highest spikes/m^2, grain weight/m^2 and grain yield, for both treatments and Adnanya had longer spikes under the demonstration and variety IPA/99 in control treatments.

In all locations and treatments, IPA 99 was highest in the number of grains per spike and Telaffer-3 for its 1000 seeds weight.

The demonstration means were higher compared with the control for plant height, spike length, straw biomass, grain weight/m^2 and grain yield in all locations, except for straw biomass in Hamdanya.

3.1.2.2c Bread wheat in supplementary irrigation areas (SI)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk No/m^2	Seeds no/spk	Grains g/1000	Spec wt kg/hl	Grain wt g/m^2	Grain yield kg/ha
Rabeea	Demo	Tel Affer3	90.2	7.7	541.5	344.8	27.1	30.0	82.5	229.5	1498
		Cham-6	58.9	7.8	330.1	439.0	39.6	21.2	78.7	300.4	1771
		Cham-4	61.7	7.6	392.7	303.3	38.5	21.4	77.5	224.9	1094
		AboGraib3	71.2	8.9	524.3	383.8	36.7	21.9	82.8	258.1	1504
		Adnanya	83.0	9.6	434.2	446.6	35.4	27.3	77.6	335.2	1889
		Mean	73.0	8.3	444.6	3833	35.5	24.3	79.8	269.6	1551
	Control	Tel Affer3	77.6	8.6	433.9	284.3	33.8	34.0	81.1	248.6	1000
		Cham-6	63.7	7.6	358.4	421.8	41.6	19.7	78.0	270.8	1600
		Cham-4	58.5	7.8	227.0	333.3	37.8	21.4	73.2	192.6	700
		AboGraib3	70.7	8.3	384.2	368.5	39.0	23.2	82.3	272.4	1000
		Adnanya	84.1	9.7	394.1	274.0	35.3	29.7	80.6	265.2	1000
		Mean	70.9	8.4	359.5	336.4	37.5	25.6	79.0	249.9	1060
Hummaidat	Demos	Tel Affer3	65.0	7.6	159.1	371.8	30.1	29.2	80.7	194.0	1691
		Cham-6	50.2	5.2	147.6	390.3	21.8	27.3	79.9	204.4	1842
		Cham-4	54.6	6.3	186.5	347.5	27.5	29.4	80.4	163.8	1430
		AboGraib3	61.0	5.8	206.4	361.0	27.7	27.6	82.8	210.8	1744
		Adnanya	57.8	7.3	191.8	345.8	34.6	24.1	82.7	161.0	1638
		Mean	57.7	6.4	178.3	363.3	28.3	27.5	81.3	186.8	1669
	Control	Tel Affer3	58.1	7.7	83.1	275.5	29.1	29.4	77.0	126.2	1594
		Cham-6	47.2	4.6	107.8	242.0	20.3	29.1	77.0	112.4	1511
		Cham-4	50.3	6.5	91.5	202.8	31.6	27.3	72.0	102.0	1248
		AboGraib3	55.5	6.0	113.1	262.5	28.3	28.5	76.1	166.8	1594
		Adnanya	46.0	7.2	86.6	208.3	34.1	26.6	78.0	113.3	1413
		Mean	51.4	6.4	96.4	238.2	28.7	28.2	76.0	124.2	1472
Nimrud	Demos	Tel Affer3	86.0	8.8	302.1	412.3	31.7	31.6	82.8	313.2	2938
		Cham-6	57.1	6.2	197.2	386.5	29.7	29.4	82.2	247.0	1675
		Cham-4	54.4	6.6	215.7	354.0	27.9	41.3	85.4	256.0	1625
		AboGraib3	58.0	9.1	247.9	317.8	38.8	24.4	84.1	205.3	1500
		Adnanya	71.8	8.5	217.2	397.8	33.7	33.4	82.1	276.1	1750
		Mean	65.5	7.8	236.0	373.7	32.3	32.0	83.3	259.5	1898
	Control	Tel Affer3	90.5	9.5	343.2	378.5	32.0	33.5	84.8	332.2	2915
		Cham-6	52.6	6.1	172.	348.0	27.6	24.0	82.6	193.9	1650
		Cham-4	49.0	6.3	197.70	466.3	28.4	24.6	83.4	235.1	1650
		AboGraib3	60.0	9.0	230.1	378.8	39.6	22.1	85.6	254.9	1500
		Adnanya	74.2	8.2	299.5	410.8	31.9	29.5	82.7	291.6	2500
		Mean	65.2	7.8	248.6	396.5	31.9	26.8	83.8	261.5	2043

Results and discussion of bread wheat under SI

Results are presented in Table 3.1.2.2c. Tel Affer-3 had taller plants in all treatments and locations except the control in Rabeea where Adnanya was tallest. Spike length was longest for Adnanya in both demonstrations and control in Rabeea, for Tel Affer-3 in both in Hummaidat and control in Nimrud, and for Abo Ghraib 3 in the demonstration in Nimrud. Straw biomass in both treatments was highest for TelAffer-3 in both Rabeaa and Nimrud and Abo Ghreb 3 in Hummaidat.

The number of spikes/m^2 was highest for Adnanya under demonstration and Cham 6 under control at Rabeea; for Cham 6 under demonstration and TelAffer-3 under control treatments at Hummaidat; and TelAffer-3 under demonstration and Cham/4 under control at Nimrud.

Grains/spike was highest for Cham 6 under both treatments in Rabeea, for Adnanya at Hummaidat, and for Abo Ghraib 3 at Nimrud. Grain weight was highest for TelAffer-3 in all locations and treatments except the demonstration at Nimrud, where Cham 4 had most grains/spike.

Specific weight was highest for Abo Ghraib-3 in most demonstrations and control treatments across locations. Grain weight/m^2 was highest for Abo Ghraib-3 under both treatments in Hummaidat and under control in Rabeea; for TelAffer-3 under both in Nimrud; and for Adnanya under demonstrations in Rabeea. The highest grain yield was from Adnanya under demonstrations and Cham/6 under control in Rabeea; from Cham 6 in demonstrations and Tel Affer and Abo Ghraib 3 under control in Hummaidat; and from Tell Affer 3 in Nimrud.

The means for straw biomass, spikes/m^2, grain weight/m^2 and grain yield were higher under demonstration than control treatments in both Rabeea and Hummaidat, whilst the reverse occurred in Nimrud.

3.1.2.3 Durum wheat

3.1.2.3a Durum wheat in high rainfall areas (HRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spikes no/m^2	Seeds no/spk	Grains g/1000	Spec wt kg/hl	Grain wt gm/m^2	Grain yield kg/ha
Al-Qush	Demo	Waha	61.1	6.1	254.8	246.3	43.6	28.1	81.7	167.6	800
		Cham-3	61.5	5.6	270.8	271.0	37.7	21.9	70.9	222.2	1000
		Karonia	90.3	4.7	451.7	302.0	31.0	31.1	78.3	230.8	1100
		Mean	70.9	5.5	325.8	273.1	37.4	27.0	76.9	206.9	967
	Control	Waha	42.2	5.6	142.0	178.5	37.7	21.8	74.8	129.5	800
		Cham-3	46.7	5.0	167.6	221.9	35.5	17.9	71.0	130.1	900
		Karonia	59.0	4.6	121.7	390.3	33.4	32.8	80.0	133.8	1000
		Mean	49.3	5.1	143.8	263.6	35.5	24.2	75.3	131.1	900
Rabeea	Demos	Waha	54.4	5.4	151.7	158.0	33.4	30.9	78.1	138.9	1368
		Cham-3	62.9	4.4	171.9	210.3	34.0	30.3	79.9	168.1	1494
		Karonia	82.2	4.6	214.3	304.3	31.2	37.7	79.4	138.1	1494
		Mean	66.5	4.8	179.3	224.2	32.9	33.0	79.1	148.3	1452
	Control	Waha	53.4	5.2	144.1	219.0	30.5	29.3	83.4	131.5	1044
		Cham-3	55.3	4.5	144.2	239.0	31.4	30.4	78.8	166.4	1062
		Karonia	74.2	4.1	234.9	203.8	25.6	33.2	79.2	130.7	774
		Mean	61.0	4.6	174.4	220.6	29.2	31.0	80.5	142.9	960
Shikan	Demos	Waha	47.4	6.0	96.2	144.5	39.6	31.5	80.7	110.1	480
		Cham-3	51.6	5.2	136.1	176.3	36.7	31.1	71.9	114.1	940
		Karonia	72.7	5.4	200.9	174.3	36.9	37.1	81.6	136.6	980
		Mean	57.2	5.5	144.4	165.0	37.7	33.2	78.1	120.3	800
	Control	Waha	47.7	5.9	89.5	138.8	34.0	30.1	-	90.0	440

		Cham-3	54.2	5.3	108.8	123.5	40.4	31.5	77.2	124.3	720
		Karonia	79.4	4.6	176.4	138.1	34.7	36.0	82.8	115.9	800
		Mean	60.4	5.3	124.9	133.4	36.4	32.5	80.0	110.0	653

Result and discussion of durum wheat in HRA:
Results are presented in Table 3.1.2.3a. Karonia had the tallest plants and highest straw biomass for all treatments and locations except the control in Al Qush, where straw biomass was highest for Cham 3. Spike length of Waha was longest in all treatments and locations. Spikes/m^2 was highest for Karonia in both treatments at Al Qush and in the demonstration at Rabeea; Cham 3 was highest in the control in Rabeea and the demonstration in Shikan; and Waha was highest for the control in Shikan. Grains/spike in both treatments was highest for Waha in Al Qush and Cham 3 in Rabeea. Waha was highest in the demonstration and Cham 3 for control in Shikan. Weight of 1000 seeds was highest for Karonia in all locations and treatments. Specific weight generally was highest for Karonia.

Grain weight/m^2 was highest for Karonia in both treatments in Al Qush and under the demonstration in Shikan, whilst Cham 3 was highest in both treatments in Rabeea and the control in Shikan. Karonia gave the highest grain yield in all treatments and locations except the control in Rabeea, where Cham 3 was highest.

The mean of the three varieties was higher for demonstrations than control for plant height in both Al Qush and Rabeea, straw biomass in Al Qush and Shikan, and spikes/m2, seeds/spike, seed weight, grain yield and grain weight/m^2 in all locations.

3.1.2.3b Durum wheat in medium rainfall areas (MRA)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec wt kg/hl	Grain wt g/m^2	Grain yield kg/ha
Tel Kief	Demo	Sham 5	62.3	5.6	160.9	221.5	46.9	32.8	80.7	176.1	1850
		OmRabia5	57.3	5.4	133.0	223.5	38	34.8	82.7	176.0	2040
		Karonia	71.5	4.8	200.2	245.5	37.88	32.8	76.3	245.8	2060
		Mean	63.7	5.3	164.7	230.2	41.20	33.4	79.9	199.3	1983
	Control	Sham 5	59.2	5.6	137.2	212.3	39.3	33.4	83.6	175.1	1830
		OmRabia5	59.1	5.5	161.9	285.5	34.9	33.8	85.2	176.1	2000
		Karonia	65.7	4.6	167.0	244.3	27.0	32.8	82.4	153.7	1860
		Mean	61.3	5.2	155.4	247.3	33.7	33.3	83.7	168.3	1897
Hammdanya	Demos	Sham 5	54.2	5.2	342.7	259.5	31.6	34.7	74.7	189.3	664
		OmRabia5	48.6	4.8	181.3	575.3	22.1	36.0	78.8	357.6	1350
		Karonia	58.8	4.5	167.9	482.0	26.1	40.5	74.2	232.1	900
		Mean	53.8	4.8	230.6	438.9	26.6	37.1	75.9	259.7	971
	Control	Sham 5	56.2	6.0	259.4	410.3	27.3	31.2	75.2	267.0	576
		OmRabia5	50.0	4.6	391.3	457.3	22.6	32.1	72.5	265.8	856
		Karonia	57.0	4.7	231.2	630.3	27.3	37.6	68.3	276.8	1260
		Mean	54.4	5.1	294.0	499.3	25.7	33.6	72.0	269.9	897
Baashiqa	Demos	Sham 5	58.1	6.1	216.5	275.0	32.5	36.4	82.3	227.3	1720
		OmRabia5	75.1	4.2	339.5	430.0	24.8	42.1	83.8	309.2	1830
		Karonia	65.0	4.8	285.7	399.5	28.5	38.5	85.4	368.5	1950
		Mean	66.1	5.0	280.6	368.2	28.6	39.0	83.8	301.7	1833

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec wt kg/hl	Grain wt g/m^2	Grain yield kg/ha
	Control	Sham 5	48.6	4.4	199.5	303.5	24.7	37.6	83.6	189.8	1340
		OmRabia5	54.1	5.9	233.4	349.5	25.3	36.3	85.3	181.3	1520
		Karonia	60.5	3.7	242.1	394.3	20.8	37.2	86.6	248.1	1650
		Mean	54.4	4.6	225.0	349.1	23.6	37.0	85.2	206.4	1503

Results and discussion of durum wheat in MRA:
Results are presented in Table 3.1.2.3b. Karonia gave the tallest plants in all locations and treatments except Baashiqa, where Om rabia-5 variety was taller in the demonstration. Cham 5 had longer spikes in all locations and treatments except Baashiqa, where Om Rabia-5 was longer under the control. Straw biomass was highest for Karonia under both treatments in Tel Kief and under the control in Baashiqa, while Cham 5 was highest in the demonstration and Om Rabia-5 in the control in Hammdanya. In Baashiqa, Om Rabia-5 was highest under the demonstration.

Spikes/m^2 was highest for Karonia under the demonstration in Tel Keif and under the control in both Alhammdanya and Baashiqa , while Om Rabia-5 was highest under control in Tel Kief and under the demonstration in both Al Hammdania and Baashiqa. Seeds/spike was highest for Cham 5 in all locations and treatments. Seed weight was highest for Om Rabia-5 in both demonstration and control in Tel Kief; Karonia was highest under demonstration and control in Al Hammdanya; and Om Rabia-5 under the demonstration and both Cham 5 and Karonia under control in Baashiqa.

Specific weight was highest for Om Rabia-5 under both demonstration and control treatments in Tel Keif, and it was highest for Karonia in both field demonstration and control in Baashiqa; and highest for Om Rabia-5 in demonstrations and Cham 5 for the control in Al-Hammdanya. Grain weight/m^2 and grain yield were highest for Karonia under the demonstration and Om Rabia-5 in the control in Tel Kief; for Om Rabia-5 under demonstrations and Karonia under control in Al Hammdania; and for Karonia in both demonstrations and control in Baashiqa.

