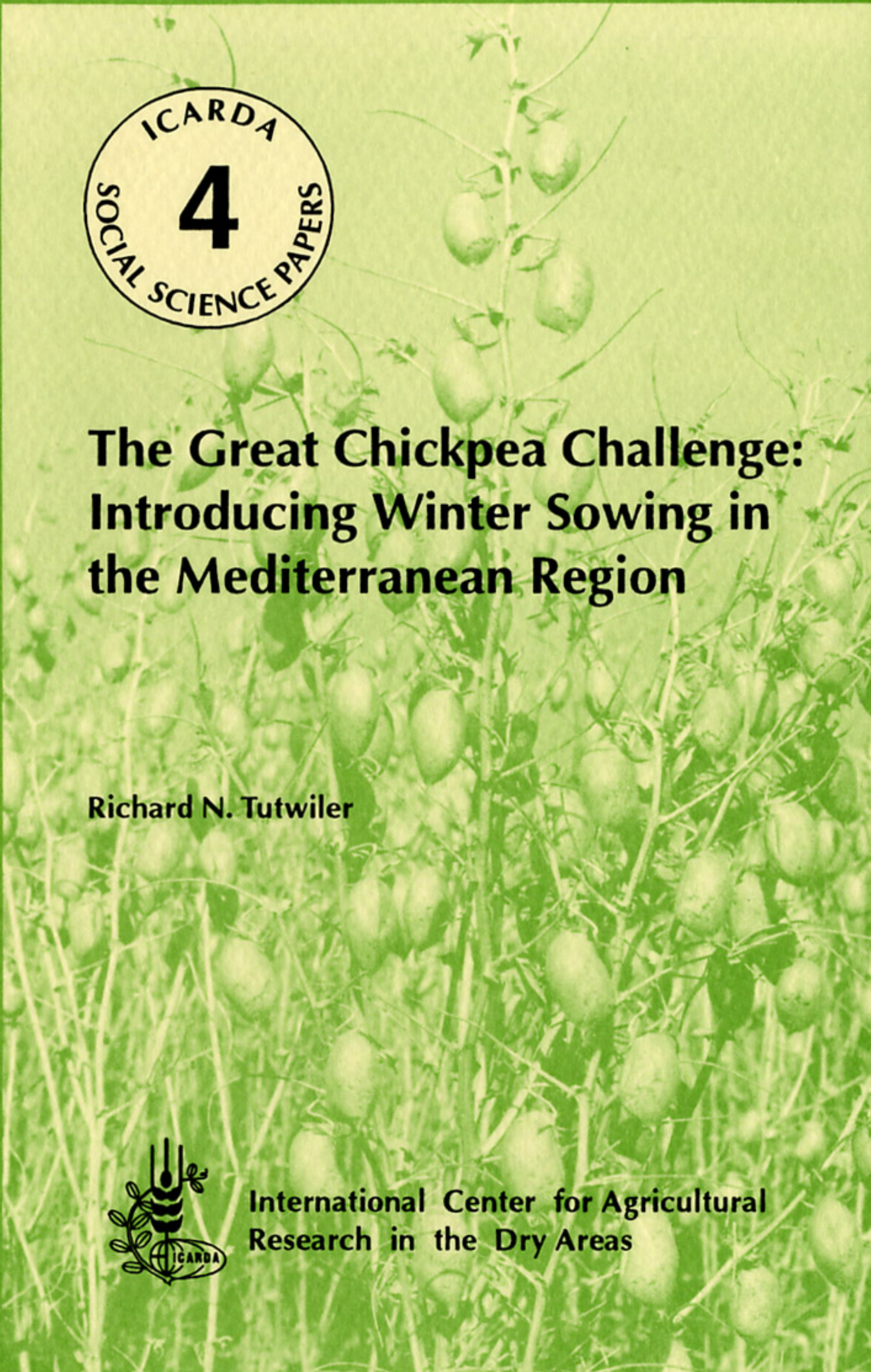

ICARDA
4
SOCIAL SCIENCE PAPERS

The Great Chickpea Challenge: Introducing Winter Sowing in the Mediterranean Region

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ICARDA Social Science Papers

This is the fourth of the ICARDA Social Science Papers, a series which we hope will make a worthwhile contribution to sustainable agriculture in the West Asia and North Africa (WANA) region.

ICARDA Social Science Papers present the results of on-going research both within the Center and in collaboration with national program partners in the Region. The series is designed to disseminate findings widely in order to encourage discussion and comment on improved agricultural technologies, their use and benefits — including the sustainability of small-scale food-production systems. So that this can be done as quickly as possible, the papers are not subject to the rigorous approval procedures of more formal publications. But each one is subject to peer review by a panel of ICARDA senior social scientists before publication.

The papers are intended to be more substantial in content than journal articles, and to present technical material in such a way as to be accessible to colleagues in all disciplines, including interested readers with general backgrounds in agriculture and economic development.

The papers are particularly aimed at scientists and researchers within the national agricultural research systems of WANA, the international research community, policy-makers, donors and international development agencies.

More titles are planned in the near future. It is hoped that they will indeed stimulate thought and debate on sustainable agriculture — as a subject in itself, and as a component in the continuing economic development of the region.

Acknowledgements

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Summary

Kabuli chickpea is crucial to the diet of many who live in the West Asia and North Africa (WANA) region. But, while there has been some increase in production over the last few years, most of this has been in Turkey—and it has come from area expansion, not from higher yields.

Elsewhere in WANA, production has failed to show a consistent year-on-year increase. Moreover, the area planted to chickpea has fluctuated dramatically from one year to another, with corresponding peaks and troughs in production.

This is not good for anybody. It is unhelpful for agricultural and economic planners at the national level. It means an unstable market in chickpae--an important staple; this is bad for consumers.

And it is, surely, not good for farmers, who are unable to plan for land use and income. So why do they vary the area they plant to chickpea to this extent?

The answer lies in the farming systems of the region. Chickpea is planted in spring, and makes use of residual ground moisture from winter rains. By spring, the farmer will know whether the rain has been sufficient that season, and whether it is worth planting his chickpea crop. Often it is not; hence the wild swings in chickpea area.

