Impact of Winter-sown Chickpea Technology in Syria

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Introduction

Chickpea is second most important rainfed food legume crop in Syria, following only lentil in terms of area planted. This has been the case for the past twenty five years. Over the same period, the place of chickpea in terms of percentage of area planted to rainfed crops has remained relatively constant at about 2% of total annual rainfed crop area. Annual production, however, has trended upwards during the period 1981– 2005 at an average rate of only 1.6% per annum. Estimated annual growth rates of the area during the same period were 1.4% and for the yield was only 0.29%. Although there has been a noticeable trend towards increasing area planted to chickpea, the trend in increased production is less noticeable due to the downward trend in yield (figure 1). It was initially to reverse this downward trend that the new winter varieties were developed. Winter-sown chickpea promises to solve many problems through Ascochyta resistance, higher yield potential, more productive use of land, serve to stabilize chickpea area, and sustain the farming system.

ICARDA in collaboration with the Department of Agricultural Extension and General Commission of Scientific Agricultural Research in Syria (GCSAR) have been playing a vital role in dissemination of winter chickpea technology in Syria. Many filed days were organized by ICARDA and the Syrian National Programs in the farmers' fields; small amount of new varieties seeds have been distributed to chickpea producers, in addition to print some publications on winter-sown chickpea.

Currently, the recommended winter-sown chickpea package comprised two components: main and optional components. The main component included:

- Using improved varieties: Ghab 3, Ghab 4, Ghab 5
- Seed rate: 120 Kg/ha
- Planting date: First half of January
- Chemical seeds treatment
- Protecting spray against fungi during the second half of March
- Weed control when plant high reach 10 cm

The optional Components:

- Reliable Seed source
- Using drill for planting
- Fertilizer rate: 100 Kg/ha of super phosphate
- Using herbicide before planting
- Using mechanical weed control
- Using additional spraying (1-2) times when needed

A socioeconomic study was conducted with objectives to:

- Document the adoption of winter chickpea in Syria
- Identify both biological and socioeconomics constraints that influence adoption process
- Assess the impact of this technology on rural household's livelihoods in terms of income increase, food security, and labor opportunities by gender

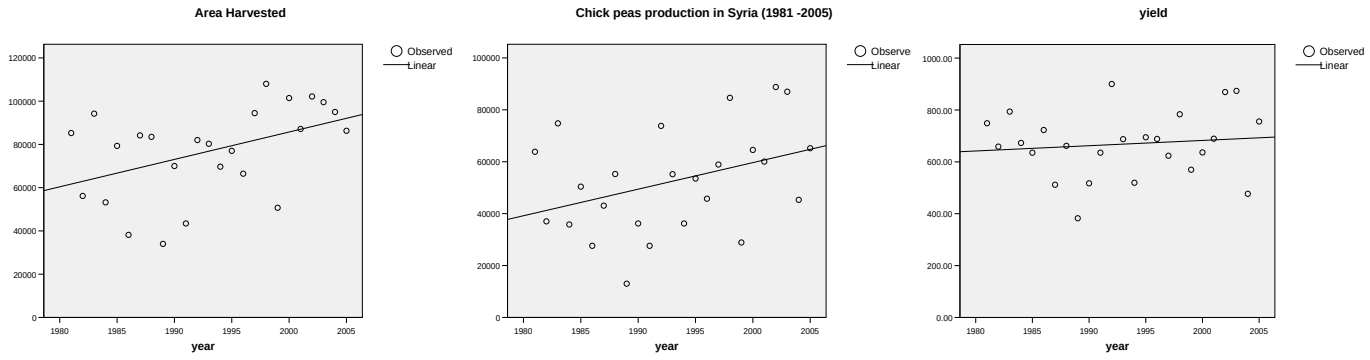


Figure 1 Area, production, and yield of rainfed chickpea in Syria

Farmers' perception on winter chickpea

Farmers' assessments of new varieties provided insights into the farmers' adoption decision behaviour. Understanding the criteria that farmers use to evaluate new crop varieties allows breeders to effectively set priorities and target different breeding strategies to different communities in the dry areas. For this purpose, farmers were asked to rank the factors affecting productivity of winter chickpea technology. It is important to note here that these farmer assessments were not facilitated by any agricultural professional, hence they are independent, individual, farmers' views based on their own judgments of the performances of the varieties and their preferences. Ascochyta blight, Insects & diseases, and weed were the most important three factors affecting the productivity of winter sown chickpea

(Table 1). Variety is important factor but was ranked as moderate by the surveyed farmers.