Looking at the means of three varieties, demonstrations were higher than controls for plant height, straw biomass, spike length and grain weight/m^2 in Tel Kief and Baashiqa; and seed number/spike, seed weight and grain yield in all locations.

3.1.2.3c Durum wheat in supplementary irrigation areas (SI)

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec Wt kg/hl	Grain Wt g/m^2	Grain Yield kg/ha
Rabeea	Demo	OmRabia5	78.3	5.7	455.9	303.2	32.5	34.4	84.2	304.9	1931
		Cham-3	68.3	5.6	363.1	350.5	33.5	25.5	78.0	210.6	1564
		Cham-1	65.0	6.9	323.5	300.2	40.2	25.3	73.0	183.2	1332
		Karonia	99.6	5.6	642.1	379.5	29.4	36.6	80.9	304.3	1809
		Mean	77.8	6.0	446.2	333.4	34.6	30.4	79.0	250.8	1659
	Control	OmRabia5	69.5	5.9	379.5	264.5	38.0	29.7	84.8	217.5	970
		Cham-3	67.0	5.8	337.8	275.5	44.7	34.4	83.2	328.8	1450
		Cham-1	64.4	6.8	265.2	249.0	42.9	28.1	81.8	272.8	1450
		Karonia	85.4	5.4	388.8	243.0	36.1	38.3	82.1	237.2	1088

Location	Treat	Cultivar	Ht cm	Spk cm	Straw g/m^2	Spk no/m^2	Seeds no/spk	Grains g/1000	Spec Wt kg/hl	Grain Wt g/m^2	Grain Yield kg/ha
		Mean	71.6	6.0	342.8	258.0	40.4	32.6	83.0	264.1	1239
Hummaidat	Demos	OmRabia5	46.2	4.2	148.8	383.5	25.6	29.4	76.3	192.5	1291
		Cham-3	61.3	5.9	163.0	283.0	20.7	31.6	77.6	169.4	1170
		Cham-1	75.2	5.0	199.8	197.5	28.7	36.0	77.0	144.9	783
		Karonia	56.4	4.9	164.1	249.0	30.2	33.7	77.3	163.5	1155
		Mean	59.7	5.0	168.9	278.3	26.3	32.7	77.1	167.6	1100
	Control	OmRabia5	43.9	4.4	70.0	207.2	30.7	32.3	72.0	116.7	918
		Cham-3	56.8	5.7	81.5	196.7	19.1	26.6	72.0	102.3	864
		Cham-1	70.2	4.4	119.4	104.5	24.9	35.6	71.0	86.5	499
		Karonia	54.6	4.8	120.4	132.2	27.2	33.4	75.0	93.4	831
		Mean	56.4	4.8	97.8	160.2	25.5	32.4	72.5	99.7	778
Nimrud	Demos	OmRabia5	77.5	5.9	302.5	313.7	33.3	26.4	83.7	276.3	2200
		Cham-3	65.1	5.	335.9	389.2	33.3	27.2	72.3	348.8	2968
		Cham-1	60.2	6.33	237.1	288.7	35.4	38.3	85.5	285.1	1800
		Karonia	88.6	5.5	308.9	295.5	31.1	27.2	69.2	173.0	1440
		Mean	72.8	5.7	296.1	321.8	33.3	29.8	77.7	270.8	2102
	Control	OmRabia5	77.1	5.9	298.4	302.5	35.4	32.6	86.0	281.6	2200
		Cham-3	70.8	5.2	343.6	455.0	36.1	26.9	73.2	362.8	2966
		Cham-1	59.8	6.0	217.2	297.5	33.1	45.8	83.8	254.0	1840
		Karonia	96.0	5.2	309.3	293.7	28.8	33.8	77.8	203.7	1736
		Mean	75.9	5.6	292.1	337.2	33.1	34.8	80.2	275.5	2185

Results and discussion of durum wheat in SI locations

Results are presented in Table 5.1.2.3c. Karonia was tallest in both Rabeea and Nimrud, while Cham 1 was tallest in Hummaidat. Spikes were longest for Cham 1 in both treatments in Rabeea and Nimrud, while Cham 3 was longest in Hummaidat. Straw biomass of both treatments was highest for Karonia in Rabeea and Cham 3 in Nimrud, whilst Cham 1 was highest in demonstrations and Karonia in the control in Hummaidat.

Spikes/m^2 was highest for Karonia in demonstrations and for Cham 3 in controls in Rabeea; Om Rabia-5 was highest in both treatments in Hummaidat; and Cham 3 was highest in both in Nimrud. Grains/spike was highest for Cham 1 the demonstration and Cham 3 in the control in Rabeea; Karonia in the demonstration and Om Rabia-5 in the control in Hummaidat; and Cham 1 in the demonstration and Cham 3 in the control in Nimrud. Seed weight was highest in both treatments for Karonia in Rabeea, and for Cham 1 in both Hummaidat and Nimrud.

Grain weight/m^2 and grain yield were highest for Om Rabia-5 in the demonstration and Cham 3 in the control in Rabeea; for Om Rabia-5 in both in Hummaidat; and for Cham 3 in both in Nimrud location.

For variety means, demonstrations were higher than controls for straw biomass in three locations; for spikes/m^2 in both Rabeea and Hummaidat; for grain weight/m^2 in Hummaidat; and for grain yield for both Rabeea and Hummaidat.

3.2. Forage and food legumes

Dr Kassim Khalil Kasim, MOA, Mosul, Ninevah, Iraq

3.2.1 Objectives of the legume trials

1. To increase the productivity of wheat and barley.
2. To introduce forage legumes such as vetch for increasing forage production
3. To evaluate new lines of chickpea and lentil

3.2.2. Introduction

The traditional farming system in the rainfed areas was cereal/ fallow rotation until 1990. Fallow means leaving half of the lands idle without cultivation for 16-18 months. Fallow land was exposed to soil erosion by rain in winter and wind in summer. In addition, there are economic losses caused by leaving half of the land without cultivation. The fallow system has changed since the 1990s to continuous cropping, i.e. continuous cultivation of wheat and barley on the same land by using chemical fertilizer as compensation for fallow.

Many problems have been raised by using this continuous cropping system, such as low productivity of wheat and barley, spread of disease, insects, and nematodes and problems of weeds and deficiency or shortage of forage.

In recent years, problems were observed in the continuous cropping system, and farmers in the area went back to a fallow system. Here, a new farming system should be established to increase wheat and barley productivity and availability of forage and control diseases, insects, nematodes and weeds.

The new system is accomplished by introducing forage legumes such as vetch (*Vicia sativa* L.) as a pure stand or mixed with barley for sheep grazing in the limited rainfall area (200-350 mm) or for hay making under moderate rainfall (350-450 mm) in rotation with wheat or barley. The new system will be forage legumes/wheat or barley. Forage legumes offer a useful bonus in terms of residual soil nitrogen which can benefit subsequent wheat or barley, in addition to utilization for sheep grazing or hay making for sheep feeding or contributing seed in sheep diets.

The studies reported below were to test the potential of various new forage legumes in association with barley for grazing sheep.

3.2.3 Materials and methods

A number of locations were chosen for the studies in the limited rainfall area (200-350mm) at Mahalabia, Hatra and Tel-Abta and in the moderate rainfall area (350-450 mm) at Bashiqa, Hamdanyia and Telkief.

3.2.3.1 Forage legumes

In the limited rainfall areas (LRA), two-rowed black barley was mixed with common vetch (Vicia sativa L.) cv. IPA 2001 or narbon vetch (Vicia narbonensis L.) cv.velox at Mahalabia. At Tel-Abta, barley was mixed with woollypod vetch (Vicia dasycarpa Ten.) cv.couhak or common vetch cv. IPA 2001. At Hatra, barley was mixed with common vetch cv. IPA 2001 or common vetch 713.

The area of each plot was 5 hectares. The seed rate for the mixtures was 80% vetch/25% barley (100kg/ha for vetch and 25 kg/ha for barley) and for barley/narbon vetch was 120 kg/ha for vetch and

20 kg/ha for barley. Urea fertilizer was added at the rate 20kg/ha during vegetative growth for each location.

Date of sowing was 30 Nov 2005 for Tel Abta and 21and 29 Dec 2006 for Hatra and Mahalabia, respectively. Local farmer machines and equipment were used for plowing and cultivation.

Under moderate rainfall areas (MRA), treatment areas were different at different locations. At Hamdanyia, two-row black local barley was mixed with common vetch cv.IPA2001 for seed propagation in an area of 1ha and woollypod vetch cv.couhak was cultivated as a pure stand for seed propagation in an area of 0.5ha. At Bashiqa, common vetch cv.IPA2001 was cultivated in 0.5ha and narbon vetch cv velox in an area of 0.5ha. At Telkief, common vetch cv.IPA2001 was cultivated in an area of 1ha and lathyrus (Lathyrus sativus L.) cv.587 and Ali-bar were cultivated in an area of 0.5ha each for seed propagation.

Fertilizer DAP (Diammonium phosphate, 18% N and 46% P_2O_5) was added at the rate of 60 kg/ha at sowing time and urea (45% N) was added at the rate of 20 kg/ha during the vegetative growth stage. The seeding rate was 120kg/ha for lathyrus and narbon vetch. The seed rate for the mixture of common vetch and barley was 100 and 20kg/ha respectively.

Date of sowing was 6 and 18 Jan 2006 at Bashiqa and Hamdanyia respectively and13 Feb 2006 for Telkief. Local farmer machines and equipment were used for plowing and cultivation.

Dry matter yield was estimated at flowering time in 10 quadrates (1x1m) for each treatment. Vegetative material was dried at 75 °C for 48 hrs then weighted. Plant height and number of branches or tillers/plant for barley, common vetch, woollypod vetch, narbon vetch and lathyrus were measured at maturity. The seed yield was determined by harvesting the whole plot using a farmer combine.

3.2.3.2 Food legumes

A number of locations were chosen for the testing of food legumes. Chickpea (Cicer arietinum L.) cvs Dijla, Ghab 1, 2, 3, 4 and IPA 510 were tested in moderate rainfall area (350 – 450 mm) at Telkeif , Bashiqa and Hamdanyia and in the high rainfall area (>450 mm) at Al-Kosh and Al-Shikhan. Lentil (Lens culinaris) cvs. IPA 98, Baraka , Idleb2 , Idleb3 and a local cultivar were tested under moderate rainfall areas Telkeif , Bashiqa and Hamdanyia. Faba bean cv. Aquadolce was tested under high rain fall at Al-Shikhan site. The area of each cultivar differed between locations and ranged from 0.25 to 4 ha depending on the availability of seed. Seed rates for chickpeas and lentils were 120kg/ha. Date of sowing was 6 and18 Jan and 13 Feb 2006 for Bashiqa, Hamdanyia and Telkeif, respectively. Fertilizer DAP was added at the rate of 60kg/ha at sowing time and 20kg/ha urea during vegetative growth for each treatment. A seeder was used for cultivation of chickpeas under the demonstration method, whereas local farm equipment (for cultivation and broadcasting) was used for the control. Seed and biological yields were estimated in 10 quadrats (1x1m) at maturity time for each cultivar/location.

3.2.4 Results and Discussion

3.2.4.1 Forage legumes

Data presented in Table 3.2.4.1a show some differences in dry matter yield of the barley/vetch IPA 2001 mixture between the three LRA locations, where Hatra was higher than Tel-Abta and Mahalabia by 77% and 5% respectively. These differences were due mainly to the distribution of the amount of monthly rainfall during the growing season (Table 3.1). Vetch IPA 2001 was superior to vetch 713 by

41% at Hatra. Height of plants and number of tillers or branches/plant showed differences between the three locations (Table 3.2.4.1b). For example, the height of barley plants ranged from 40–50 cm whereas the number of tillers/plant ranged from 4-5. Height of vetch plants ranged from 15-33cm and the number of branches/plant from 1-2. The barley/vetch mixture for the three locations was used for sheep grazing at flowering time.

Table 3.2.4.1.a. Mean dry matter yield (kg/ha) of barley/vetch mixture and their utilization at three locations under low rainfall for the growing season 2005/2006.

	Locations		
	Tel Abta (272mm)	Hatra (238mm)	Mahalabia (434mm)
Dry matter	1062 (barley + V.S.IPA2001)	1880 (barley + V.S.IPA2001)	1790 (barley + V.S.IPA2001)
	1840 (barley + Couhak)	1330 (barley + V.S. 713)	1812 (barley + V.N. Velox)
Utilization	Sheep grazing	Sheep grazing	Sheep grazing

Table 3.2.4.1.b. Mean plant height (cm) and number of branches or tillers/plant of barley/vetch mixtures.

	Locations								
	Tel Abta (272 mm)			Hatra (238 mm)			Mahalabia (434 mm)		
	Barley	V. S.	V. D. Couhak	Barley	V. S. IPA 2001	V. D. Couhak	Barley	V. S. IPA 2001	V. N. Velox
Plant height	40	15	17	50	33	28	50	25	63
Branches/ plant	4	1	3	4	2	3	5	2	2

Note : V.D. *Vicia dasycarpa*; V.N. *Vicia narbonensis*; V.S. *Vicia sativa*; barley = two–row black (local variety)

In the moderate rainfall areas (Table 3.2.4.1.c), there were differences in dry matter and seed yield of barley/vetch IPA2001, with dry matter at Telkeif increased by 14% over Hamdanyia. These increases in dry matter were due mainly to the distribution of the amount of rainfall. The depression in seed yield at Telkeif was due mainly to delay in harvesting. Also, there were differences for barley in height of (68-74 cm) and number of barley tillers/plant (2-4) and in vetch for height (59-65 cm) and number of branches/plant (2-3) (Table 3.2.4.1.d).

Table 3.2.4.1.c. Mean dry matter and seed yields (kg/ha) of barley/vetch at two locations under moderate rainfall for the growing season 2005/2006

	Locations	
	Hamdanyia (548mm)	Telkeif (463mm)
Dry matter	4528 (barley + V.S. IPA2001)	5180 (barley + V.S. IPA2001)
Seed yield	1280 (mixture)	600 (mixture) *

*Note: there was a delay in harvesting

Table 3.2.4.1.d. Mean plant height (cm) and number of branches or tillers/plant of barley/vetch mixtures.

	Hamdanyia		Tel Keif	
	Barley	V.S. IPA2001	Barley	V.S. IPA2001
Plant Height	68	59	74	65
Branches/plant	2	2	4	3

Note: V.S. *Vicia sativa*: Barley two–row black (local); mm rainfall

Table 3.2.4.1.e presents dry matter and seed production of common vetch IPA 2001, woollypod vetch cv. couhak and narbon vetch cv. velox at Bashiqa and Hamdanyia, and of two cultivars of lathyrus at Tel Keif. IPA and velox vetches with barley gave over 5t/ha of dry matter whilst seed yield was highest with couhak. For lathyrus, the dry matter yield of the two cultivars was over 4t/ha and seed yield over 1t/ha. Height of plants and number of branches/plant of all cultivars under study are presented in Table 3.2.4.1.f. Couhak/barley was much taller than other legumes and, with its good seed production, would be amenable to mechanical harvesting.