There is a need both to stabilize production and improve yields of this consumer staple. The challenge referred to in the title of this paper is that of finding a chickpea technology that can improve yield, without exposing farmers--especially poorer ones—to the risks they now avoid through their spring planting decision.

The answer could lie with winter-sown chickpea. It has several advantages: it can take more advantage of winter precipitation, resulting in higher yields; there is higher stand at maturity, making mechanical harvesting an option; and the harvest is four to six weeks earlier, away from the cereal harvest, so that labor costs are lower. And, with winter sowing, the decision to plant must be taken before the extent of winter rain is clear. So the area should stabilize, especially if yields are high enough.

ICARDA is closely associated with the development of winter chickpea varieties. In 1989 it went into partnership with a number of national programs to assess the acceptability of winter-sown chickpea. This was to be done by establishing a dialogue with farmers so that scientists could better understand exactly what they need from chickpea, and whether the new winter-sown varieties really meet those needs.

The paper that follows presents the results of that dialogue in two countries, Morocco and Syria. Overall, they are encouraging; but there is both success and failure.

Morocco needs to concentrate on seed size, as its markets discriminate against smaller seeds; consumers like their chickpeas boiled and whole. This was less of a problem in Syria, where people eat chickpea in pureed form (for example, as hummus).

Ascochyta-blight resistance is a serious issue in both countries---to the extent that chickpea cultivation of any kind is currently suspended for three years in one Syrian province, in order to control the disease.

Cold tolerance is important in Syria, where the winter can be quite severe. Climatic factors are extremely important. And there may be an "information gap". Farmers in Syria thought that some of their neighbors did not adopt winter chickpea technology because they didn't know enough about the necessary weed control and agronomic practices.

These can be dealt with. There are now large-seeded, ascochyta-resistant varieties being bred from ICARDA lines, and three have just been released in Spain. And the "information gap" is a matter for extension services.

However, in both countries, there was a commercial dimension. It was found that farmers judge success or failure of this technology by net return, not yield as such.

It was also clear that winter chickpea must fight for its place in the farming system. Farmers did not compare net returns with spring chickpea alone. Rather, they compared chickpea in general with alternative crops. We have found the answers, or some of them, to the challenge of chickpea production; but farmers face the challenge of the economic system as a whole.

The Great Chickpea Challenge: Introducing Winter Sowing in the Mediterranean Region

1. Chickpea in West Asia and North Africa

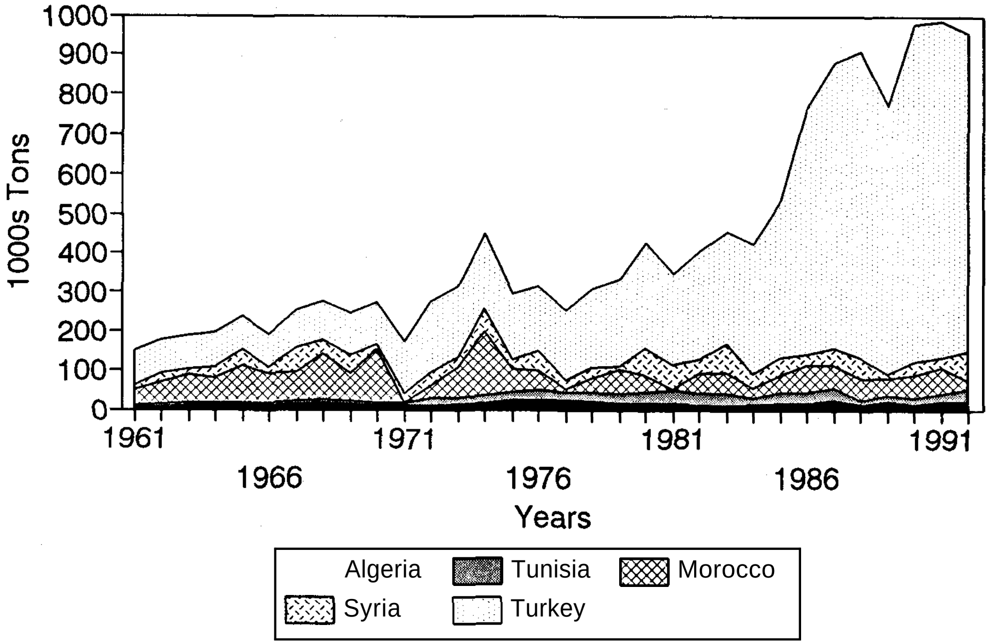
Problem Identification

The kabuli type of chickpea *(Cicer arietinum* L.) is an integral part of both the rural diet and the dryland farming systems in West Asia and North Africa (WANA). It provides an important source of protein and income for resource-poor farmers. The past 15 years have witnessed spectacular growth in regional production levels, from around 300 thousand metric tons a year in the late 1960s and 1970s to close to a million in the 1990s (Figure 1). At the international level, this reflects a rising demand for, and volume of trade in, chickpea, with a threefold increase since the mid-1970s (Kelley and Rao 1992). Turkey accounts for almost all the increase and now represents over 80% of WANA chickpea production. Four other Mediterranean countries (Algeria, Morocco, Syria, and Tunisia) comprise most of the remainder, with only a tiny contribution from Egypt, Iraq, Jordan, and Lebanon.

Despite the recent emergence of improved production technologies, almost all the growth in chickpea production has come from area expansion (Figure 2), most of which can be attributed to the Turkish "Utilization of Fallow Areas" project (Keatinge *et al.* 1994) and an attractive export incentive policy of the government (Kelley and Rao 1992). Indeed, as Turkish chickpea production moves into lower potential environments, national per hectare yield levels have tended to fall. Nor have other major producers been able to improve yields significantly. WANA yields are characteristically low; national levels are generally between 1000 and 500 kilograms per hectare. It is not unusual for them to fall below 400 kg/ha, particularly in North Africa (Figures **3** and 4).

Why have yields not risen, despite the availability of improved technology and a favorable international market? Much of the answer lies in the traditional system of chickpea production in Mediterranean WANA countries. The key to understanding farming practices in WANA environments is the climate; there are extreme variations in annual precipitation and capricious distribution of rainfall within seasons. These translate directly into annual yield variation for the principal cereal crops sown in the autumn before the rainy season.