Table 1: Factors affecting productivity of winter chickpeas (% of farmers)

Factor	No affect	Low	Moderate	High
Variety	14.9	6.0	43.4	35.8
Previous crop	18.0	17.4	39.6	25.0
Date of sowing	4.7	5.6	39.4	50.3
Method of sowing	14.9	13.6	43.7	27.8
Seed rate	6.3	8.5	43.9	41.4
Seed treatment	8.2	12.3	30.4	49.1
P application	21.5	10.9	29.3	38.3
Insects & diseases	3.8	5.8	19.9	70.5
Weeds	2.2	5.0	27.1	65.6
Ascochyta blight	4.2	8.0	15.7	72.2
Credit	29.1	15.2	32.1	23.5
Marketing	24.5	15.4	28.1	32.0

The ranking of winter chickpea varieties compared to the spring cultivar was done by farmers who planted the varieties and observed their yield performances and other attributes. Farmers indicated that the characteristics of winter chickpea were better than spring chickpea except for grain size, grain color, and price of grain (Table 2).

Table 2: Comparing characteristics of winter chickpea to spring chickpea (% of farmers)

Characteristic	Winter is better	Spring is better	No difference	No idea
Frost resistance	64.2	8.3	6.1	21.3
Ascochyta resistance	48.9	16.9	11.4	22.8
Drought resistance	38.2	21.2	13.2	27.4
Yield under marginal conditions	54.7	7.4	9.9	28
Earliness of maturity	72.3	6.1	2.5	19
Needs more weeding	54.6	8.7	17.9	18.9
Easiness for mechanical harvest	71	1.8	5.6	21.5
Resistance to shattering	27.6	12.4	30.9	29.1
Grain size	11	69.1	4.1	15.9
Grain color	14.5	53.7	11.9	19.9
Grain yield	66	7.9	6.1	20.1
Straw yield	34.6	21	19.4	24.9
Cooking time	30.4	11.6	13.4	44.6
Price of grain	14	58.4	9.2	18.4
Taste	15.6	26.8	20.8	36.9
Consumer demand	23.5	39.3	14	23.2

Measuring adoption and diffusion of winter- sown chickpea

Three adoption indicators were used in this study to measure the adoption: (1) Adoption rate which represent the percentage of farmers adopting the technology, (2) Degree of adoption which represent the proportion of land under the new technology, and (3) Intensity of adoption which equal to adoption rate time degree of adoption. Table 3 show theses indicators by stability zones, provinces, and wealth quartiles. Adoption of winter chickpea is expanding in Zone 2 which is drier compared to Zone 1 and not traditionally a chickpea production area. As a result, Aleppo province that covers part of Zone 2 also show high intensity of adoption compared to other provinces. Dar'a is a traditional chickpea production area; however, due to the lack of extension support to farmers, adoption is relatively low. It is also evident that the intensity of adoption is highest for well-off farmers. Poorer farmers are sensitive to the risk associated with early adoption of any new technology, and takes time to observe the positive effects before increasing adoption intensity.

Table 3: Adoption rate and adoption intensity of winter chickpea varieties

	Area of winter chickpea	Total chickpea area	% of winter chickpea	Adoption rate (%)	Adoption intensity (%)
Zone:					
Zone 1	1.2	1.8	65.7	64.0	42.0
Zone 2	3.0	4.6	65.8	72.7	47.8
Province:					
Aleppo	2.3	2.6	85.6	75.0	64.2
Idleb	1.3	2.0	67.8	66.2	44.9
Hama/El Ghab	1.0	1.4	68.1	63.8	43.4
Dar'a	1.8	4.7	37.8	43.6	16.5
Wealth quartiles					
Lowest 25%	0.8	1.4	56.6	56.5	32.0
25%-50%	1.1	1.8	64.7	64.6	41.8
50%-75%	1.1	1.7	66.0	67.5	44.5
Highest 25%	3.0	4.6	65.7	73.3	48.1
Average	1.6	2.4	65.7	66.0	43.4

The Syrian Extension Agent has provided farmers with full package and it was farmers' decision on the uptake of individual components or the full

package. Results of this study indicated that only three farmers adopted the full package and most farmers adopted one or few technology components in addition to winter chickpea variety. Tables 4 summarized adoption rate for the main and optional technology component associated with using winter-sown chickpea varieties. In addition to the new variety more than 50% of farmers adopted planting date, seed treatment, fungi and weed control. These results are consistent with previous adoption studies which showed clear tendency of farmers toward the adoption of individual technological components compared to full package adoption.