Table 3.2.4.1.e. Mean dry matter and seed yields (kg/ha) of barley/vetch mixtures at three locations under moderate rainfall for the growing season 2005/06

	Bashiqa (349 mm)		Hamdanyia (548 mm)	Telkeif (463 mm)	
	V.S.IPA 2001	V.N.velox	C.V. couhak	L.S.587	S.Ali-bar
Dry matter	5726	5228	3621	4276	4020
Seed yield	820	700	1700	1080	1040

Note: L.S. *Lathyrus sativus*; V. S. *Vicia sativa*; V. N. *Vicia narbonensis*; mm rainfall

Table 3.2.4.1.f. Mean plant height (cm) and number of branches/plant

	Bashiqa (349 mm)		Hamdanyia (548 mm)	Telkeif (463 mm)	
	V.S. IPA 2001	V.N.velox	CV. couhak	L.S.587	L.S.Ali-bar
Plant Height	65	75	90	76	62
Branches/plant	2	1	2	2	2

3.2.4.2 Food legumes

Results in Table 3.2.4.2a show some differences in biological and seed yields of chickpea cultivars between the demonstrated method and the farmer's method at Hamdaniya. For Ghab1, the demonstration surpassed the farmer's method in biological and seed yield by 97% and 40%, respectively. For Ghab3, biological yield and seed yield were surpassed by 21% and 95%, respectively. No marked differences were observed in biological and seed yields for Ghab 2 and Ghab 4. There were no clear differences between the two methods in weight of 100 seeds.

Table 3.2.4.2a Mean biological yield, seed yield [kg/ha] and 100 seed weight [g] for Ghab 1, 2, 3 & 4 at Hamdaniya for the growing season 2005/2006

	Demonstration method	Farmer's method

Cultivar	Biological Yield	Seed Yield	100-Seed Weight	Biological Yield	Seed Yield	100-Seed Weight
Ghab 1	7247	3045	26.6	3682	1446	25.5
Ghab 2	4337	1680	25.1	4571	1891	25.5
Ghab 3	7410	3474	25.1	5307	1771	25.8
Ghab 4	8186	3923	26.2	8664	4185	27.9

At Hamdanyia, there was a comparison between the demonstration and farmer methods for chickpea cvs. Ghab4 and Dijla (Table 3.2.4.1b). The increase in biological and seed yields of Ghab 4 under demonstration was 18% over the yields obtained using the farmers' method.

Table 3.2.4.1b Mean biological and seed yields (kg/ha), and 100 seed weight (g) for Ghab 4 and Dijla at Tel Kief for the growing season 2005/2006

	Demonstration method			Farmer's method		
Cultivar	Biol. yield	Seed yield	100-seed weight	Biol. yield	Seed yield	100-seed weight
Ghab 4	3679	1869	27.6	3106	1574	25.9
Dijla	3266	1302	23.4	2980	1271	23.0

Table 3.2.4.1c shows slight differences in seed yield between chickpeas cultivars IPA 510, Dijla and Ghab4 under high rainfall at Al-Kosh and Shekhan.

Table 3.2.4.1c. Mean biomass and seed yield (kg/ha) and weight of 100 seeds (g) of chickpea cv. IPA 510 at Al-Kosh and Al-Shekhan for the growing season 2005/2006

	Al-Kosh (506 mm)			AL-Shekhan (852 mm)		
Cultivar	Biological yield	Seed yield	Wt.100 seed	Biological yield	Seed yield	Wt.100 seed
IPA 510	4326	1217	30.9		680	
Dijla					720	
Ghab4					770	

Lentil seed yields (Table 3.2.4.1d) showed some differences between Bashiqa, Telkeif and Hamdanyia. The overall low seed yields for all locations were due mainly to shortages in seed and the subsequent low seed rates used by farmers, as well as late sowing because of continuous rain and weeds. Only Idleb2 at Telkief approached 1t/ha.

Table 3.2.4.1d. Mean seed yield (kg/ha) of lentil cultivars at Bashiqa, Telkeif and Hamdanyia for the growing season 2005/06.

Cultivars	Locations		
	Bashiqa (349 mm)	Telkeif (463 mm)	Hamdaniya (548 mm)
IPA98	536	960	436
Idleb 3	520	840	---
Baraka	---	---	776

Faba bean cv. Aquadolce at Al-Shikhan showed no clear trend, due to late sowing in February, four months after the recommended sowing date of early November, which resulted in small and/or abortive seeds and poor yield at harvest in late June. No data were collected. This shows the importance of timely sowing.

3.3. Evaluation

3.3.1 Preparation

Finance: Lack of funds was an initial problem limiting the sustainability or continuity of the project. This was overcome or controlled by cooperation between the project management and the national coordinator. Funds were borrowed from the Ministry of Agriculture for the continuity of the project. To assist before funds were received from ICARDA, the project team visited the fields many times using their own cars and bought the fertilizer and seed and fertilizer transport on retail. Control of expenditures was exercised by people from the Agriculture Directorate.

Security: The security situation in Ninevah Governorate varied from neutral to very bad. A good choice of locations and farmers from the beginning enabled the achievement of the major project targets with few exceptions and was due to tremendous work done by the project team in spite of the difficult security situation.

Field work: During the first meeting of the project implementation committee, field work was divided into four areas led by technical people from the Agriculture Directorate, each dealing with a certain rainfall zone. Four agriculture zones were selected as follows:

1. Low rainfall zone (Hatra, Tel-abta, Mahalabia).
2. Moderate rainfall zone (Telkief, Bashiqa, Hamdania).
3. High rainfall zone (Al-Shekhan, Rabiaa, Al-Kosh).
4. Irrigated zone (Rabiaa, Al-Namroud, Homadate).

In the Directorate of Agriculture, 18 meetings were held by project staff during the growing season, for the purpose of discussion and to solve problems that would affect the project activities.

3.3.2 Work plan adjustments

Work planning included two adjustments:

a) a farmer's method was added (similar in area and location to project treatment) to comparisons. The same quantity and quality of seed was used for an equal comparison between tested cultivars in the project demonstration and the farmer treatments.

b) genetic mixtures were expected between cultivars on the demonstrations in farmer fields. These farmer fields were inspected by a field inspector from the inspection and certified seed office for genetic purity. The requirement of the project for wheat and barley seed was bought from two successful farmer fields. Returned seed from the farmer after harvesting will be distributed to other farmers in the zones for expansion and extension of project varieties.

Project management in ICARDA Syria agreed on the two corrections. The two corrections were within the limit of the project budget.

3.3.3 Field observations and suggestions for solving problems

a) large clay masses appeared after using the chisel plow and the plowing had to be followed by another operation done for soil degradation by disc

b) it was difficult to use the chisel plow before rainfall events because of hardness of soil. In more than one location some damage to the chisel plough occurred even after rainfall events. Consequently, the chisel plow was best after rainfall for plowing.

c) there were difficulties in some locations in the availability of good seeders at the proper time.

d) the most important factor studied for field demonstration was grain yield (kg/ha). This was accomplished by harvesting the whole area under study under the demonstration (improved) and farmer's methods for all locations by combine harvester. The grain yield was weighed by field balance in the field for accuracy reasons. In addition to seed yield, other characters were studied as mentioned in the results tables. To study these characters, four replications (sub-samples) were randomly chosen for all experimental units in an area of 1x1m for both project and farmers treatments for all locations. This method was used because there was no experimental harvester.

e) for studied characters mentioned above, there was a large difficulty in field sample collections and processing which demanded a lot of physical efforts. Marked bags were used and all the samples were transported to the Directorate Agriculture Laboratories for study. In the Agriculture Lab in spite of 20 technicians working for the samples study, it was difficult to achieve results within time limits. There was a big problem in some estimation of characters such as grain yield/m^2 due to unavailability of laboratory spike threshers in Ninevah Province. All the samples were sent to Dohuke Province with technicians. The work was continued for three days up to 11 o'clock at night for threshing all spikes.

f) in relation to straw yield, this was estimated from four replications (sub samples) for all treatments and locations. It was difficult to depend on it in economic calculations because of differences in cutting level between hand harvesting and combine harvesting. It is difficult to extrapolate straw yield estimated in a small area to the whole area. It is common in Ninevah Province and some other parts in Iraq for free sheep feeding on straw, therefore this character was excluded from the economic study for this season only. Straw character will be studied next year if there are proper machines.

g) with the zero tillage machines which were sent to Ninevah Province, there is a weakness in some parts and we expected unsuccessful results under solid (hard) soil in Ninevah Province.

3.3.4 Suggestions:

a) in relation to chisel plows, there was contact with project management at ICARDA for buying three chisel plows, which were selected and supplied in part for soil degradation (break-down) and we expect they will be successful for plowing and degradation of soil in one pass. Project management agreed to buy these within project budget.
b) there is a difficulty of plowing by chisel before rainfall in Ninevah Province because of solid soil as a result of continuous cultivation with the local disk. Such areas will depend on rainfall before first plowing by chisel plow. We suggested introducing a new factor of sub soiling (deep ripping) to a depth of more than 50cm. This plow (sub soiler) has been used in Ninevah Province with good results. The problem of sub soiling (deep ripping) is it needs a strong tractor with more fuel and slow work. Dr Abdul Sattar Rajbu saw a suitable sub soiler with two swords to a depth 50 cm which can work with a tractor of ordinary power and at high speed with less fuel consumption. We suggest purchasing several for the project and test plowing to a distance 10cm between rows for each season.
c) three modern seeders are needed for the three zones in order to secure quick seeding and reduce the need to transport seeders.
d) three small harvesters are needed to use on the three zones for accuracy of measurements especially straw yield.
e) after soil texture analysis for locations the limited rainfall zone was chosen for zero tillage. This was because, firstly, of light soil textures for this zone and, secondly, to reduce cost of production where there is lower rainfall and low productivity in comparison with other zones. With experience and results from this zone, it can be decided whether to use this ZT machine in other zones or not, or make suggestions for some modifications to the machine.

3.3.5 Achievements:

From field days, field visits, meetings and results achievements, the project was successful in the following directions:
a) adoption of some cultivars of wheat and barley by farmers
b) chisel plowing was successful in most locations for solving the problems mentioned
c) choosing the right dose of fertilizer as a result of soil analysis showed its efficiency. Some farmers such as at Al-Namroud competed with the demonstration treatments through increasing the number of plowings and the fertilizer dose, but reflected that with cost increases it was not necessary because there was equality of yield between demonstration and farmer treatments
d) there was a good reputation for the project in the province between farmers. Press media was used for this purpose
e) if it can be agreed to supply seed cleaners in the project, farmers will be very happy and there will be strong demand to clean farmer seed
f) on the technical side, the training was very good especially for soil people, where all soil samples of the project were analyzed by the soil lab. Many post graduate students are dependent on the soil lab for analysis of their soil samples
g) in the field of plant protection, there was a survey on insects and diseases in the fields of the project. There was control of these insects and diseases. The project asked Dr. S. Ardeny of UM to cooperate with the plant protection department to prepare studies on controlling insects and diseases for the next growing season
h) there was tremendous work on forage mixtures under the moderate rainfall zone. Some farmers in this zone were very keen on adoption. For the sustainability of the activity, mechanical harvesting instead of grazing is required. There are difficulties using grazing of the wheat and barley crops because animals will cause some damage to these crops. Dr. Kasim reported on the achieved results and suggestions for the next growing season and for crop rotation.

4. Research program

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Research trials evaluating better adapted lines/varieties of the project crops were planned at ten locations: Rabiah (HRA), Al Kosh (HRA), Al Rashidya (MRA), Baashika (MRA), Telkeyf (MRA), Al Namroud (MRA), Bartala (LRA), Al Hadar (LRA), Tel Abta (LRA) and Tel Afar (LRA). However, it was only possible to conduct 27 of the planned 80 research trials mainly at Al Rasheedya, and some at Al Kosh locatins. The trials planned and conducted were as follows:

- bread wheat: 4 of 14 planned experiments conducted at Al Rashidya Research Centre
- durum wheat: 2 of 4 planned experiments conducted at Al Rashidya
- barley: 5 of 17 planned experiments conducted at Al Rashidya
- chickpea: 13 of 16 planned research experiments conducted at Al Rashidya and Al-Kosh
- lentil: 2 of 8 planned experiments conducted at Al Rashidya
- faba bean: 1 of 9 planned experiments conducted at Al Rashidya
- forage legumes: none of 16 planned experiments (vetch-5; oats-2; grass pea-2) conducted.

Many trials in the ambitious research plan could not be established because of heavy rain, security concerns, land disputes and transport shortages.

4.1 Weather at Rasheedya

The rainfall and temperatures are shown in Figures 4.1.1 and 4.1.2. Rainfall commenced in December 2005 and there was a total of 434mm. The minimum temperature occurred in January around sowing. Cold may have slowed germination and seedling establishment in the field. No snow or frost occurred during March or April. A drought period occurred during March and early April. Delayed sowing caused heading to be delayed until mid-late April for some crops, when temperatures were higher.