Figure 1. Chickpea Production in WANA

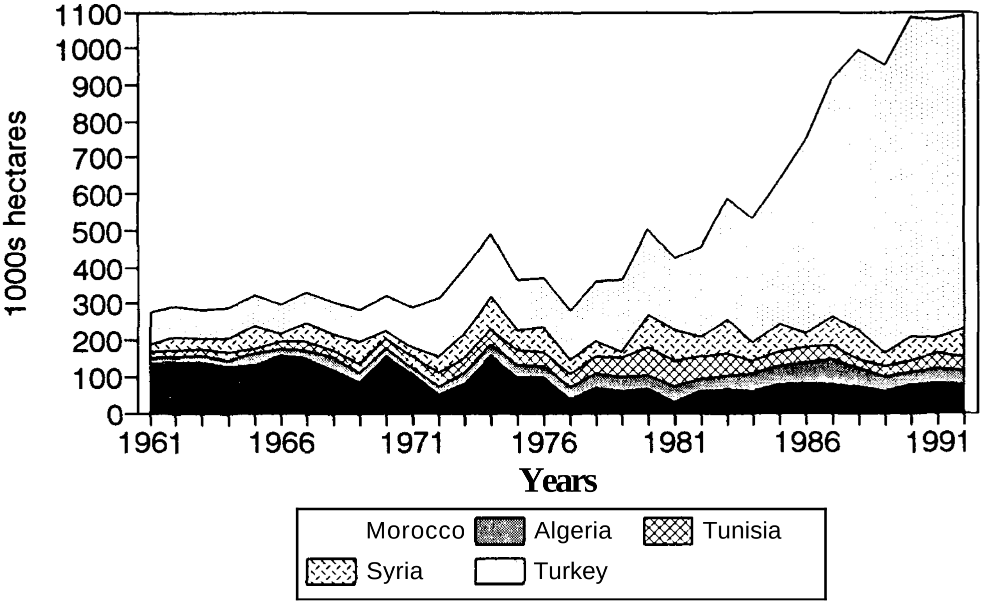


Source: Agrostat

However, chickpeas are planted in the spring (March to May) and are largely raised on residual soil moisture, since precipitation tends to occur during the winter months. This restricts yields, and spring planting also means that the reproductive growth phase coincides with sharply increasing and possibly limiting temperatures. However, uncertainty is reduced, as the farmer already knows what moisture availability—and, therefore, prospective yield—is likely to be that year. In dry years, many farmers choose not to plant, thereby saving the cost of production and avoiding the risk of crop failure. This is especially important for the poorer producers. And land not sown can be left fallow to store moisture for the subsequent cereal crop and/or used as a weedy pasture for household livestock.

Because farmers may or may not plant spring chickpea, variations in regional production are mostly due to fluctuations in annual area rather than yields (Kelley and Rao, 1992). In fact, yield of chickpea is more stable than production figures imply. For Syria, a comparison of coefficients of variation (CVs) for yield among rainfed crops in drier areas shows that spring chickpea has the lowest among the major winter-sown crops, particularly the dominant cereals (ICARDA, 1979). In fact, during the same period of comparison, the CV for precipitation was higher than for chickpea yield levels (although wild fluctuations ***can*** occur-as in Morocco; see below).

Figure 2. Chickpea area in WANA



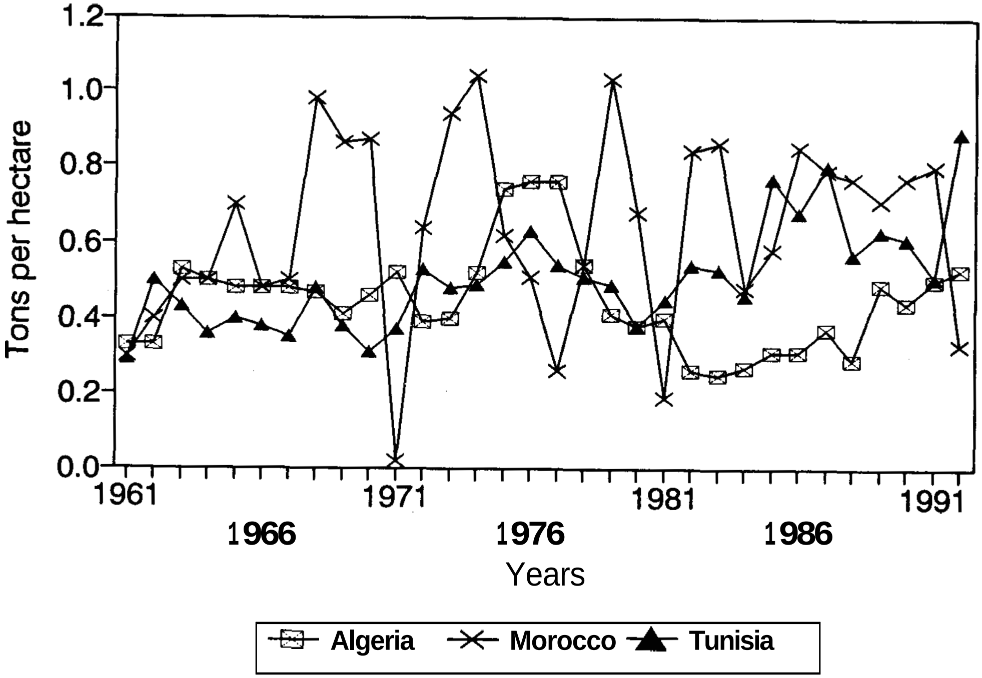
Source: *Agrostat*

There is an additional economic advantage in spring planting; it reduces weed-control costs. Weeds can present a serious problem for winter crops because, like the crops themselves, weeds benefit from the rain falling during the winter months. Their greatest period of growth coincides with that of the winter cereals. A spring chickpea producer destroys most of the winter weeds when the field is prepared for seeding, leaving only the lesser spring weeds to contend with during the chickpea-growing season. This can save considerable labor costs over winter crops. A further labor benefit is that labor demand can be spread over the season, avoiding conflict with cereal planting. However, spring chickpeas can present a conflict at harvest time, as they mature at about the same time as wheat and must be hand-harvested because of their low stature.