Table 4: Adoption rate of winter-sown chickpea components (% of farmers)

Component	Zone 1	Zone 2	Both zones
Main components			
N of observations	253	77	330
Seed rate	38.7	13.6	32.7
Planting date	53.6	40.5	50.7
Seed treatment	49.0	63.6	52.4
Fungi control	69.9	50.6	65.5
Weed control	98.0	79.2	93.6
Full package	1.1	0	0.9
Optional components			
Reliable seed source	72.1	61.0	69.1
Using drill	64.1	57.3	62.5
Appling super phosphate fertilizer	70.3	44.2	64.2
Appling 100 Kg/ha of super phosphate	22.5	23.3	22.7
Using herbicide before planting	29.2	11.7	28.2
Using mechanical weed control	8.7	0	6.7
Using (2-3) spraying against Ascochyta	18.9	7.8	16.4

A quantitative relationship between adoption and influencing factors was established by using Logit Model to predict whether a farmer will or will not adopt the new technology. The result indicated that there were many factors influencing adoption of winter chickpea varieties, the most important one were zone, total holding area, having irrigation source, farmer's age,

chickpea yield obtained by farmer, wealth index, and participating in field days.

The time dimension is essential in the diffusion process; it is an important aspect of any communication process. Researchers (Rogers 1983; CIMMYT 1993) have shown that adoption of an innovation when plotted against time often follows a normal distribution curve. If the cumulative number of adopters is plotted over time, the resulting distribution is an S-shaped curve, and the logistic curve is the most common way of representing technology diffusion.

Based on the time-series data of the number of adopters of winter chickpea varieties which were gathered in this study, the coefficient values of the logistic functions which gave the best fit of the time-series data was estimated, and the actual and predicted cumulative percentages of adopters is shown in Figure 2. Adoption is increasing at an accelerating rate and it is expected that its maximum (90%) will be reached by 2015.

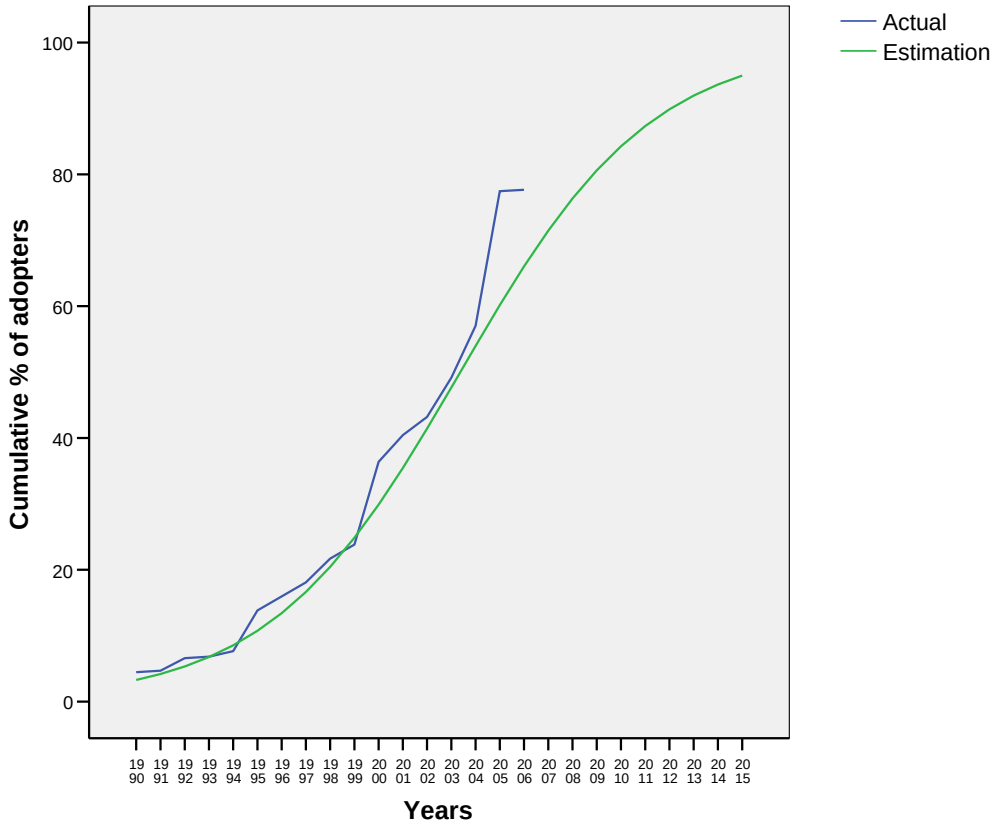


Figure 2: Diffusion of winter chickpea varieties

Adoption and diffusion of new technology is essential to achieve the impact. Traditionally, impact is assessed by measuring the effect of new technology on productivity and profitability. Recently, other indicators are used to measure the impact such as the impact on household income, poverty reduction, labors requirement, and water productivity.