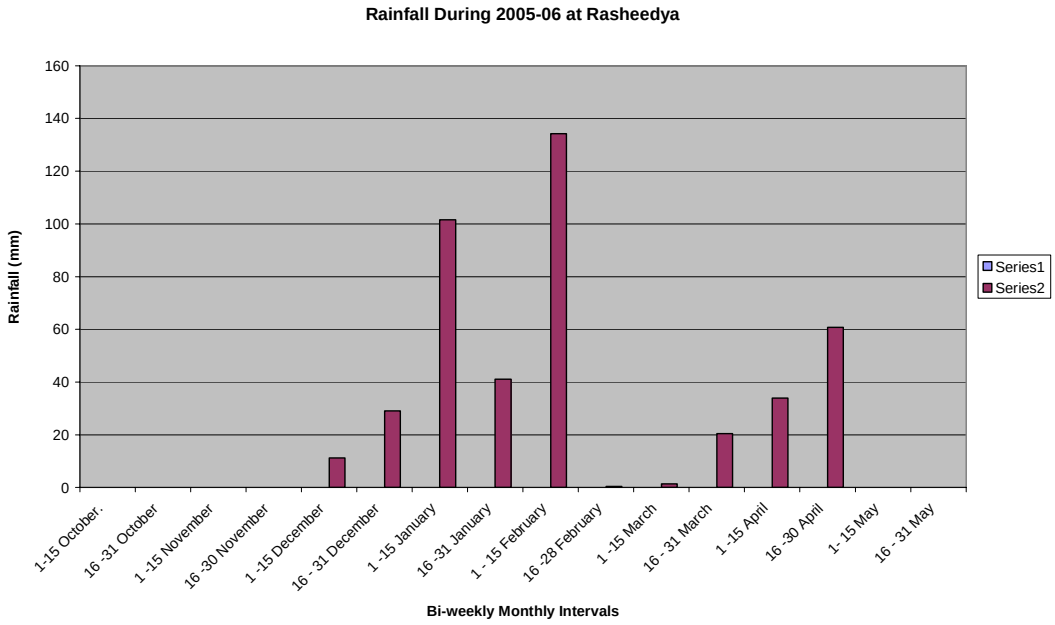


Figure 4.1.1 Rainfall during 2006 growing season at Rasheedya

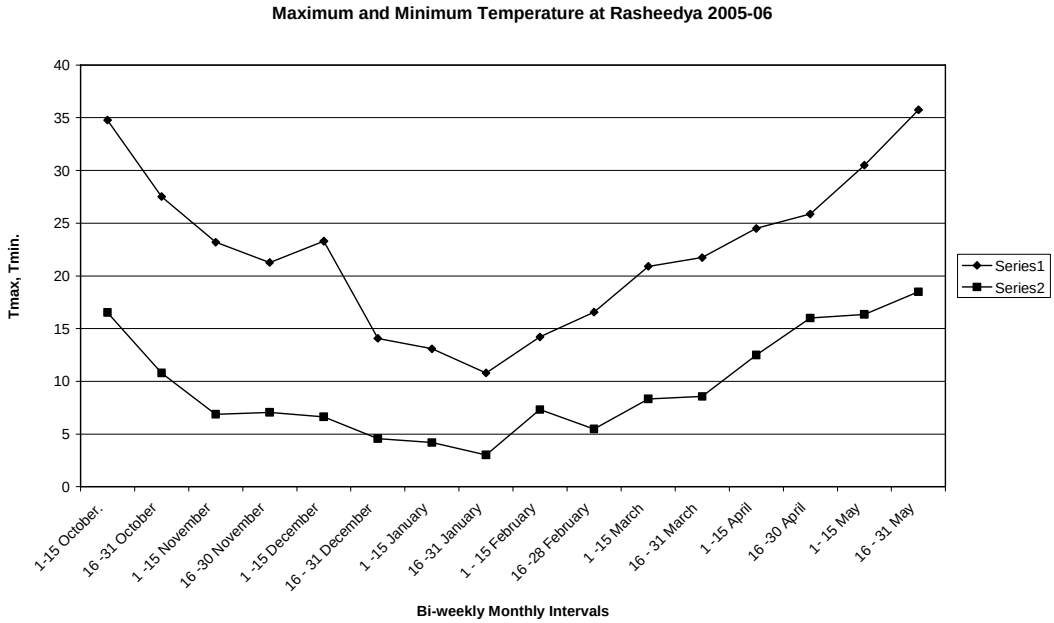


Figure 6.1.2 Maximum and minimum temperatures during 2006 growing season at Al-Rasheedya

4.2 Cereals

Summary of nursery and yield trial results

4.2.1 Bread wheat

Nurseries established and results were:

- CWANA First Dry land Spring Bread Wheat Screening Nursery 2005-06
  - 30 lines selected out of 81
- CWANA First Dry Land Spring Bread Wheat Yield Trial: Low Rainfall – Temperate Areas
  - discarded because of flooding and salinity
- CWANA First Dry Land Spring Bread Wheat Yield Trial: Low Rainfall – Continental Areas
  - discarded because of flooding and salinity
- Crossing Block and F1, F2 Nurseries
- Australian – Iraqi Wheat trial

Results of the multi-country wheat comparison were as follows:

No.	Name	O	HD	MD	Plth	HN	GY	STR	SPW	KW	KN
1	Kallanie	AUS	18	43	70	130	499	3519	1.6	38.2	39.0
2	Calingiri	AUS	14	45	68	49	205	790	2.2	39.1	21.3
3	Perinjori	AUS	19	46	63	68	322	483	1.9	38.5	-
4	Machete	AUS	19	46	63	162	1256	2910	1.6	36.0	33.3
5	Stilleto	AUS	20	51	65	141	577	3254	2.4	34.5	24.0
6	Westonia	AUS	21	51	72	67	510	1942	2.6	37.0	39.0
7	Blade	AUS	21	51	70	128	462	2315	2.6	36.5	20.5
8	Amery	AUS	19	49	79	108	589	2541	2.7	35.3	39.5
9	Wilgoyne	AUS	19	47	78	88	698	1856	2.5	36.3	38.0
10	Adnanya	IRAQ	19	46	78	66	246	1034	2.3	38.5	39.0

No.	Name	O	HD	MD	Plth	HN	GY	STR	SPW	KW	KN
11	AbuGhr3	IRAQ	17	42	60	47	209	680	2.2	27.2	47.0
12	SU-30	IRAQ	20	43	82	89	522	1145	2.2	33.2	35.2
13	Hamra	IRAQ	17	50	73	71	387	1630	2.8	29.5	38.7
14	ACSA933	ACSAD	19	50	90	83	463	2537	3.4	37.4	47.0
15	ACSA901	ACSAD	20	50	73	78	816	2295	3.4	39.3	40.5
16	ACSA981	ACSAD	21	47	78	133	732	2713	2.5	34.8	30.9
17	ACSA885	ACSAD	18	54	75	87	739	2094	1.8	33.2	30.7
18	ACSA899	ACSAD	21	46	77	94	663	1784	2.4	36.2	31.5
19	Caudillo	USA	22	53	62	96	766	2460	1.5	27.5	40.5
29	Vee 's'	-	20	47	70	42	171	617	2.0	38.2	31.7

4.2.2 Durum wheat

Nurseries established and results were:

- International Durum Segregating Populations-Mediterranean Dry land
  - 15 out of 45 populations selected using 5-15 individual plant selection
- International Durum Yield Trial for Dryland Temperate Areas
  - 6 lines selected out of 24:
    - 2, 3, 4, 5, 6, and 7 with yields 2055-3611 kg/ha
    - in comparison Oumrabia gave 2358 kg/ha and the national check 1000 kg/ha
- International Durum Observation Nursery for Irrigated/Favorable Areas
  - no superior lines identified

4.2.3 Barley

Nurseries established and results were:

- International Barley Segregating Populations-Spring Type
  - crop failed
- International Barley Segregating Populations-Winter Types
  - selected 9 out of 146 populations as bulk
- Barley Nursery for Iraq-Moderate Rainfall Areas
  - Book available for the names, pedigree and data of the lines studied
  - Number of lines tested:100
  - Data collected: heading date, maturity date, plant height, biological yield, grain yield, 1000 kernel weight
  - Selection criteria:
    - grain yield > 1000 kg/ha or more than the yield of Rihane-03
    - lodging tolerance
    - 1000 Kernel weight > 45
  - Selected 32 lines for further testing: 11, 17, 18, 19, 20, 21, 23, 24, 25, 27, 29, 37, 41, 43, 48, 49, 51, 52, 53, 54, 55, 57, 61, 65, 76, 77, 78, 88, 90, 91, 92, 94
  - Next season plan: 32 selected lines planted in 6 x 6 lattice design with two replicates and 3 locations in Rasheedya, Telkafe and Hamdanya
- Barley for Iraq - Low Rainfall Areas
  - Books available for names, pedigree and data.
  - Number of lines tested:100
  - Selection criteria:
    - grain yield > 500 g/plot

        - lodging tolerance
        - black seeded
        - kernel weight > 45
        - smooth awns
    - Selected 46 lines for further testing: 5, 6, 8, 9, 10, 14,15,16,17, 23, 24, 25, 26, 27, 28, 29, 30,31,32, 33, 34, 35, 36, 38, 41, 44, 45, 46, 48, 49, 50, 55, 56, 66, 70,71, 75, 77, 79, 81, 84, 86, 87, 88, 90, 94
    - Next season plan: planting selected lines in 7 X 7 lattice design with two replicates and 3 sites in Hatra, Mukhazaka and Hamdanya, with no fertilizer inputs

4.3 Food legumes

Summary of nurseries and yield trial results

4.3.1 Chickpea

Nurseries conducted and results were:

- Chickpea International F4 Nursery-Mediterranean Region 2006
    - 15 populations out of 30
- ? Chickpea International Nursery for Drought Tolerance 2006
    - results available
- ? Chickpea International Nursery for Fusarium wilt-2006
    - 38 lines selected out of 61
- Chickpea International Nursery for Cold Tolerance-2006
    - 20 selected lines out of 41
- Chickpea International Nursery for Ascochyta Blight-2006
    - 27 lines selected out of 41
- Chickpea International Elite Nursery-Spring-2006
    - 28 lines selected out of 49
- Chickpea International Elite Nursery-2006
    - 19 lines selected out of 49

Detailed results of chickpea nurseries/trials are presented in Appendix 2.

4.3.2 Lentil

Nurseries conducted and results were:

- ? Lentil International F3 Nursery-Large Seed-2006
    - 7 populations using 5-10 individual plant selection
- Lentil International Elite Nursery-Small Seed-2006
    - 17 lines selected out of 64
- Lentil International Drought Tolerance Nursery 2006
    - 17 lines selected
- Lentil International Elite Nursery-Large Seeds-2006
    - 10 selected out of 25

Detailed results of lentil nurseries/trials are presented in Appendix 2.

4.3.3 Faba bean

One nursery was conducted at Rasheedya as follows:

- Faba Bean International Improved S1 Populations Nursery 2006
  - 8 selected out of 8

  Methodology
    - Book of names , pedigree and data available
    - 8 lines were planted in 4 row plot, 4m long 50 cm apart. Planting was in hills 20 cm apart with one seed at 6cm depth

  Results and discussion

  Results are presented in Table 4.3.3 Faba bean and Appendix 2.

    - grain yield
      - All entries exceeded the local check
      - seed yield of all the tested populations exceeded the local check, Entries 3, 6 and 2 gave the highest grain yields of 2001, 1642, and1446 kg/ha. The local variety was the lowest at 990 kg/ha, indicating good gains from improved germplasm.
    - seed index
      - entries 6 and 7 gave the highest seed index of 97 - such large-seeded types are preferred for human consumption and have good potential in Iraq.
      - the local variety was lowest at 58, indicating local satisfaction with small seeded types, which are suitable for processing and mechanical harvest

    These finding indicate that improved small seeded types are promising in Iraq to increase national production. Individual plant selection, within all tested populations, was undertaken to provide lines for further evaluation next season.

Table 4.3.3 Faba bean growth performance in International Improved S1 Populations Nursery 2006 at Rasheedya

Name/pedigree	Heading Time	Seed Yield	Seed Index	Plant Height
1. HPB/SOA/2005	76	1371	77	57
2. HBP/SOB/2005	76	1446	64	51
3. HBP/SOD/2005	76	2001	64	57
4. HBP/SOC/01F6	76	1173	67	60
5. HBP/S1D/01-F6	76	1212	65	64
6. ILB1814	76	1642	97	52
7. ILB1266 Aq.dolci	76	1313	97	65
8. Local	76	990	58	76

4.4 Lessons learnt and implications for 2006/7 planning on research program

Major constraints

- more man power needed
- better security
- lack of logistics – transportation
- need for movable fences to protect experiments

- better seed storage
- seed production for elite varieties
- market distortion (unfavorable marketing environment due to very low prices of imported produce)
- reluctance to use fertilizers

Changes needed for improved efficiency in project implementation

- change from public to private vehicles for security in project work
- need to concentrate on timely sowing
- timely harvesting to avoid grazing by sheep
- rebuild the poultry industry based on small-seeded faba bean genotypes
- seed containers
- no cold tolerance nursery
- supply of large-seeded chickpea

5. Supporting research at ICARDA

The research was mainly conducted by Atef Haddad, Colin Piggin, Juergen Diekmann, and Mustafa Pala.

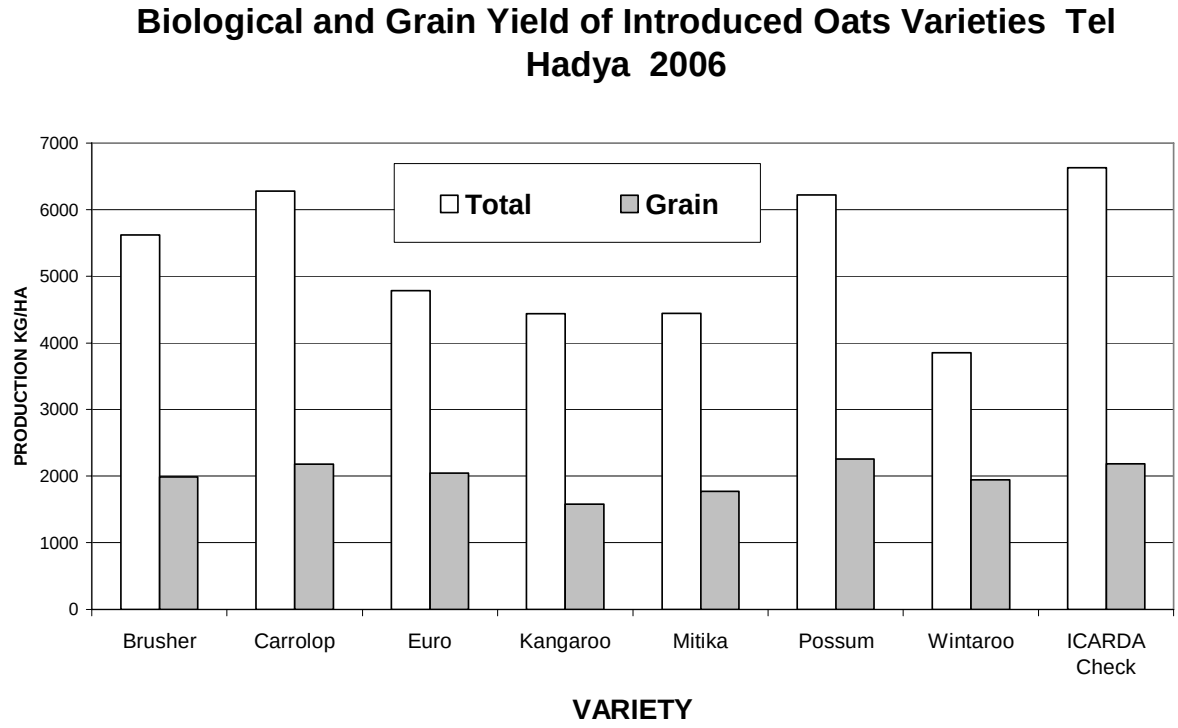
Several studies were conducted at ICARDA's Tel Hadya research station to provide information and seed multiplication to support the crop improvement and agronomy work in Ninevah. Background and results from these studies are briefly presented below. They were all conducted by the agronomy and station operations groups.