Chickpea may not be an especially high-yielding crop, but it occupies an important niche in the rainfed farming system of resource-poor farmers. It is a relatively dependable and low-risk enterprise in an extremely risky rainfed farming environment dominated by winter cereal production.

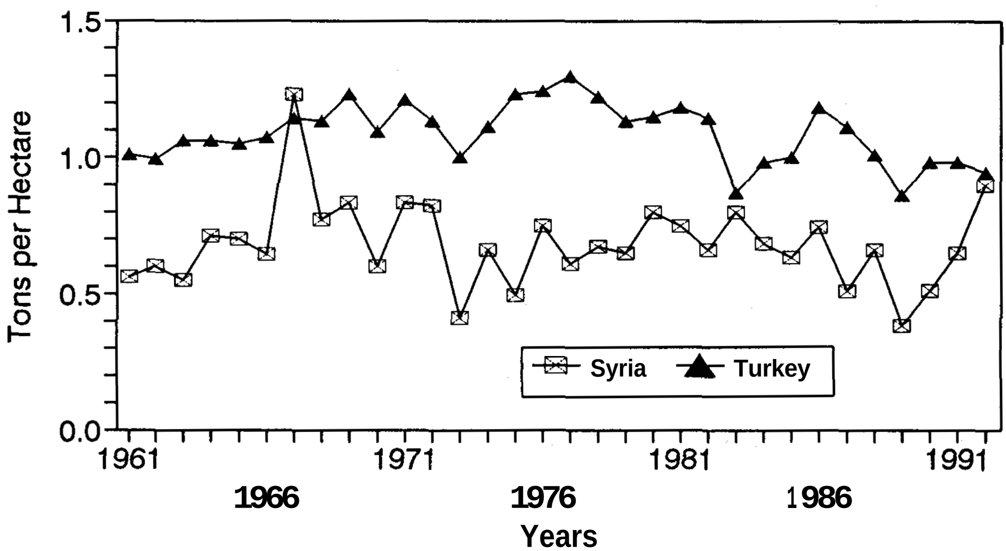
It is important to keep in mind, however, that the decision to produce chickpea at the farm level is often the result of factors other than rainfall. Government policies, selling prices and competition from more profitable crops have all had obvious impacts over the past few decades in several WANA countries. These can encourage as well as discourage chickpea production. But the spectacular growth in chickpea area in Turkey appears to have reached its limit. In Syria, the recently successful drive to achieve self-sufficiency in wheat production and higher-value

Figure 3. Chickpea yields in North Africa



Source: Agrostat

Figure 4. Chickpea yields in West Asia



Source: Agrostat

crops has been at the expense of potential chickpea area in wetter years, as well as traditional fallow that could be used for chickpea expansion. The situation in North Africa is less clear, but the trend is not to expand chickpea areas. Across the region, the rise in agricultural wages has acted to discourage crops that cannot be mechanized, particularly chickpea.

Unlike cereals, chickpea's market position has remained strongly tied to local supply and demand factors. With the exception of Turkey, government intervention and international commodity market influence has been low.

However, traditional spring-sown chickpeas, although they will never supplant the dominant position held by cereals, are a desirable crop because of the lower risk attached to planting decisions, the lower implied costs of production, and their utility and market values. Like cereals, chickpeas are a consumer staple.

The challenge faced by scientists and government agencies charged with improving chickpea production is how to raise yields per hectare in a situation where area expansion is increasingly constrained. The challenge lies in identifying and developing a solution that reconciles intensification with the traditional risk avoidance and relatively low-cost character of chickpea. And the answer may be not to sow in the spring.

A technological solution; winter sowing

From a strictly biophysical point of view, the biggest constraint on chickpea yield in WANA is moisture availability. An obvious strategy is to advance the planting date so that the crop can take advantage of winter rainfall—and escape late spring drought and high temperatures. ICARDA research in the late 1970s demonstrated the potential inherent in a winter-planting strategy, at least for low to medium elevations where winter cold is not too severe (Table 1). However, as temperatures rise in the presence of moist conditions, the young plants are susceptible to attack by ascochyta blight (Ascochyta rabiei), a fungal disease endemic to the WANA region which, if left unchecked, can destroy the entire crop. Researchers concluded that avoidance of ascochyta, rather than freezing temperatures, is probably the principal reason why farmers plant chickpea in the spring rather than winter (Hawtin and Singh 1984). Since there exists no means of control that is both clearly effective and easy to apply, the development of new cultivars resistant to ascochyta while also tolerant to cold has been followed as the best means of overcoming low and unstable yield levels in the Mediterranean basin.

Impressive results have been achieved. By 1993, National Agricultural Ressarch Systems (NARS) in some 14 circum-Mediterranean countries had released a total of 44 kabuli chickpea cultivars for winter sowing with ascochyta-blight resistance and cold tolerance. Verification trials throughout the region demonstrated the yield advantages of winter planting using the new cultivars. While it is recognized that weather factors cannot be completely overcome, research indicates that over **a** multi-year period the new cultivars should outperform the local spring chickpeas considerably, both in terms of yield and economic return.

Table 1. Effect of dates of sowing on plant height, number of branches and pods, and seed yield of eight genotypes of chickpea at Tel Hadya, Syria, 1977-78.

Date of sowing	Plant height	Number/branches	Plant pods	Seed yield
December 4	34.0	6.5	22.0	1767
December 29	32.3	6.5	19.4	1724
February 2	26.7	5.6	13.9	1415
March 6	22.3	5.0	10.9	666
LSD (P=0.05)	3.9	0.8	3.1	211.3

Source: Saxena, M.C. Agronomic studies on winter chickpeas in Saxena, M.C. and K.B. Singh (eds.), Ascochyta Blight and Winter Sowing of Chickpea. Martinus Nijhoff, The Hague, 1984.