- **Impact on productivity**

Results show that the winter-sown technology had a positive effect on crop productivity. Yields obtained by farmers, in both zone 1 and zone 2, who adopted the full or some components of the technological package were higher compared to non-adopters during good, normal, and dry years (Figure 3). The magnitude of the yield difference between winter and spring chickpea obtain by farmers varied from 33% to 54% in Zone 1, and from 9% to 61% in Zone 2, and depended on the rainfed season and other climate condition. Improved variety was an important component in increasing yields; spatial distribution of yield gain due to shifting to winter production using improved varieties, the average increase is estimated by 32% in Zone 1, and 18% in Zone 2

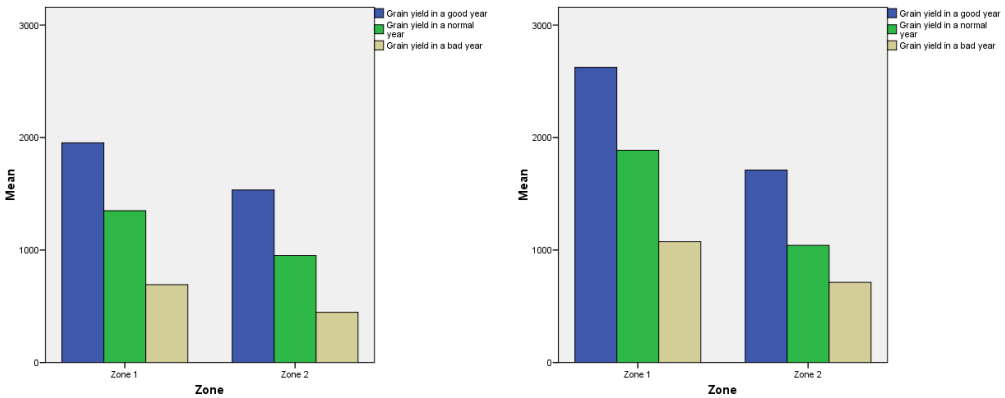


Figure 3: Estimated average chickpea yields in good, normal, and bad seasons

- **Impact on profitability**

Winter chickpea is profitable technology for farmers, it is possible to increase the net revenue by more than US$ 200 per hectare, and the ratio of

the net revenue increase to the additional costs is about 318%. All categories of farmers very poor, poor, moderate, and well-off (Table 5) obtained higher net revenues from winter chickpea as opposed to spring one. This result provides evidence of the appropriateness of the technology for all type of farmers.

Table 5: Costs and revenue of spring and winter chickpeas

	Spring			Winter		
Wealth quartiles	Total Revenue	Total production costs	Net revenue	Total Revenue	Total production costs	Net revenue
Lowest 25%	50288	16098	34191	63122	19684	43437
25%-50%	45689	14641	31048	58074	18818	39256
50%-75%	46079	15960	30119	59935	18278	41657
Highest 25%	46458	16569	29889	62404	19204	43201
Average	47404	15839	31565	60869	18974	41895

- **Impact on household income**

The average annual household income in the sample was estimated at US$ 13,900. The contribution of chickpea in the total household income represented about 21%, which is distributed between winter chickpea (14%) and spring chickpea (6%) came from. This contribution was higher for the farmers who grew winter chickpea, and for the poor farmers compared to well-off (Figure 3).