5.1 Testing of alternative crops

Alternative dryland crops for Mediterranean environments (oats, legumes and oilseeds) were evaluated at ICARDA's Tel Hadya research station.

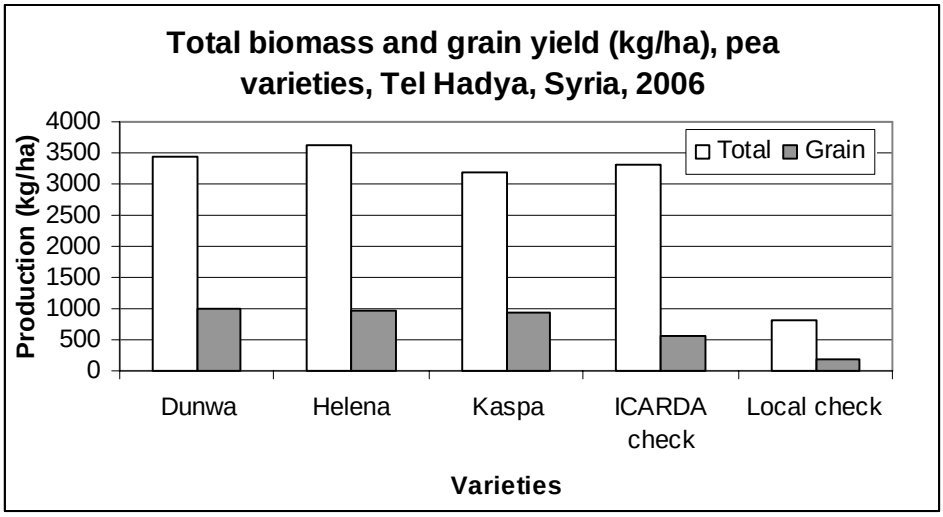
5.1.1 Oat varieties for grain, feed, forage

The following oat varieties tested were: 1. Brusher, 2. Carrolop, 3. Euro, 4. Kangaroo, 5. Mitika, 6. Possum, 7. Wintaroo, and 8. ICARDA Check. Planting date was 30 Nov 2005, there were 4 replicates, 50kg/ha N fertilizer was given on 5 March 2006 (tillering stage); the harvest date as 5 June 2006. The figure below shows the results.



5.1.2 Peas for grain and feed

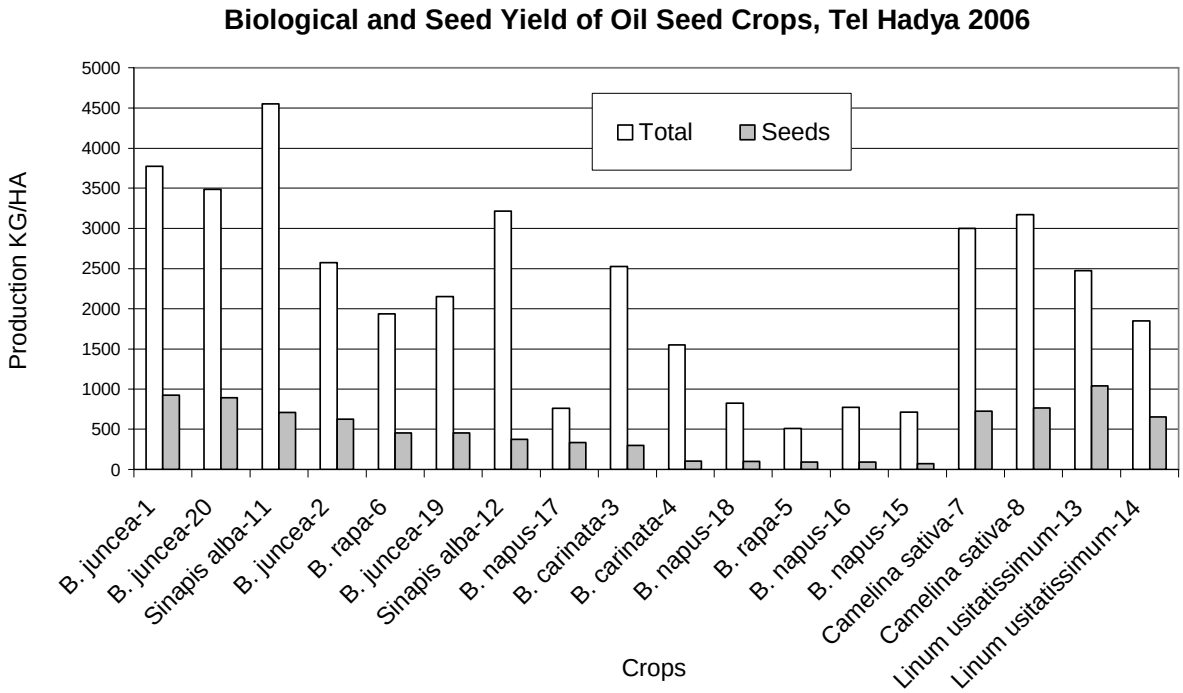
The following pea varieties were tested: 1. Dunwa, 2. Helena, 3. Kaspa, 4. ICARDA Check, 5. Local check. Planting date was 30 Nov 2005, harvest date was 20 May 2006, and there were no replicates. The graphic below shows the yield results.



5.1.3 Oilseeds for oil, feed, mustard, soil conditioning (fumigant, macropores)

Planting date was 30 Nov 2005, there were 4 replicates; harvest dates were 16-21 June 2006. The following 18 species/varieties/lines were tested. Yield results are presented in the figure below.

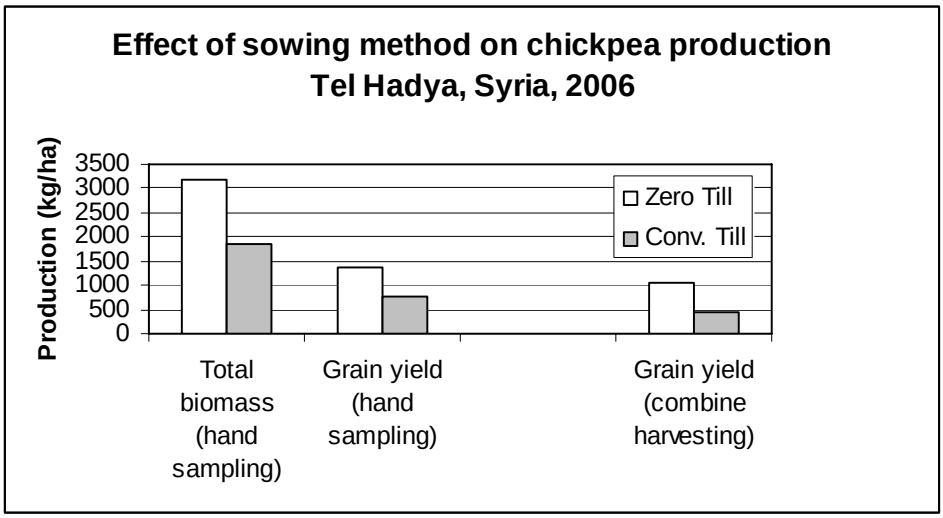
Botanical name	**Variety/line**	**Common name**
Brassica juncea	Sel 21, 4355, 82NO00-67, 82NO00-98	Indian mustard
Brassica carinata	94024.2, 195923.5.2	Ethiopian mustard
Brassica napus	Tramby, DB62-OOW2, DB76-OOW6, DB163-OOW2	Canola
Brassica rapa	91182, Pusa Kalyana	Turnip rape
Camelina sativa	4164, 4183	False flax
Camelina alyssinica	337110, 94053	Crambe, Camelina
Sinapis alba	Tliney, 94488	White/English Mustard
Linum usitatissimum	Glenelg, 110637	Linseed, Linola



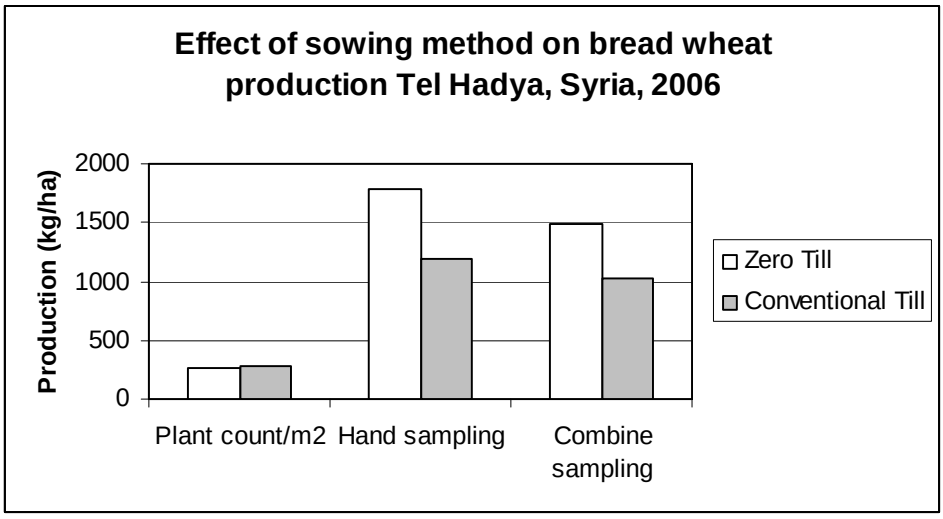
5.2 Zero-tillage for more sustainable cropping

The objective was to evaluate alternative crop establishment techniques in Mediterranean environments. The yield effects of conventional cultivation were compared with a zero-till plot (stubble retained) on 5ha demonstration plots.

5.2.1 Chickpea on wheat stubble



5.2.2 Wheat on chickpea stubble



5.2.3 Benefits of reduced tillage

- time, fuel and machinery savings
- better soil structure and soil-water dynamics (OM, porosity, etc)
- improved trafficability
- timely sowing
- better WUE
- higher yield potential
- less erosion

5.3 Conclusions

The 2005/06 ICARDA agronomy research on alternative crops and zero-till/stubble mulching showed some interesting results/potential:

- some food and feed grain oat varieties which gave > 5t/ha biomass and > 2t/ha of grain, with Brusher and Carrolop seeming best adapted
- some pea varieties which gave > 3t/ha biomass and > 1t/ha of grain, with Kaspa particularly resistant to lodging
- some oilseeds which gave > 3t/ha biomass and up to 1t/ha of grain, particularly some lines of *Brassica juncea*, *Camelina sativa*, *Sinapis alba*, and *Linum usitatissimum* performing well
- around 50% higher yields from zero-till than conventional cultivation for chickpea (1043 vs 427 kg/ha) and for wheat (1483 vs 1032 kg/ha). It should be noted here that these wheat yields were very low. The growing season rainfall (1 Sept 05 to 31 May 06) was 290mm giving an attainable yield (available moisture x WUE) of say (290mm – 60mm) x 20kg/mm = 4.6 t/ha. Better agronomy to lift yields is critical.

These alternative crops and zero-till/stubble mulch technology are worth further research, verification and promotion in Iraq.

6. Collaborators

Name/Title	Institution
Australia	
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Mr. Hiji M. Yakub Agriculture Extension	Directorate of Ninevah Agriculture
Mr. Zuhar Salem Abou Agricultural Engineer	Directorate of Ninevah Agriculture
Mr. Thenoun M. Younis Auditing Department	Directorate of Agriculture
Mr. Abdul- Moniem M. Mohamed Follow up/Third Sector	Directorate of Ninevah Agriculture
Mr. Hazem Aziz Saleh Follow up/Second sector	Directorate of Ninevah Agriculture

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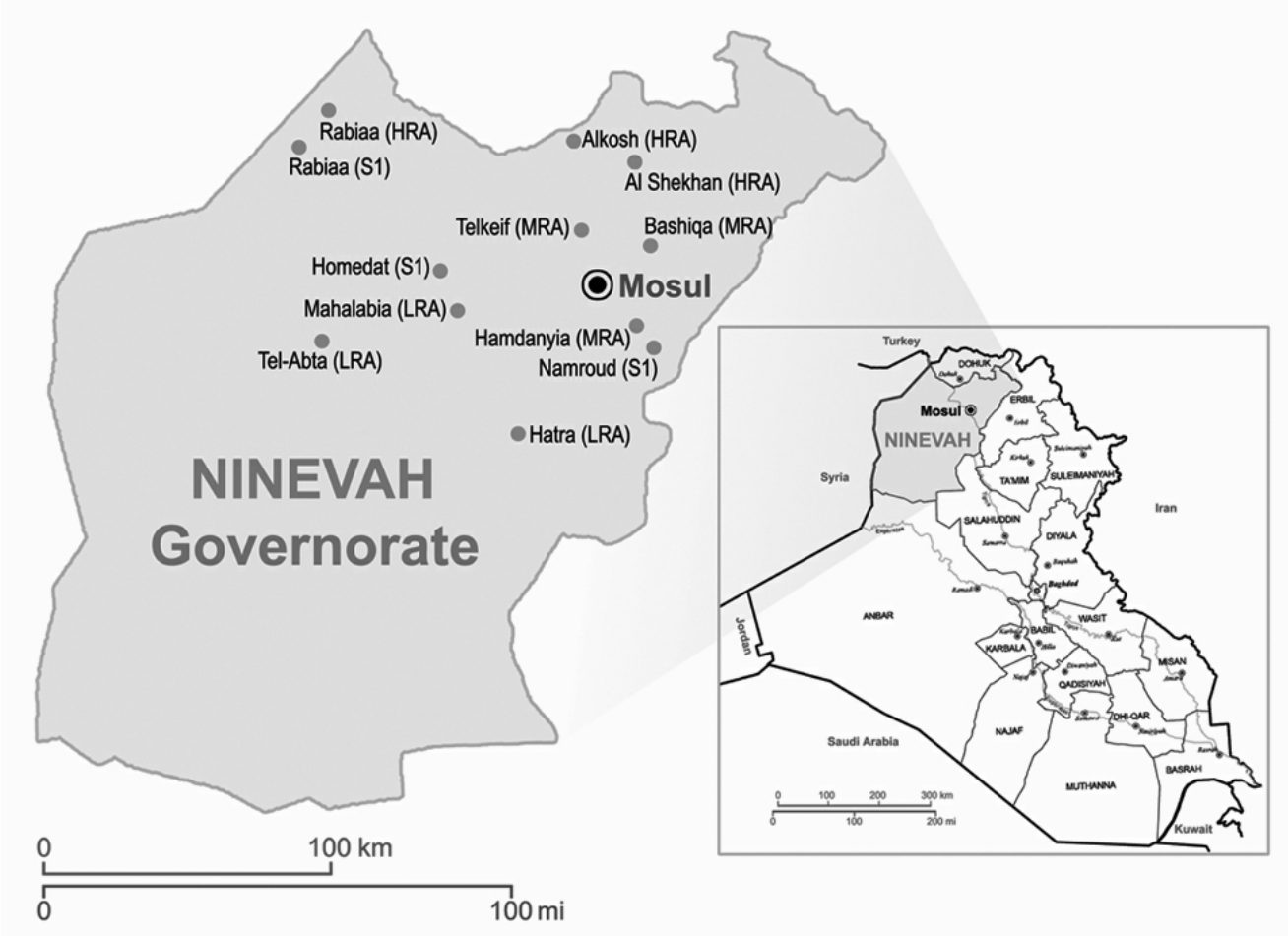
Appendix 1. Location of demonstration sites in Ninevah, Iraq