Economic feasibility was evaluated using partial budgeting techniques. Careful records of variable costs were kept in on-farm trials and these were compared to those for spring chickpea. Improvement in net benefit was in the order of 45-65%. The differences in income benefits were due largely to yield differences. Production costs were much the same for both types, but with one important exception. Weeds that emerge with winter rainfall are eliminated during tillage and planting of spring chickpea, but producers of winter-sown cultivars must somehow control weed infestations within the growing crop. Commercial herbicides can be used when available, but it is likely that weed control will most often be done by hand, as it is for other food legume crops. In on-farm research, the costs for weed control in winter chickpea have been typically two to three times higher than for spring chickpea.

However, the extra cost should be more than recovered through yield improvement—and mechanical harvesting. Because of the more favorable moisture conditions and selective breeding, winter-sown cultivars tend to be much taller than spring-sown landraces. Additional height allows the use of combine harvesters, provided that there is adequate preparation of the field prior to planting. Mechanical harvesting is generally less expensive than using hand labor. Throughout the region, farmers have already adopted mechanical harvesting for cereals in response to rising labor costs, and there is no reason why this should not happen with winter-sown chickpea. Moreover, winter chickpea matures as much as four to six weeks earlier than spring-sown chickpea. This allows harvesting well before the peak harvest time for cereals. Machinery and labor are therefore cheaper and more available because of lower demand.

Winter chickpea technology has emerged as a package with a number of complementary components. Early planting should be done using the new ascochyta- and cold-tolerant cultivars. Weed control is necessary, either using a sprayed chemical (usually recommended as a pre-emergence herbicide applied at sowing) or later hand weeding. There are also recommendations, differing slightly by country, regarding seed rate, row spacing, and planting method.

Some possible negative factors were identified by researchers. Most notably, the earlier releases of winter cultivars were characterized by a markedly smaller seed size than the spring-sown landraces. This could hinder acceptance by farmers as well as consumers, depending on the nature of the consumer market. Another factor is the overlap in planting date with cereals and other winter crops; this might cause farmers trouble in terms of machinery and labor availability. This can be avoided by delaying winter chickpea sowing until January, but there might then be problems planting in heavy, saturated soils. And of course, the question remains if farmers are willing to take risks with chickpea in the same way that they must take risks with other crops planted before the major rainy period.

In 1989 ICARDA and a number of national programs began a series of farm-level studies to assess the acceptability of winter chickpea among the region's farmers. The studies were designed to establish a dialogue between the scientists who are developing winter chickpea technology, and the farmers who are the intended beneficiaries. There are four main objectives:

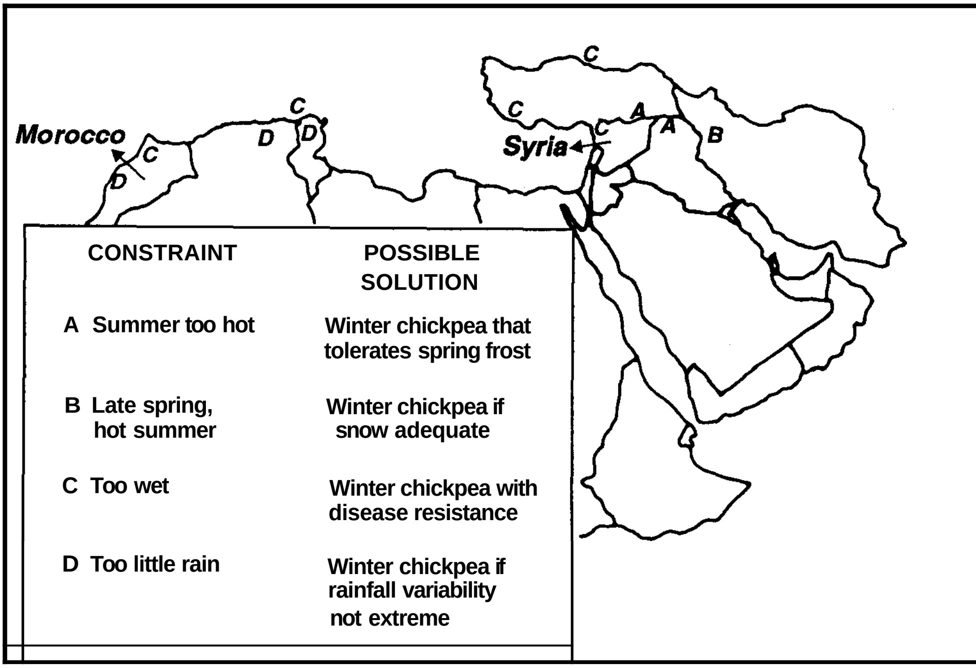
1) Identifying the farm-level incentives and constraints regarding adoption of winter-sown chickpea,
2) Evaluating performance of the new technology in farmers' hands,
3) Assessing the benefits farmers derive from winter chickpea, and
4) Providing farmers with the means to participate in the further development of the new technology.

This paper presents some of the findings of two complementary studies undertaken in Morocco and Syria during the period 1988 to 1991; and relates these to the broader issue of the potential for introducing winter chickpea among the farmers of the Mediterranean basin. Morocco and Syria were chosen as the initial venues for the studies because of the progress made by the national programs in these two countries, in both developing and locally adapting the technology; and because both countries have lowland environments, where winter sowing would seem most appropriate and promising (Figure 5).

2. Winter Chickpea in Morocco

Total Moroccan chickpea area fell by almost one half between the early 1970s and mid-1980s. Yields fluctuated wildly during the same period between a peak of about 1000 kg/ha in 1979 to around 200 kg/ha in 1981. The average since 1985 is near 800 kg/ha. There has been a marked change in the geographical distribution of chickpea in Morocco (Figure 6). Formerly highly productive regions to the south

Figure 5. Winter Chickpea Target Environments



CONSTRAINT	POSSIBLE SOLUTION
A Summer too hot	Winter chickpea that tolerates spring frost
B Late spring, hot summer	Winter chickpea if snow adequate
C Too wet	Winter chickpea with disease resistance
D Too little rain	Winter chickpea if rainfall variability not extreme