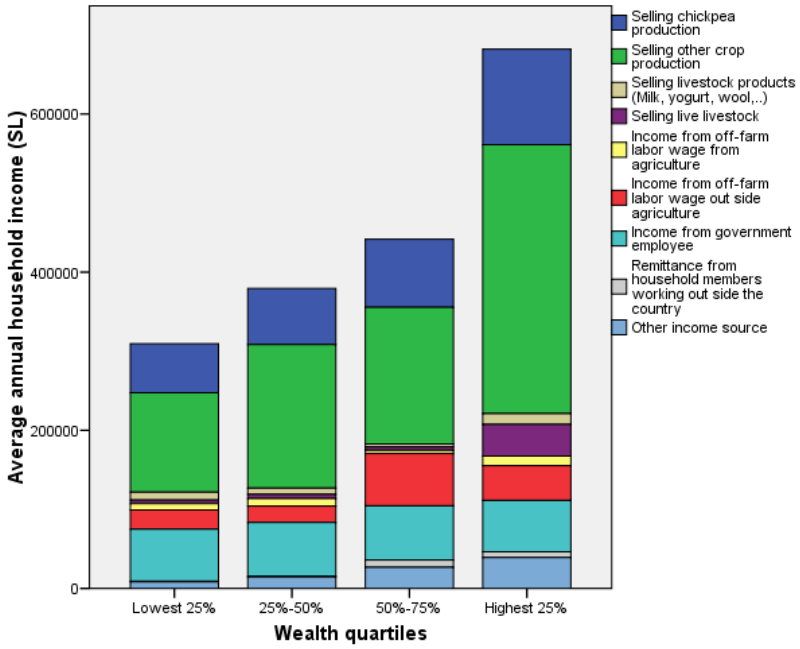
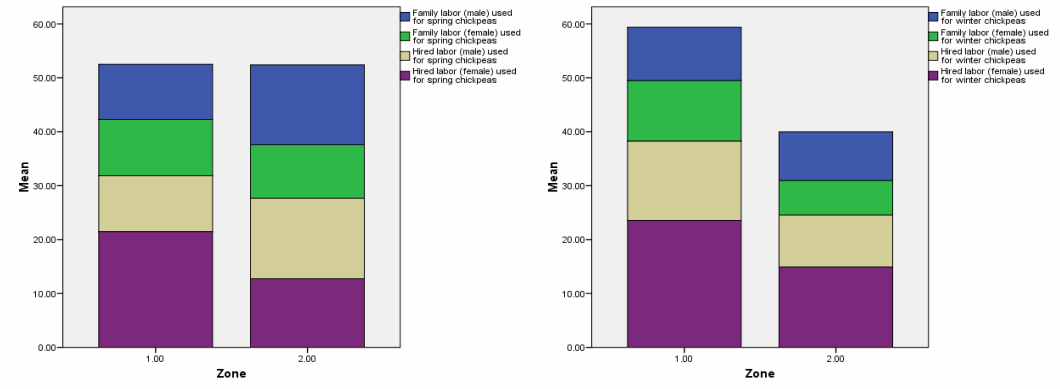


Figure 3: Average annual household income by wealth quartiles

- **Impact on labors**

Figure 4 show the estimation number of labor needed per hectare by gender for winter and spring chickpea for Zone 1 and Zone 2 in Syria. There is clear indication that winter chickpea increase labor requirement for certain operations such as weeding. Because weeding operations are mostly carried out by family and non-family female labor in rural areas, increased adoption of winter chickpea provides more opportunity for women to find work.



Spring chickpea **Winter chickpea**

Figure 4: Estimated number of labors needed per hectare for winter and spring chickpea

- **Impact on water productivity**

  Water productivity indicator is measured in this study as the ratio of plant productivity (yield of chickpea) to rainfall rate. Based on the data collected from farmers on chickpea and obtain from Extension Agent on the rain, It is estimated that in average each 1mm of rain (Equivalent to 1 M^3 of water) produce 5 kg of winter chickpea compared to 3.6 kg for spring one. This productivity was varying according to amount of rain and its distribution due the season. However, water productivity was higher for winter chickpea than spring in all administrative districts where this study took place (table 6).

Table 6: Water productivity by distracts

District	Spring chickpea	winter chickpea
Izaz	3.5	4.1
Samaan	3.5	5.5
Efreen	2.4	6.6
Idleb	4.2	5.4
Ariha	2.3	3
El Ma'arra	4.8	5
El Ghab	3	4.9
Mesiaf	5	8.6
Dar'a	2.9	2.4
Izra'	2.8	3.1
Sanamein	3.1	4.2
Average	**3.6**	**5**

Conclusion

Based on this survey and analysis, it is possible to conclude that winter-sown chickpea technology is expanding in the study area. Ascochyta blight, insects, diseases, and weed were the most important factors affecting the productivity of winter sown chickpea in Syria. Variety is widely adopted and most farmers have in addition adopted other components of the recommended package. Expansion of winter chickpea area in Zone 2 was clearly noticeable. The technology is profitable and proved appropriate for all types or wealth categories of farmers who obtained high net returns from growing winter-sown chickpea. Household incomes from chickpea increased following adoption of winter-sown varieties and the positive impact is relatively greater among poor farmers. Similarly, employment opportunities were created for female labor and water productivity increased in terms output per millimeter of rainfall.

Winter chickpea dissemination trial

Training of National Extension and Research Systems in Syria on Implementation of Adoption and Impact Studies

Farmer's Field Planted by Winter Chickpea Seeds obtained from ICARDA

Seeds distribution to farmers

Farmers' field day in Idleb