

Review of background information on crop rotation under the rainfall conditions in Northern Iraq (June 2006)

Iraq-ICARDA-ACIAR Project (CIM/ 2004/ 024) Better Crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq

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At the meeting of the project (ACIAR CIM/ 2004/ 024) which was held at ICARDA, Aleppo on 4–8th September 2005 there was consideration on undertaking some crop rotation studies under rainfed conditions. It was agreed to review the literature and experience in Ninevah before proceeding with crop rotation work.

Rainfall area in northern Iraq is characterized by three distinguish rainfall zones:

1. Low rainfall zone (200 – 350 mm) covering the largest area of 957007ha arable land.
2. Moderate rainfall zone (350 – 450 mm) covering 537959 ha.
3. High rainfall zone (>450 mm) covering the smallest area of 92492 ha.

1- Limited Rainfall Zone

The following crop rotations studies which were accomplished in this zone are:-

- a. Effect of various rotations on wheat yield under dry land farming conditions of Hammam Al-Alil (Al- Fakhray, 1972).

Dryland farming is the main feature of agriculture in northern Iraq which covers on area of 4 million hectares. The crop production per unit area is very low due to insufficiency and irregularity of rainfall on the one hand and lack of technical knowledge about dryland farming on the other hand. Crop-fallow is the only rotation being practiced by farmers in this region.

The objective of this work was to study the effect of fallowing on wheat yield and determine the possible use of legumes as replacement for fallowing. The experiment was initiated in 1972/1973 and continued until 1977/1978 through which the study was repeated in three cycles. The experiments which were replicated four times consisted of four treatments:-

- 1- Wheat / fallow
- 2- Wheat / legumes (lentils) for seed
- 3- Wheat / legumes (lentils) to be plowed under
- 4- Continuous wheat.

The amounts of rainfall (mm) were:-

Growing Season

72/73	73/74	74/75	75/76	76/77	77/78
194.9	416.1	306.0	393.4	239.0	351.9

The results showed that under the treatment legume (lentils) to be plowed under, wheat has proved to be the best which has given the highest yield throughout the three cycles. This result indicates the possibility of using annual pasture legumes to replace fallow as a source for animal feeding either by light grazing or hay than plowed under. This will provide additional advantages of improving soil structure and soil fertility.

b. Jezira project (Australian team 1980 – 1984)

Five crop rotations were conducted in the area of limited rainfall (200 – 350 mm) at Agnadeen (Telafar) and at Hammam Al-Alil.

The three treatments were:-

1. Wheat/wheat.
2. Wheat/medics.
3. Wheat/fallow.

The results showed that there was no significant response for the crop rotation at Agnadeen (Telafar) and Hammam Al-Alil because of the dominance of wild barley for the period of the study.

c. The effect of forage and food legumes on the production of wheat under limited rainfall conditions in northern Iraq (Al-Fakhray, Ali, 1988).

The study includes four treatments were:-

1. Wheat/fallow.
2. Wheat/forage mixture.
3. Wheat/annual medics.
4. Wheat/lentils.

The results showed superiority of wheat yield cultivated after lentils, forage mixture and annual medics of a ratio of 25 %, 5 % and 15 % respectively, in comparison with wheat yield after fallow. In addition, there was a benefit of producing feed material from forage legumes and lentils in the growing season of 1985/1986 and 1986/1987.

d. Replacement of fallow by forage legumes in cereal rotation under rainfed conditions (Kasim, Mohammed, 1995).

A field experiment was conducted at the farm of the college of Agriculture and Forestry at Hammam Al-Alil for the three successive seasons of 87/88, 88/89 and 89/90 under limited rainfall zone (200–350 mm) to study the replacing of the fallow system by introducing medics in cereal rotation.

The study consists of four treatments as follows:-

1. Wheat/wheat/wheat
2. Wheat/medics
3. Wheat/medics/medics
4. Wheat/fallow.

The amounts of rainfall (mm) were:-

Growing Seasons

86/87	87/88	88/89	89/90
209.9	537.9	252.9	326.0

The results showed that continuous wheat cultivation resulted in depression in wheat yield by 34 % in comparison with fallow treatments and, on the contrary, the wheat yield was increased by 9% and 21% when cultivated after one and two growing seasons of medics (*Medicago* spp. L.) treatments, respectively.

e. Crop rotation which was established by Mashreq project (ICARDA) under limited rainfall area.