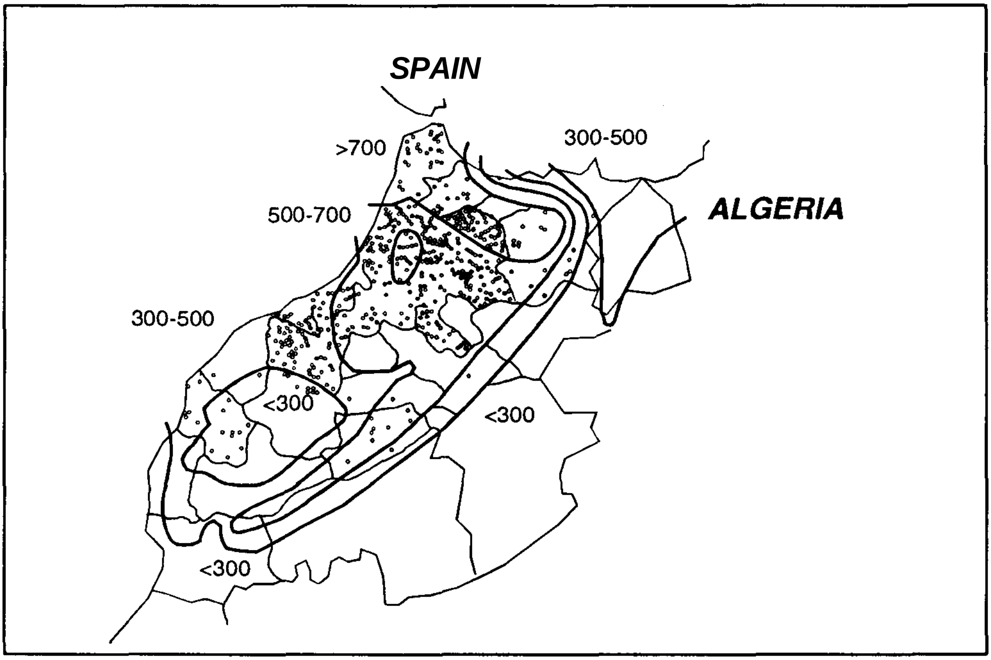
Source: adapted from Walker, 1992

and southwest of Casablanca have considerably reduced chickpea area, and many farmers have abandoned chickpeas altogether. The retreat has been attributed to various causes: a prolonged drought, the ravages of ascochyta blight during early spring, the rising costs of hand labor for harvest, and competition from more profitable crops.

Morocco worked hard on winter chickpea technology as a possible way of improving and stabilizing national production trends. Beginning with germplasm developed at ICARDA, scientists at the Institut National de la Recherche Agronomique (INRA) started the process of adapting winter chickpea technology to the conditions of Moroccan farmers (Kamel 1990). **INRA** followed a dual approach: on-station work concentrated on testing germplasm and cultural practices, while on-farm trials aimed at verifying the new technology and identifying the constraints to achieving maximum yields. Two varieties, ILC 482 and ILC 195, were catalogued and released in 1987188. A nation-wide program of farmer-managed demonstrations was begun by the Direction de la Production Vegetale (DPV) in the same year.

The results were promising. The demonstration farmers obtained much better yields with the new winter cultivars as compared to the local spring chickpea. The demonstration program was expanded for the 1988189 and 1989190 seasons. There

Figure 6. Chickpea in Morocco (one dot = 100 ha)



Source: Walker, 1992

had been little in the way of analyses of farmers' reactions to the new technology, nor assessment of its adaption potential. The gap was filled with monitoring surveys of farmers participating in the demonstrations.

Two categories of farmers were covered during the two years 1989 and 1990: 1) participants in trials and demonstrations, and 2) farmers who had experimented with winter sowing independently without support from the demonstration program or extension. The survey results allow the comparative evaluation of incentives and constraints to adoption according to farmers' levels of experience with the new technology. For the purpose of measuring acceptability, adoption was defined as the decision to grow the crop in the years following an initial year of production. Acceptance and adoption ratings are based only on evaluation by those farmers with at least one year's practical experience growing winter chickpea. Non-adoption was defined as abandoning winter sowing following one year or more's experience with the technology.

The sample was further divided into four locational groups, each representing a different agricultural environment. The northern provinces of Fes and Khemisset represent current principal producing areas of chickpea. The two southern provinces, Safi and Settat, are areas in which chickpea, previously important, has been largely replaced by cereals, forage maize, and weedy fallow. Safi and Settat are lower-rainfall areas, and it is hoped that winter-sown cultivars will do well therre--opening the door to re-introduction of chickpea into these important agricultural regions. Within each province, several districts were selected on the basis of intensity of demonstration efforts and the knowledge local extension agents had of what crops farmers were growing.

Climatic conditions in the initial year of demonstrations were favorable for winter sowing. But in the following year, 1988189, the situation was different. Although accumulated rainfall was about average, the distribution was uneven. Heavy April rains created conditions conducive to the spread of ascochyta in all areas except Fes province; even there, the absence of ascochyta was little consolation to the majority of farmers, who suffered from extraordinary weed infestations and hailstorms. Spring chickpea suffered equally because of the lateness of the ascochyta development. Overall, the mean yield for winter chickpea was 970 kg/ha, and spring chickpea was 840 kgha. But in Settat and Khemisset provinces, spring chickpea actually managed to outyield winter chickpea by some 360 kg/ha and 180 kgha respectively.

By surveying all trials and demonstrations participants in the selected areas, it was possible to estimate an initial acceptance rating for winter chickpea according to years. Overall, winter chickpea had been adopted by 61% of farmers who had experience of growing the new cultivars prior to the 1988189 season. The ravages of the 1988189 ascochyta epidemic are reflected in the acceptance rating of first-time winter chickpea producers in that year, which fell to only 40%. The extent of the setback to adoption of winter cultivars is further revealed by the abandonment of previous adopters. Some 26% of pre-1988189 winter chickpea adopters decided to no longer grow the crop after 1988189.

Farmer acceptance of winter chickpea prior to 1988189 was based largely on the significantly higher yields compared to traditional spring chickpea. However, there had been no major attacks of ascochyta blight prior to 1988189. Non-adopters prior to 1988189 reported dissatisfaction with the smaller seed size of winter sown varieties and the costs of hand weeding the winter sown crop.