Appendix 2 Detailed results from food legume research nurseries/trials

Dr Adnan Adary
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Introduction

Results from the following 2005/06 trials and nurseries summarized under 4.2 Legume Report are reported in detail below:

2.1 Chickpea
2.1.1 Chickpea International Elite Nursery 2006 Al Kosh 1
2.1.2 Chickpea International Elite Nursery-S-2006 Al Kosh 2
2.1.3 Chickpea International Cold Tolerance Nursery 2006 Al Kosh 3
2.1.4 Chickpea International Ascochyta Blight Nursery 2006 Al Kosh 4
2.1.5 Chickpea International F4 Nursery-Mediterranean Region-2006 Al Kosh 5

2.2 Lentil
2.2.1 Lentil International Elite Nursery-Large Seeds 2006 Al Rasheedya 1
2.2.2 Lentil International Drought Tolerance Nursery 2006 Al Rasheedya 2
2.2.3 Lentil International Elite Nursery-Small Seed 2006 Al Rasheedya 3

2.3 Faba bean
2.3.1 Faba bean International Improved S1 Populations Nursery 2006 Al Rasheedya

2.1 Chickpea
2.1.1 Chickpea International Elite Nursery 2006 Al Kosh 1

Materials and Methods

The nursery comprised 44 test entries and five checks, ILC482, FLP82-150C, FLIP 88-85C, FLIP93-93C and the local variety (Shawky). The chickpea was planted on calcareous loamy soil at Al-Kosh, 52 km north of Mosul. The previous crop was durum wheat (Waha variety). The land was plowed by one-way disk during February and disked by the same disk a second time to smooth the soil crumbs. No chemical fertilizers were applied. At planting, a single seed was dropped in hills at a 10 cm distance. Each line was planted in plot of two rows 4 m long and 45 cm apart (plot area 3.6 m2). The date of sowing was on 15 March 2006 and the maturity on 10 June 2006. Harvest was on 24 June 2006. Data were recorded on stand percentage, plant height, biological yield, grain yield and seed index (weight per 100 seeds). However, before harvest, the nursery was visually evaluated for the worth of the selection and a ticked mark was put in the field book, with characters considered being plant height, lodging, shattering, branching and growth habit (erect vs. prostrate).

Results and Discussions

Table Chickpea 2.1.1 presents the data collected for the lines selected for further consideration from the nursery

Stand

The range for the stand percentage was 31 to 71% in different lines. However, the stand percentage was low in most lines (Table 2). This might be related to the level of land preparation, depth of sowing and variety characteristics. The low stand affected the productivity per unit area. This is could be increased through the manipulation of seeding depth or increasing seeding rate and spacing in the field. These aspects were not studied in Iraq. Improving tillage practices and early sowing might improve this serious problem.

Plant height

The range for the plant height of the selected lines was 25 cm for line 21 to 40 cm for line 48 (Table 2). The range of plant height and others characteristics such as lodging tolerance, erect growth habit and good height of the first pod (15 to 25 cm) make these lines suitable for mechanical harvesting. Most of the lines selected exhibited the desired characters for this aspect

Seed Yield

The seed yield for the selected lines ranged between 151 to 270 g/plot (Table 2). The seed yield for the rest of the lines, which are the highest selected lines lies within this range, exhibit the potential for the selection of high yielding cultivars adapted to the local conditions. Next season these lines will be tested and further selection will be made in the same trend. Further yield improvement of the lines of the nursery could be achieved through better management and earlier sowing date, if rain permits planting in late winter (late February).

Seed Index

Table 2 presents the seed index of some selected lines. The range is 21g for line 14 to 31g for lines 20 and 33. However, no line has 35g or more, which is the large seed index desired by farmers and consumers in the area. The available materials are very good for the medium size seed index.

Table Chickpea 2.1.1 The performance of selected lines from the Chickpea International Elite Nursery 2006 planted at Al-Kosh

Entry	Name	Stand %	Plant height cm	Seed yield g/plot	Seed index g/100s	Yield kg/ha
8	FLIP 98-106C	35	40	159	-	442
10	FLIP 99-34C	38	25	241	27	669
14	FLIP 00-40C	40.	35	151	21	419
16	FLIP 01-36C	35	40	165	-	458
19	FLIP 02-10C	40	35	152	-	422
20	FLIP 02-23C	39	29	180	31	500
21	FLIP 02-30C	35	25	195	26	542
29	FLIP 03-77C	39	35	159	30	442
32	FLIP 03-105C	32	30	178	-	494
33	FLIP 03-112C	68	35	180	31	500
34	FLIP 03-113C	35	30	196	30	544
35	FLIP 03-117C	31	30	151	28	419
37	FLIP 03-123C	71	30	180	29	500
38	FLIP 03-128C	41	30	154	30	428
39	FLIP 03-134C	42	35	153	28	425
42	FLIP 03-141C	43	40	182	29	503

43	FLIP 03-142C	31	40	153	-	422
45	ILC482 (check)	43	30	270	-	750
48	FLIP 93-93C	43	40	214	25	594

2.1.2 Chickpea International Elite Nursery-S-2006 Al Kosh 2

Materials and Methods

The nursery (CIEN-S-2006) consisted 44 test entries and five check varieties; ILC482, FLIP82-150C, FLIP88-85C, FLIP93-93C and the local (Shawky). The nursery was planted at Al-Kosh (52 km north of Mosul) which is a high rainfall area (annual rainfall 510 mm during 2006 growing season). The soil was calcareous loamy soil with medium fertility. No fertilizers used in the nursery. The previous crop was durum wheat (Waha). The lines were planted in accordance to simple lattice with two replicates. Each line was planted in a 2-row plot, 4m long and 45cm apart (plot area 3.6m2). Number of seeds per plot was 120 (about 6.7cm distance among seeds within row) or 120 kg/ha. The seeds were treated with Vitavax 200 fungicide and Actellic insecticide. Sowing date was on 8 March 2006. Seeding depth was around 4-5 cm. Maturity was 10 June 2006 and the harvest was on 22 June 2006. At harvest, the total number of plants for each line was recorded. All plants were pulled and put in large bags and transferred to the laboratory for processing. Data were collected plant height, biological yield (g/plot), seed yield (g/plot), and 100 seeds weight (g).

Results and Discussion

Results are presented in Table Chickpea 2.1.2

Stand percentage

The range for stand percentage was 24 to 43% for different lines in the nursery. These levels of stand are quite low. This might indicate that the level of moisture available during germination was a limiting factor or the seeding depth was incorrect for some lines or sowing date was inappropriate during this season. Earlier sowing during the second week of February might solve the problem and will be tested in the next planting.

Plant height

The range of plant height for the selected lines was 25 to 45 cm. This plant height when accompanied by lodging and shattering tolerance is quite suitable for mechanical harvesting of chickpea in the area. Selection of erect growth habit of chickpea and plant height >40 cm is desirable for mechanical harvesting. The lodging incidence during this season was quite low.

Biological yield

The biological yield for different lines ranged between 300 g/plot (lines 33 and 21) to 900 g/plot (Line 18). However, this highest level of growth was not reflected in high seed yield indicating low harvest index for this lines. However, most of the lines have intermediate biological yield of 500-550 g/plot with a reasonably high yield potential or high harvest index. The levels of biological yield to seed yield (harvest index) needs to be studied according to regional adaptation conditions. Lines number 22, 16, 42, 13, 42 and 15 might serve such purpose in the area. Further studies for the effects of fertilizers and sowing dates seasonal variation might also be beneficial.

Seed yield

The range of seed yield was 118 to 340 g/plot. High yielding lines were identified (over 200 g/plot) from this nursery and should be studied further for adaptation and genotype x environment interactions in different locations of high and moderate rainfall areas of northern Iraq. The application of the GxE analysis techniques presented by Dr. Jens Berger for the study of such interactions might be useful to understand the behavior and adaptation of chickpea in different areas of the region. We welcome the cooperation with Dr. Berger on such a subject. Collaborative chickpea studies between Iraq, Australia and India is needed to widen the genetic base of chickpea breeding in Iraq. The lines of this nursery and the other nurseries could serve such purpose. From this nursery lines 29, 22, 16, 42, 18, 15, 21, 45, 29 and local could be utilized to initiate such program in coming seasons

Seed index

Seed index for the selected lines is presented in Table 2. All the lines were selected with a seed index of >25 g. The upper range is 32 (Line 29). However, Lines 7, 40, 36, 49, and 26 have a seed index over 29 grams. This range of seed index is an intermediate category of seed size. Iraqi farmers and consumers more likely need larger seed sizes of >35g. Further improvement is needed for chickpea and better adaptation and productivity in the local conditions should be sough tin the future nurseries supplied by ICARDA to Iraq.

Table Chickpea 2.1.2 Chickpea lines selected from the International Chickpea Elite Nursery in Al-Kosh of northern Iraq in 2006

No.	Entry	Name	Plant height(cm)	Biological yield g/plot	Seed yield g/plot	100 seed weight (g)
1	33	FLIP 03-83C	40	300	141	29
2	6	FLIP 01-5C	40	350	149	26
3	7	FLIP 01-32C	35	350	128	30
4	40	FLIP 039-8C	35	350	155	31
5	29	FLIP 03-66C	35	400	222	27
6	3	FLIP 99-46C	40	500	187	24
7	39	FLIP 03-97C	45	400	186	27
8	13	FLIP 01-50C	45	400	252	29
9	22	FLIP 03-31C	30	450	295	26
10	16	FLIP 02-06C	35	550	277	28
11	42	FLIP 03-124C	35	500	208	28
12	44	FLIP 03-154C	30	500	132	23
13	12	FLIP 01-43C	40	550	156	26
14	18	FLIP 02-21C	40	900	210	26
15	49	LOCAL	25	400	172	29
16	26	FLIP 03-55C	30	300	126	40
17	36	FLIP 03-87C	30	350	120	31
19	15	FLIP 01-57C	45	550	214	26
20	21	FLIP 03-15C	35	300	226	29
21	8	FLIP 01-33C	35	400	194	26
22	11	FLIP 01-40C	35	400	199	28
23	20	FLIP 02-84C	25	-	175	29
24	19	FLIP 02-47C	40	300	190	28
25	45	ILC482 local	30	450	209	25`

No.	Entry	Name	Plant height(cm)	Biological yield g/plot	Seed yield g/plot	100 seed weight (g)
26	24	FLIP 03-47C	36	350	132	27
27	1	FLIP 98-117C	30	250	129	30
28	29	FLIP 03-66C	35	500	215	32

2.1.3 Chickpea International Cold Tolerance Nursery 2006 CICTN06 Al Kosh 3

Materials and Methods

The nursery consisted of forty test entries and one susceptible check repeated after every two test entries. Experimental design was a RCBD with two replicates. The nursery was planted in the Al-Kosh area of the high rainfall region of Northern Iraq. The total rainfall during the season was 510 mm. The previous season's crop was Waha durum wheat. The soil was calcareous loam soil with medium fertility. No fertilizers were used in the experiment. Experimental units consisted of one row, 4m long and 45cm apart (area 0.9 m2). Twenty seeds per row were used at 5 cm distance within rows. Sowing date was on 15 March 2006 and maturity was on 10 June 2006. Data was collected on the following characters:

1. stand percentage: plant count at harvest divided by number of seeds planted
2. plant height at maturity
3. biological yield (g/plot)
4. seed yield (g/plot)
5. seed index (weight per 100 seeds)

Results and Discussion

Results are presented in Table Chickpea 2.1.3

It was unfortunate that, since the planting date was during mid March, there was no cold period encountered during growing period so there was no selection of materials based on cold tolerance. Selection was mostly based on plant height, grain yield and seed index. This nursery should be planted in winter next season in order to select for the cold tolerance character.

Stand percentage

The range of plant stand was 35-100%, with many lines having a stand of over 50%. These levels of stand are good under the prevailing field conditions in Al-Kosh. Lines number 27 and 39 had the highest stand percentage (100%). Line 29 had a 75% stand with a good yield level (71 g/plot). Lines number 1, 36, 14, and 29 also had high stand percentages (75-95%) with good yield potential.

Plant height

Most lines were 30cm or higher in plant height. This is necessary for mechanical harvesting. Lines 11, 31, 33, 39 and 14 were 35cm, which is very good (Table 2). Low plant height was noticed with lines 10 (23cm), 9 (25cm) and 29(25cm).

Biological yield

Biological yield for the different lines ranged from 100 to 250 g/plot. The highest biological yield was given by lines 1, 35 and 29. We speculate that higher the biological yields might give the plant good tolerance to cold. The rest of the lines gave low values of 100 to 150 g/plot.

Seed yield

The most important character for the crop is the seed yield. The range for these lines was 50 g/plot for line 36 to 70 g/plot for line 29. The highest yielding lines were 36, 23, 35, 29 and the check (4). The rest of the lines yielded under 50g/plot.

Seed size
The range of seed size was 23 to 30 g/100 seeds. The highest seed size was for lines 24 (32g), 8 (30g), 14 (30g), and 29 (29g). The rest of the lines had seed sizes under 29g/plot.