In 92/93 and 93/94 growing seasons crop rotation was established under limited rainfall conditions (200–350 mm) at four locations: Tel-Asmir, Ain-Talwai, Musltan and Hatra. The crop rotation consisted of five treatments as follows:-

1. barley/fallow
2. barley/ barley
3. barley/vetch
4. barley/medics
5. barley/mixture.

Vetch = *Vicia sativa* L.

Medics = *Medicago* spp. L.

Mixture = 75 % vetch + 25 % barley

The amounts of rainfall (mm) were:-

Locations

Tel-Asmir		Ain-Talwai		Musltan		Hatra	
91/92	92/93	91/92	92/93	91/92	92/93	91/92	92/93
-	-	398.8	571.9	232.2	251.2	233.2	251.0

The results showed that there was a tendency for increased yield of barley which was cultivated after vetch, medics and mixtures at a ratio of 33%, 31% and 15% respectively, in comparison with the treatment fallow/ barley, whereas the treatment barle/ barley was depressed by 43% in comparison with fallow/barley treatment.

f. Al- Fakhray, Ali (1988) reported two similar studies. These studies revealed that wheat yield cultivated after forage (*Vicia narbonensis* + barley) was increased by 5% in comparison with fallow treatment. Another study revealed that there was increase in wheat yield cultivated after forage mixture by 16 % in comparison with fallow treatment. The amount of rainfall was 298 mm. Another study accomplished by the same authors indicates that there was increase in wheat yield cultivated after fallow and lentils by 34 % and 14 % respectively, in comparison with fallow treatment. The amount of rainfall was 204 mm.

2- Moderate Rainfall Zone (350 – 450 mm)

The following crop rotations were accomplished at this zone.

a. Jezira project (Australian team 1980-1984)

Five crop rotations were conducted in the area of moderate rainfall at Rabiaa by an Australia team.

The number of treatments was three as follows:-

1. Wheat/wheat.
2. Wheat/medics pasture.
3. Wheat/fallow.

The result showed that cultivated wheat after fallow gave the highest yield of 2.65t/ha whereas continuous wheat gave yield of 2.1 t/ha and the wheat yield after medic pasture treatment was 1.83t/ha, because of domination of wild barley as a weed.

b. Crop rotation which was established by Mashreq project (ICARDA).

A field experiment was conducted under the moderate rainfall zone at Tel–Murak location for the growing seasons 91/92 and 92/93 to study the effect of pulse crops lentils and chickpeas on the following subbarley yield. The amount of rainfall (mm) was:

Growing season

91/92 92/93

411.6 500.8

The study consisted of four treatments:-

1. barley /fallow
2. barley /lentils
3. barley /chickpeas
4. barley / barley.

The result showed superiority of the barley/lentils treatment over barley/fallow, barley/barley and barley/chickpeas treatments by 4%, 32% and 48% respectively.

3. High Rainfall Zone (> 450 mm)

The area of the high rainfall zone is very small and does not exceed 92492ha. There is no crop diversity. The traditional farming system is cultivation of mainly wheat, chickpeas and melon in small areas. In the traditional farming system in the area of moderate rainfall, farmers cultivate wheat after lentils. Also, farmers cultivate spring chickpeas in small areas in rotation with wheat at high rainfall zone. In addition to, some farmers in the same area cultivate melon.

Conclusion

According to the previous results and activities on crop rotation in the three rainfall zones, the conclusion should be made here that there is no need to do further work than what had been done so far as the benefits of including food and forage legumes in the rotations are clear and consistent. There is no problem with crop rotation at moderate and high rainfed zones. There is a problem with area under limited rainfed zone, where the people are trying with some difficulties to push forage legumes such as vetch (*Vicia sativa* L.) and annual medics (*Medicago* spp. L.) in the form of pure stands or mixed with barley for sheep grazing.

One of the difficulties is how to convince the farmer to change the traditional farming system of barley/fallow and to adopt the new farming system of barley/forage legumes. Another problem is that the area which is allocated for each farmer (about 25 ha) is very small for crop rotation and is not sufficient for farmers to follow the new system under

rainfed conditions in northern Iraq especially under limited rainfall. Land availability is constrained by the system called share cropping i.e. where one person from outside the countryside mainly from city holds large areas from small farmers.

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