Based in part on the results of the 1988189 survey, the Moroccan national program revised their technology transfer strategy for the 1989190 season. First of all, the survey showed that the cultivar ILC 482 had been more affected by ascochyta than had ILC 195, and it was decided to use only ILC 195 in the 1989190 demonstrations. Second, because ascochyta had been less severe in Safi and Fes provinces, the demonstration program for the next year would put relatively more emphasis on these provinces and adjacent areas away from the Settat and Khemisset hot-spots. Third, the extension agents who were introducing winter chickpea to demonstration participants were given additional training in the various agronomic practices associated with winter sowing, so that they could advise farmers should problems arise. Fourth, a weed control component was added to the demonstrations if farmers requested it. This was intended mainly for the demonstrations in the wetter areas.

These changes were amply justified by the results of the 1989190 demonstrations. The acceptance of winter chickpea among farmers growing the new cultivars for the first time in 1989190 was 70%. This constituted a major recovery for the new technology. It was all the more significant because there was practically no dis-adoption of winter chickpea in the 1989190 season.

The monitoring surveys conducted in 1988189 and 1989190 enabled the Moroccan national program to construct a baseline for farmer acceptance and adoption of winter-sown chickpea built upon actual farmer evaluations and perceptions of the new technology. Of the 123 farmers who had grown winter chickpea and were interviewed in either one or both years of the survey, some 44% elected to adopt the new cultivars. Moreover, winter sowing brought them sufficient benefits for them to significantly increase the average annual area they plant to chickpea.

Adoption was not uniformly distributed, however. Acceptance of winter sowing was greatest (62%) in Safi province and slightly less in the Fes region (54%). In the ascochyta hot spots of Settat and Khemisset, it was only 21% and 33%.

The above experience with farmer-managed demonstrations and monitoring surveys in Morocco shows that introducing winter chickpea at the farm level is not a one-way process; and there is no fixed prescription for all farmers' locations and years. Rather, the transfer from researchers to farmers is interactive, with dialogue developing between farmers and researchers through the technology-transfer activities—in this case, through farmer evaluations of new cultivars. By quantifying these evaluations through monitoring surveys, the Moroccan national program was able to test a number of a ***priori*** assumptions about the acceptability of winter-sown chickpea. From this, decisions could be made for the future. So, above all, the strategy followed should be flexible and capable of considerable revision.

The survey results indicate that the main constraint to future adoption and expansion of winter chickpea technology in Morocco is apparently the small seed size of the released cultivars (Tables 2 and 3). Moroccan scientisrs have long suspected this. It has nothing to do with the technical aspects of production, seed quality, or even food quality. It is simply the Moroccan preference for eating boiled, whole chickpeas. Large-seededness is much preferred for aesthetic reasons. Large-seeded chickpeas such as the local spring landrace command distinctly higher prices than the smaller-seeded winter cultivars, particularly in local markets.

An important discovery from the surveys is the importance farmers place on the "information constraint". This is especially revealed in the factors limiting adoption of winter chickpea cited by adopters, as opposed to non-adopters. These appear to confirm a distinction made by many researchers in the region between, on the one hand, simply planting chickpeas in the winter rather than spring; and on the other, understanding that winter planting requires new varieties which are resistant to ascochyta. Farmers clearly understand the moisture, and therefore potential yield, advantage of early planting, but what they want is information about the new varieties and the associated agronomic practices.

Table 2. Morocco: Principal constraint to adoption of winter chickpea. Frequency (in rounded percentages) of factors reported by farmers, by adoption category.

Constraint	Independent adopters	Trials adopters	Trials non-adopters	Independent non-adopters	Total sample
Small seed size	7	32	64	60	47
Need more information	22	25	5		13
No seed available	14	15	2	10	8
High labor costs	7	10	7		7
Weed control	14	12	2		7
Diseases and pests		3	10	10	7
Poor market and prices	7		7	20	6
Conflict w/cereals	22				2
Low or uncertain yields	7		2		2
No constraint given		3	1		1
Total	100	100	100	100	100

Table 3. Morocco: Principal constraint to adoption of winter chickpea. Frequency (in rounded percentages) of factors reported by farmers, by location.

Constraint	Fes	Khemiset	Safi	Settat	Total
Small seed size	31	67	41	50	47
Need more information	15	10	15	11	13
No seed available	27	3	5		8
High labor costs	8		8	14	7
Weed control		13	8	4	7
Diseases and pests	4		10	11	7
Poor market and prices	11	7	3	3	6
Conflict with cereals			8		2
Low and uncertain yields				7	2
No constraint given	4		2		1
Total	100	100	100	100	100

Comparisons between farmers with different levels of experience with the new technology revealed another important dimension to the incentives/constraints matrix. Although diseases and pests were seen as very significant problems encountered in production, they were less important in the actual decision to adopt the new technology and to expand winter chickpea area. Despite the ascochyta attacks of 1988189, farmers generally ranked winter chickpea as better than local spring chickpea for resistance to diseases and pests.

Winter cultivars also got much better ratings for other characteristics which breeders have carefully selected: higher yield, more stable yield, greater straw production, plant stand and vegetative growth. Also mentioned as distinct economic advantages were the winter cultivars' earlier maturity—and taller stature, allowing mechanical harvesting. For richer farmers with larger fields, this means cheaper costs through lower labor requirements.

Moreover, even poorer farmers find that harvesting a month or more earlier than the traditional spring landrace (which usually coincides with the wheat harvest) means they can take advantage of off-peak lower wage rates, higher chickpea prices before the spring-sown harvest glut, and quicker cashflow to pay off debts and finance the up-coming cereal harvest.

The small seed and lower price constraints do not apply uniformly to all winter chickpea producers. Some do recognize the advantages of economies of scale. By growing large areas, harvesting mechanically, and receiving a significant yield advantage over spring chickpeas, a proportion of winter-sown chickpea adopters can easily accept a lower selling price––because their greater production still results in higher profitability. Some small producers, using mostly family labor with a low opportunity cost, also prefer winter chickpea, because of a lower perceived risk of crop failure.

The price disadvantage of winter sown chickpeas varied greatly by location, time of sale, and farmer market position. In general, the larger producers and the early sellers experienced the smallest price disadvantage due to seed size. They also tended to have access to better market outlets, such as wholesalers and even exporters in large cities.