Table Chickpea 2.1.3 Growth of lines selected from the Chickpea International Cold Tolerance Nursery (CICTN06) at Al-Kosh during 2006 growing season

Plot	Entry	Name	Stand Percentage	Plant Height cm	Biomass Yield g/pl.	Seed Yield g/pl.	Seed Index g/100 Seeds
19105	10		45	30	200	36	24.7
19220	11		60	35	100	28.6	25.8
19205	24		60	30	150	47.2	32.1
19209	31		45	35	100	27	24.8
19211	15		35	30	100	30.2	-
19212	33		60	35	150	44.4	26.4
19214	8		50	30	100	36.2	30
19215	32		60	35	100	34.1	27.2
19217	18		65	30	150	33.8	26.2
19218	1		85	30	200	34.9	29.2
19226	36		75	30	150	50	27
19227	3		60	30	100	29.6	26.2
19236	27		100	30	150	41.5	25
19238	39		100	35	150	45	23
19108	9		45	25	100	43	24
19112	23		65	23	100	55.6	26
19115	35		65	30	200	66	26.2
19118	29		75	25	250	71	29
19124	14		95	35	150	38.3	30.3
19119	4	Check	50	27	150	57	25

2.1.4 Chickpea International Ascochyta Blight Nursery 2006 (CIABN06) Al Kosh 4

Materials and methods
The nursery (CIABN06) consisted of 40 test entries and one susceptible check (ILC263). Names and origin of the materials are presented in the field book of the experiment. The experiment was sown in Al-Kosh, 52 km north of Mosul at the high rainfall zone. The soil is calcareous loam with medium fertility. The previous crop was durum wheat variety Waha. The total number of entries was 41 and the total number of plots was 61. The experiment was sown according to the RCBD design with 2 replicates Experimental plots consisted of one row plot 45 cm apart (plot area 1.8m2). The row length was 4m. The number of seeds sown per row was 40 (about 6.7 cm distance between seeds within the row).

Sowing date was on 6 March 2006. Emergence date was March 28. Hand weeding was undertaken o13 n April 2006. Total rainfall during the season is 510 mm, with a drought period occurring during March and early April. Maturity date was 10 June 2006 and the harvest was on 15 June 2006. Data were collected for stand percentage, plant height, biological yield (g/plot), seed yield (g/plot) and seed index (weight per 100 seeds). No critical symptoms occurred for ascochyta blight. No records for this disease were recorded for the season. Selection of lines was on the base of visual evaluation in the field and data obtained, especially yield and seed index.

Results and Discussions

The main purpose of planting the nursery was to select lines for the aschochsyta blight tolerance. However, no severe infection occurred in the nursery especially because of spring planting this season. The plan is to plant this nursery during the winter growing season of 2006-2007 to ensure infection by this disease. Results of the trial are presented in Table Chickpea 2.1.4.

Stand

The stand percentage for the selected lines ranged from 33 to 73. Most of the lines had stands over 50 %, which is good for establishment of plants in the field. The highest stand lines were Lines 14, 26, 15, 41, 23, 17, 18, and 19. Most of these lines also had seed yield over 50 g/plot.

Plant height

The plant height range was 25-35 cm and most lines had an erect type of growth. These lines are suitable for mechanical harvesting. The tallest were 14, 41, 36, 32 and 40, reaching 35 cm.

Biological yield

The highest biological yields (300 g/plot) were from lines 26, 15, 38, 13, 32, and 21. The rest of the lines had 150 to 250 g/plot. High total biomass should have a good relationship with seed yield if moisture is available. It is more likely that the biological yield is higher in winter planting. This point needs exploration in the next winter season.

Seed yield

The range for seed yield was 40 to 81 g/plot. The most productive lines were 12, 14, 35, and 41, with yields ≥ 70 g/plot). There were good opportunities in this nursery to select highly productive lines with larger seed index (≥ 29 g/100 seeds).

Table Chickpea 2.1.4 Growth of lines selected from the Chickpea International Ascochyta Blight Nursery during 2006 growing season at Al-Kosh

Plot Number	Entry	Name	Stand %	Plant height cm	Biol Yield g/plot	Seed yield g/plot	Seed index g/100s
17106	12	FLIP 00-20C	45	25	200	70	25
17108	14	FLIP 02-28C	70	35	200	81	29
17109	35	FLIP 03-122C	63	30	200	79	27
17110	41	ILC 263	33	35	250	76	30
17111	39	FLIP 03-146	43	30	200	68	23
17112	30	FLIP 03-92C	40	35	200	68	30
17114	24	FLIP 03-48C	50	30	150	62	25
17115	10	FLIP 98-130C	55	30	200	69	27
17129	26	FLIP 03-73C	68	25	300	57	-
17133	9	FLIP 98-129C	65	30	200	51	-

17136	15	FLIP 03-29C	73	35	500	63	-
17138	36	FLIP 03-128C	55	35	300	64	-
17142	34	FLIP 03-121C	45	30	250	63	-
17143	41	ILC 263	63	35	200	49	-
17148	33	FLIP 03-120C	65	30	250	54	29
171499	41	ILC 263	55	30	150	40	26
17150	13	FLIP 02-20C	45	35	300	61	-
17209	23	FLIP 03-44C	65	26	200	59	-
17218	8	FLIP 97-230C	63	30	200	40	-
17226	31	FLIP 03-93C	50	30	150	50	-
17227	17	FLIP 03-36C	65	30	150	50	-
17233	32	FLIP 03-93C	50	35	300	53	-
17239	39	FLIP 03-146C	55	30	200	55	-
17271	18	FLIP 03-37C	75	30	200	45	-
17251	21	FLIP O3-42C	53	25	450	54	-
17223	40	ICC 12004	60	35	250	52	-
17215	19	FLIP 03-40C	65	30	150	60	-

2.1.5 Chickpea International F4 Nursery-Mediterranean Region-2006 (CIF4N-MR-2006) Al Kosh 5

Materials and methods

The nursery contained 30 entries including 27 test entries from ICARDA F4 generation crosses and hree check varieties ILC482, FLIP 82-150C and Iraqi local (Shawki). The nursery was planted at Al-Kosh (52 km north of Mosul), which is a high rainfall area. Total rain during 2006 was 510 mm. The soil is calcareous loam with moderate fertility and no fertilizer was added to the experiment. The previous crop in the last season was durum wheat. Traditional farmer equipment was used for land preparation. Planting was in rows at 45 cm distance. The design for the experiment was an unreplicated nursery with systematic checks. Each population was planted in a plot of 8 rows with 200 seeds planted at 20cm intervals within each 4m. The seeds were treated with Vitavax 2200 fungicide and Actellic insecticide. The date of sowing was 8 March, maturity date was in 10 January and harvesting was on 15 June 2006. All plants in the plot were harvested and then placed in a large bag and transferred to Mosul for analysis. The main objective of this nursery was bulk advancement of promising crosses. Observations on stand %, biological yield, seed yield and seed index were collected for population selection.

Results and Discussions

Results are presented in Table Chickpea 2.1.5

Stand

The stand range was a low 20-34%. This may have been related to late planting and cold, as with the other legume nurseries planted in Al-Kosh this season. However, it may also relate to the fact that these are segregating populations and may contain inferior genotypes/individuals with poor emergence/establishment capability. Selection of plants within each population might be beneficial to improve germination and emergence. Populations 25, 4, 12 and 28 have better stand percentages (≥30%) compared to the rest of the populations.

Plant height
Many populations had a plant height of ≥35 cm. Lines 25, 26, 4, 11, 29 and 14 had a plant height of 40 cm and would be suitable for mechanical harvest or contributing tallness characteristics in other chickpea lines developed from these populations.

Biological yield
The biological yield (g/plot) of the different populations ranged from 500-1400 g/plot. Populations 4, 29, 17, 14 and 28 gave ≥1000 g/plot biomass. There are opportunities to select for high biomass/high harvest index genotypes from these populations with lines 4, 29, 14 and 28 giving ≥1000g biomass and ≥350g of seed per plot. Further selection on an individual plant basis is needed to clarify this point.

Seed yield
The range in seed yields was 125 (population 21) to 392 (population 20). None of the populations gave a better yield than ILC482 (the long term check) or the improved check FLIP 82-150C. The higher yielders, with potential to give high yielding genotypes from populations 20, 12, 4, 11, 29, 17, 14 and 28, which yielded over 300 g/plot. Individual plant selection in F5 or F6 within high yielding populations might assist development of high-yield genotypes.

Seed weight
The range in seed weight was 21 to 27.2 g/100 seeds (Table 2). This level is low and might improve in future selection targeting large seeds. The check varieties ILC482 and FLIP 82-150C has small seeds with a seed size of 23 and 23.9 respectively. Larger seed sizes are desired from the point of view of farmers and consumers in Iraq.

Table Chickpea 2.1.5 Growth of chickpea populations selected from the nursery CIF4N-MR-2006 from Al-Kosh in 2006

Plot	Entry	Name	Stand %	PTHT cm	BY g/plot	Seed Yield g/plot	100 seed Weight (g)
15102	30	Local Check	21	30	600	172	27.2
15103	25	X03TH177	34	40	900	136	-
15104	26	X03TH182	25	40	500	195	-
15105	20	X03TH166	22	35	900	392	27
15107	12	X03TH130	30	35	800	335	26
15110	24	X03TH176	21	35	500	160	-
15117	9	X03TH26	20	30	850	284	-
15118	30	Local check	20	30	600	248	27
15119	4	X03TH16	32	40	1000	373	21
15120	11	X03TH129	-	40	600	356	24
15121	29	ILC482	-	40	1100	402	23
15123	17	X03TH153	25	35	1000	333	-
15124	21	X03TH169	-	35	700	125	24
15127	14	X03TH136	25	40	1400	373	-
15132	28	FLIP 82-150C	31	35	1000	420	23.9

2.2 Lentil

2.2.1 Lentil International Elite Nursery-Large Seeds (LIEN-L-06) Al Rasheedya 1

Materials and methods
The nursery was obtained from ICARDA in 2005. The number of test entries was 24 plus one local check. The experiment location was in Al-Rasheedya station, which is in the moderate rainfall area (350-450 mm). The soil is clay loam with a good fertility level and no fertilizer was applied to the experiment. Entries were planted in a simple lattice design (5x5) with 2 replicates. Each entry was planted in a $2m^2$ plot of 2 rows, 4m long and 0.25m row width. The number of seeds per plot was 400. The seeds were treated with Vitavax 2200 fungicide and Actelic insecticide. Sowing date was in 5 January, emergence date was 2 February and weeding was undertaken in March 2006. The harvested area was $1.5m^2$ from each plot. Data recorded were stand percentage, plant height, biological yield g/plot, seed yield g/plot, and seed index (g per 100 seeds).

Results and Discussion
Results are presented in Table Lentil 2.2.1

Plant height
The range of plant height was 26-38 cm, with lines 13, 16, 2, and 1 growing to 35-38 cm. The other lines were in the range 26-30 cm.

Biological yield
The range in biological yield was 150 to 900 g/plot, with biomass highest from lines 13, 21, 2, 3, and 16.

Seed yield
Seed yield of the lines ranged from 13 to 265 g/plot. Line 21 gave the highest yield (265 g/plot). Lines 18, 13, 3, and 16 gave yield range of 100 to 155 g/plot. The relatively low yield levels might have been due to the delay in sowing date (5 January 2006). Next season planting should be within the normal sowing period in middle of November to achieve higher levels of yield.

Seed index
The seed index range was 2.2 to 3.0. Lines 18 and 2 gave the highest seed index (2.5 and 3 respectively). Interestingly, line 21 had a seed index of 2.2g but gave a good seed yield (265 g/plot). The rest of the lines were low in seed size (2.2 g) with lower yield potentials.

Recommendations:
- 2006/07 planting of the selected lines with 4 row plots and 2-3 replications
- plant at the normal sowing date of mid-November
- apply basal phosphate fertilizers
- check and rate for diseases
- check and rate for plant development stages.

Table 2.2.1 Growth of lentil lines selected from LIEN-L-2006 nursery planted in Al-Rasheedya during 2006

Plot Number	Entry	Name	Plant Height cm	Biological Yield g/plot	Seed Yield g/plot	Seed Index g/100 S
21203	13	FLIP2005-4L	35	900	117	2.2
21204	21	FLIP2006-9L	30	900	265	2.2

Plot Number	Entry	Name	Plant Height cm	Biological Yield g/plot	Seed Yield g/plot	Seed Index g/100 S
21206	18	FLIP2006-6L	30	500	155	2.5
21211	3	FLIP2003-2L	30	700	106	2.5
21214	16	FLIP2006-31	38	700	116	-
21222	5	FLIP2003-5L	30	350	74	-
21201	11	FLIP2005-3L	26	550	98	2.2
21114	22	FLIP2006-101	30	300	88	2.3
21113	2	Syrian local L.	35	750	59	3.0
21109	1	Chilean 33-032-10403	37	150	13	2.2

2.2.2 Lentil International Drought Tolerance Nursery 2006 LIDTN – 2006 Al Rasheedya 2

Materials and methods

The nursery was obtained from ICARDA in 2005. The number of test entries was around 30 plus one local check. The experiment location was in Al-Rasheedya station, which is in the moderate rainfall area (350-450 mm). The soil is clay loam with good fertility level. No fertilizer was applied to the experiment. Entries were planted in a simple lattice design (5x5) with 2 replicates. Each entry was planted in a $2m^2$ plot of 2 rows, 4m long and 0.25m row width. The number of seeds per plot was 400. The seeds were treated with Vitavax 2200 fungicide and Actelic insecticide. Sowing date was in January, emergence date was in February and weeding was undertaken in March 2006. The harvested area was $1.5m^2$ from each plot. Data recorded were plant height, biological yield g/plot, seed yield g/plot, and seed index (g per 100 seeds).

Results and discussion

Results are presented in Table Lentil 2.2.2

Plant height

The range in plant height was 20-35 cm (Table 2). Lines 4 and 20 had the tallest plants (35cm) with the rest of the lines in the range 20-30 cm. These plant heights are suitable for mechanical harvesting. However, with normal sowing dates, the plants would be expected to be taller.

Biological yield

Total biological yield range from 200 to 1000 g/plot (Table 2). Lines 17, 28, 4, 29 and 14 gave the highest biological yields of 700-1000 g/plot. Line 4 gave 1000 g/plot and 28 and 29 gave 900 g/plot. Higher values of this character might demand too much water for high seed yields under drought. Biological yield needs to be carefully studied for several seasons especially under drought conditions to have better understanding of the relationships between biomass, harvest index and seed yield and allow better selection of suitable genotypes. Rainfall quantities and distribution are erratic and different in every season in the moderate rainfall region of northern Iraq. Drought has occurred frequently during March and April.

Seed yield

The highest seed yield was obtained from lines 28, 20 and 14 (seed yield ≥200 g/plot). The other lines were in the range of 100-200 g/plot. Repeating the experiment for several seasons in several locations would allow a better understanding for GXE interaction under constraints such as drought and diseases.

Table Lentil 2.2.2 Growth of lentil lines selected from LIDTN06 during 2006 growing season at Rasheedya

Plot Number	Entry	Name	Plant ht cm	Biomass yield g/plot	Seed yield g/plot	Seed index g/100s
29101	17	FLIP2005-53L	30	700	176	-
29104	28	FLIP2006-97L	20	900	244	-
29106	19	FLIP2006-58L	25	300	174	-
29108	26	FLIP2005-94L	30	450	143	-
29109	27	FLIP2006-95L	30	450	122	-
29110	12	FLIP2005-32L	25	450	100	-
29111	18	FLIP2005-54L	30	500	137	-
29113	8	FLIP2004-58L	30	500	104	-
29115	4	FLIP2004-3L	35	1000	192	-
29119	29	FLIP2006-99L	30	900	135	-
29127	7	FLIP2004-44L	30	450	135	-
29129	20	FLIP2006-79L	35	600	227	1.2
29207	1	FLIP2002-7L	30	450	126	-
29212	2	FLIP2002-20L	25	600	155	-
29213	14	FLIP2005-38L	30	700	200	-
29223	28	FLIP2006-97L	30	650	139	1.8
29226	23	FLIP2006-90L	30	200	100	-

2.2.3 Lentil International Elite Nursery-Small Seed 2006 Al Rasheedya 3

Materials and Methods

The nursery consisted of 63 entries plus local check. The experiment was planted in Rasheedya Experimental Station at the moderate rainfall area of northern Iraq (350-450 mm annual rainfall). The soil is clay loam with good fertility. No fertilizer was used in the nursery. The design used was a Simple Lattice (8x8) with one replicate. The plot consisted two rows (4m long 0.25m apart). Plot area was $2m^2$ and the harvested area $1.5m^2$. Seeding rate was 400 seeds per plot. The seeds were treated with Vitavax 2200 fungicide and Actelic insecticide. Planting date was on 18 January 2006. Emergence started around 6 February 2006. Hand weeding was carried out on 26 March 2006. Harvest date was in the last week of May. Data collected were stand (%), plant height at maturity, biological yield (g/plot), seed yield (g/plot) and seed index (grams/100 seeds)

Results and Discussion

Results are presented in Table 2.2.3

Stand

The stand percentage was 3.8-10.3% of the seed planted (Table 2). This percentage is quite low, perhaps due to the delay in sowing date. Lines 26, 33, and 41 gave the highest stand (8-10.3%), whilst most of the lines were in the range 3.8 to 7.8%.

Plant height

The plant height for the selected lines ranged from 25 to 35 cm (Table 2). The tallest lines (35 cm) were 31 and 41, with the rest in the range 25-30 cm.

Biological yield
The range of biomass was 300-600 g/plot for different lines. Lines 28, 33, 54, 61, 41, and 43 gave biological yields of 450-600 g/plot. Some lines with high biomass production also gave high seed yields but the relationship was not strong (Table Lentil 2.2.3 and Figure Lentil 2.2.3). The rest of the lines had lower values with 31, 15 and 42 having the lowest at 300 g/plot.

Seed yield
The seed yield ranged from 43 to 127 g/plot. The highest lines were 28, 26, 33 and 54 at around 120 g/plot. The rest of the lines gave lower yield, with 15, 52 and 14 giving only 43-65 g/plot. The selected lines will be planted next season, for adaptation and GxE interactions with years and locations.

Seed Index
The seed index for the selected lines ranged from 0.7 to 2.6 g. The highest lines with a seed index ≥ 2.5 g were 1, 43 and 33 with 54 and 52 between 2-2.5 g. The rest of the lines gave a seed index below 2 g.

Recommendations

- plant the 17 selected lines at normal sowing times (mid-November) in 2006/07
- use a RCBD design with 3 replications
- use basal phosphate fertilizers
- record data on heading date, maturity date, harvest date
- select the best 4 lines for seed increase.

Table Lentil 2.2.3 Growth of lentil lines selected from LIEN-S-2006 at Rasheedya

Plot number	Entry	Name	Stand %	Plant height cm	Biomass yield g/plot	Seed yield g/plot	Seed index g/100
22106	28	FLIP 2005-31L	6.8	25	600	120	-
22109	26	FLIP2005-13L	8.8	30	400	127	1.8
22110	33	FLIP2005-25L	10.3	30	450	124	2.5
22113	54	FLIP2006-34L	4.5	30	450	116	2.1
22114	12	FLIP2004-13L	5.0	30	350	95	1.9
22119	3	FLIP1996-47L	5.0	30	350	94	-
22117	31	FLIP2005-23L	3.8	35	300	55	1.7
22124	58	FLIP2006-39L	5.5	30	350	54	1.7
22125	14	FLIP2004-17L	6.0	25	400	43	1.4
22126	61	FLIP2006-42L	6.3	30	450	87	0.7
22127	52	FLIP2006-32L	7.8	30	350	64	2.0
22129	44	FLIP2006-22L	6.8	30	400	125	1.9
22130	41	FLIP2006-18L	8.0	35	450	72	1.4
22131	1	PI339319	5.0	30	400	95	2.6
22144	43	FLIP2006-21L	5.0	30	500	98	2.6
22148	15	FLIUP2004-21L	3.8	25	300	65	-
22152	42	FLIP2006-20L	5.0	30	300	88	1.4

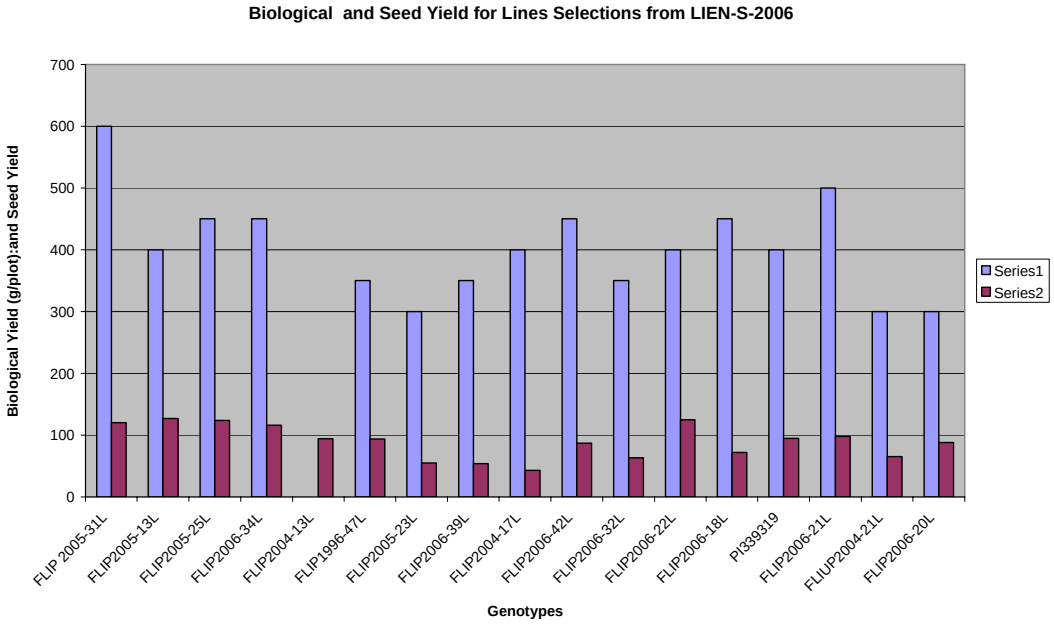

Figure Lentil 2.2.3 Biological and seed yield for selected lines from the nursery LIEN-S-2006 at Al-Rasheedya in 2006 growing

2.3 Faba bean

2.3.1 Faba bean International Improved S1 Populations Nursery 2006 Al Rasheedya

Introduction

Faba bean is one of important field crops in Iraq. It is planted in all areas of Iraq under both irrigation and rainfed systems. Traditionally, faba bean is planted during October to the end of November in northern Iraq under high rainfall conditions. The rate of seeding is 120 kg/ha for the local variety.

The nursery consisted of 5 S1 populations of faba beans. Names, pedigrees and sources are presented in Table 1. Three check varieties are used. The design of the experiment was RCBD with three replications. The eight lines were planted in 4 row plots, 4m long and 50cm apart. Planting was done in hills 20cm between plants within the row. One seed was put in each hill at 6cm depth. Climate parameters are presented in Table 2 and Figurers 1 and 2. The nursery was grown under rainfed conditions with one supplemental irrigation during March 2006. Sowing date was 15 January 2006. Flowering started on March 21and maturity was during the last week of May. Harvest was in the first week of June. Data were recorded for the two middle rows (5 plants taken at random) as follows:

- Branch number per plant
- Pod number per plant
- Seed Index (weight per 100 seeds)
- Biological yield (g/plant)
- Seed Yield (g/plant)

The trial data were analyzed as an RCBD using the Instat Statistical Package.

Results and Discussion

1. Climate

Table 2 presents the climate parameters for the season 2005-2006. The season started in December (11.2mm). The season was moist during January (142.7 mm) and February (134.7 mm) which caused flooding in the experimental area and caused low stand percentage in replicates 1 and 2. March was almost dry (21.9 mm). However, the season was good during April (94.7 mm) which saved the crop. The minimum temperature occurred in late December and January (Figures 1 and 2). It was around zero during a 4 days period in late December. Maximum temperature was good for normal growth conditions during March and April but high during May and June.

2. Seed Yield (kg/ha)

All entries exceeded the local entry in seed yield (Table3). Entry no. 3 gave the highest grain yield (2001 kg/ha) then entry no. 6 (1642 kg/ha) and entry no.2 (1446 kg/ha). The local gave the least seed yield of 990 kg/ha.

3. Seed Index (g/100 seed)

The seed index for different lines is presented in Table 3. Entries 1, 6 and 7 gave the highest seed weight. The largest was no.6 at 97.1g. Entry no. 7 was the second at 91.7g. These entries were among the large seeded types (ILB 1814 and Aquadolce) which are desirable for Iraqi consumers for direct boiled seed and green pods consumption

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For these reasons farmers continue to plant the large seeded types although they are lower in yield compared to small seeded types (64 to 67 g). The small seeded types could be very beneficial for the well known food stuff called Fool Mudamas or as forage legume crops for animal feed for poultry and other livestock. Entry no. 3 which is a small seeded type (60 g) but gave the highest seed yield (2001kg/ha) could be utilized for such purposes.

Further studies are required for the small seeded types in order for full expansion of broad bean release in Iraq. Another attraction for the use of small seeded types in Iraq is mechanization for planting and harvesting the crop. The high yield, small seed types have the good potential for this purpose in Iraq.

Table 1: Names and pedigree for Faba bean S1 populations planted at Al-Rasheedya during 2006 growing season.

Entry	Name	HD	MD	PLTH	Yld	SI
1	HBP/S0A 2005	76	131	56.7	1371	77
2	HBP/S0B 2005	76	131	51.2	1446	64
3	HBP/SOD 2005	76	131	56.7	2001	60
4	HBP/S1C/2001-F6	76	131	60.3	1173	67
5	HBP/S1D/2001-F6	76	131	64.0	1212	64.8
6	ILB1814 Syrian check	76	131	52.0	1642	97.1
7	ILB/1266Aqua Dolci	76	131	65.0	1313	91.7
8	Local check	76	131	76.0	990	57.7

HD = heading date; MD = maturity date; PLTH = plant height; YLD = seed yield; SI = seed index (100 seed weight)

Table2. Climate parameters at Al-Rasheedya site during the 2005-2006 growing season.

Days	Month	T. Max.	T. Min.	Days <oC	Days With Snow	RL. Max.	RL. Min.	Rainfall
1-15	October	34.19	16.5	0.0	0.0	56.4	19.6	0.0
16-31	October	27.59	10.81	0.0	0.0	60.3	22.63	0.0
1-15	November	23.20	6.81	0.0	0.0	70.3	28.3	0.0
16-30	November	21.27	7.05	0.0	0.0	84.1	46.4	0.0
1-15	December	23.29	6.64	0.0	0.0	83.2	0.0	0.0
16-31	December	14.08	4.56	4.0	0.0	95.8	0.0	11.2
1-15	January	13.10	4.19	0.0	0.0	77.9	61.9	101.6
16-31	January	10.81	3.02	1.0	0.0	94.1	61.8	41.1
1-15	February	14.22	7.32	0.0	0.0	93.2	-	134.2
16-28	February	16.57	5.48	0.0	0.0	86.1	-	0.5
1-15	March	20.91	8.35	0.0	0.0	85.3	38.6	1.4
16-31	March	21.70	8.56	0.0	0.0	88.8	43.8	20.5
1-15	April	24.50	12.51	0.0	0.0	90.6	46.6	33.9
16-30	April	25.87	16.01	0.0	0.0	87.8	46.0	60.8
1-15	May	30.51	16.35	0.0	0.0	81.2	35.3	0.0
16-31	May	35.76	18.49	0.0	0.0	61.4	22.0	0.0

Station Location: Longitude: 43E; Latitude: 36N; Altitude: 223m.

Lesson Learnt and Implications for 2006/7 Planning

For food legumes:

1. Major constrains:
    - Man power needed
    - Security
    - Lack of logistics – transportation
    - Need for movable fences to protect experiments
    - Seed storage
    - Seed production for elite varieties
    - Market distortion (unfavorable marketing environment due to very low prices of imported produce)
    - Reluctance to use fertilizers.
2. Changes needed for improved efficiency in project implementation
    - Change from public to private vehicles for project work
    - Need to concentrate on timely sowing
    - Timely harvesting to avoid grazing by sheep
    - Rebuild poultry feeding based on small-seeded faba bean genotypes
    - Seed containers required
    - No cold tolerance nursery
    - Supply of large-seeded chickpea.

Details: Faba Bean International S1 Populations 2007

Entry No.	Name	Pedigree	Origin	FAO Status
1	HBP/S0A/2005	20Crosses (Bot. x Asc.xEMxL.Tan)	ICARDA	U
2	HBP /S0 B / 2005	20 Crosses (Bot. Asco. X Oro)	ICARDA	U
3	HBP / S0 D/2005	28 Crosses(Incorp Bot. x Asco.)	ICARDA	U
4	HBP /S1C/2001-F6	19Crosses(Bot. x Asc.)	ICARDA	U
5	HBP /S1 D /2001-F6	24Crosses (Bot. xAsco. X Oro)	ICARDA	U
6	ILB1814	Syrian Local Large	Syria	D
7	ILB1266	Aqua Dolce	Spain	D
8	Local Check	Iraqi	Iraq	U

U = Undefined, D= Designated

Randomization for Faba Bean International Improved s1 Populations Nursery 2007
Randomized Complete Block

Plot Receiving Entry				
Entry	Rep 1	Rep 2	Rep3	Rep 4
1	5108	5208	5304	5408
2	5103	5201	5306	5403
3	5107	5203	5303	5407
4	5106	5205	5307	5406
5	5102	5206	5301	5402
6	5101	5204	5305	5401
7	5104	5207	5308	5404
8	5105	5202	5302	5405