Nonetheless, the importance of the aesthetic value placed on large-seededness should not be undervalued. A number of farmers disregarded discussions of profit margins and reduced risk and flatly stated that their self-esteem as farmers would not allow them to sell their chickpeas at a lower price than their spring-sowing colleagues.

Those most dissatisfied with the seed size and subsequent prices tended to be medium to small producers who relied on local weekly marketplaces and selling in small quantities from time to time. This pattern accounted for well over half the producers.

Ironically, some of the most vocal advocates of winter chickpea are small-scale farmers (and often sharecroppers) who rely on casual and local marketing. But these farmers sell their chickpeas as seed supplies to their neighbors––receiving good prices but taking the risk of dissatisfied customers should there be problems the following season.

There are two linked lessons to be learned from all of this.

First, winter chickpea is evaluated by farmers for its commercial potential, ***not*** for subsistence production or for its role in a complex dryland farming system. Second, the commercial incentives and constraints for winter chickpea are different for different farmers. This is not simply a question of technical production problems or even calculated net benefits. Rather, circumstances external to the farm—in particular, access to markets—must be considered along with internal circumstances such as farmer self-evaluation and the opportunity costs they assign to unpaid family labor.

Commercial potential is not the sole factor, however. To illustrate its importance, standard partial budgets were calculated using imputed values for family labor (based on prevailing wage rates for individual activities and times) and prices averaged for locations and times. Profitability on this basis could only account for some 60% of actual winter chickpea adoption. Obviously, although farmers overwhelmingly cite price incentives and profitability in their evaluations, other factors, perhaps other than those employed in standard economic analyses, need to be considered.

In Table 4, the column labeled "Yield Differential" gives the percentage of average winter chickpea yield among the participants in each province over or under the mean yield of spring chickpea in the same province across all years of demonstration trials. Thus, winter chickpea averaged 39% higher than spring among farmers in Fes, but it was 20% under spring yields in Settat. One might conclude that if yield alone governed acceptance within an environment, then the highest adoption should be in Fes, followed by Khemisset and Safi, with no or very little adoption in Settat.

Table 4. Morocco winter chickpea experience by location.

	Descriptors for comparison of winter and spring chickpea			
Location (province)	**Winter acceptance**	**Yield differential**	**Price differential**	**Winter paid weeding (per ha)**
Fes (n=26)	54%	+ 39%	- 44%	10.7 days
Khemisset (n=30)	33%	+ 36%	- 34%	29.9 days
Safi (n=39)	62%	+ 27%	- 25%	6.2 days
Settat (n=28)	21%	- 20%	- 28%	11.7 days
Totals (n=123)	**44%**	+ 27%	**- 33%**	**13.5 days**

The next column in Table 4 gives the differential between farm gate prices for spring and winter chickpea in each province. As researchers had anticipated (and participants confirmed), the small seed size of winter chickpea results in a price disadvantage. Moroccan consumers prefer to eat chickpeas boiled and whole, and market prices in general follow a scale in which larger means higher price, both for producers and consumers. In this column there is a clue as to why winter chickpea has considerable prospects in Safi (although by this criterion alone winter cultivars might be equally popular among Settat farmers).

The fourth column provides another indication of adaptation to socioeconomic conditions. This is the average number of days of hired labor expended by farmers in each province for weed control on a hectare of winter chickpea. This should be considered an additional expense over that required for spring chickpea production. Researchers had anticipated this additional expense, and the survey confirmed its importance and contributed to its quantification. Again, we have a clue to the acceptance of winter chickpea in Safi-because of the lower eat of weed control for Safi farmers.

Table 5 is organized on the basis of the distinction between farmers who adopted winter chickpea and those who did not, including the distinction between farmers who tried winter chickpea through the demonstration trials program, with material and information support from extension and researchers, and those who tried winter chickpea on their own without support services.

Table 5. Morocco winter chickpea by adoption category.

Adoption category	Descriptors for comparison: Yield differential	Descriptors for comparison: Price differential	Winter paid weeding (per ha)	Average arable area per farm (ha)	Av. chickpea area (ha) 1990	Av. chickpea area (ha) 1991
Independent adopters (n=14)	+ 82%	- 20%	8.9 days	189	8.7	45.9
Adopters from trials (n=40)	+ 25%	- 35%	11.6 days	90	2.0	3.9
Non-adopters from trials (n=59)	+ 4%	- 39%	16.0 days	57	3.5*	
Independent non-adopters (n=10)	+ 30%	- 50%	27.3 days	187	1.O*	

* Spring chickpea area for these farmers in 1991 is dependent on rainfall that year.

The independent adopters—who had much larger farm size than adopters from trials-enjoyed the highest yield gains, the best prices, the lowest weeding costs, and used mechanical harvesting (an important cost-saving measure) most frequently. They were followed in these advantages by the adopters from trials. Non-adopters from trials tended to experience the worst combination of these factors. The seeming inconsistency is for the independent non-adopters, but if their yields are excluded, their experience with the other descriptors is consistent with the non-adopters from trials. Looking more closely at the history of the independent non-adopters, we find that a high percentage of them had, in fact, decided to adopt winter chickpea until the ascochyta epidemic of 1988189 persuaded them to give up the new technology. For the most part, these dis-adopters did not return to chickpea production, but grew cereals instead the following year.

The final two columns indicate the potential impact of winter chickpea. First, there is the average area of chickpea (both spring and winter) for each category in 1989190. To the right of this is the additional area planned for 1990191. In the case of the two types of adopters, the additional area is winter chickpea. Thus, if the farmers implemented their plans, the area of winter chickpea would almost triple between 1990 and 1991. In fact, by the end of the five-year study period (1987-91), winter chickpea accounted for the majority of total chickpea production by all the participating farmers together.

3. Winter Chickpea in Syria

Average chickpea yields in Syria are now about 650 kg/ha. They have tended to decline since the 1960s, although the annual area sown to spring chickpea has increased 60% between 1967 and 1991 despite wild year-to-year fluctuations.

The technical problems of producing chickpea in Syria are slightly different from those in Morocco. Disease pressure is somewhat less severe, but there are serious problems associated with erratic rainfall and, especially, frequent killing frosts as late as March.

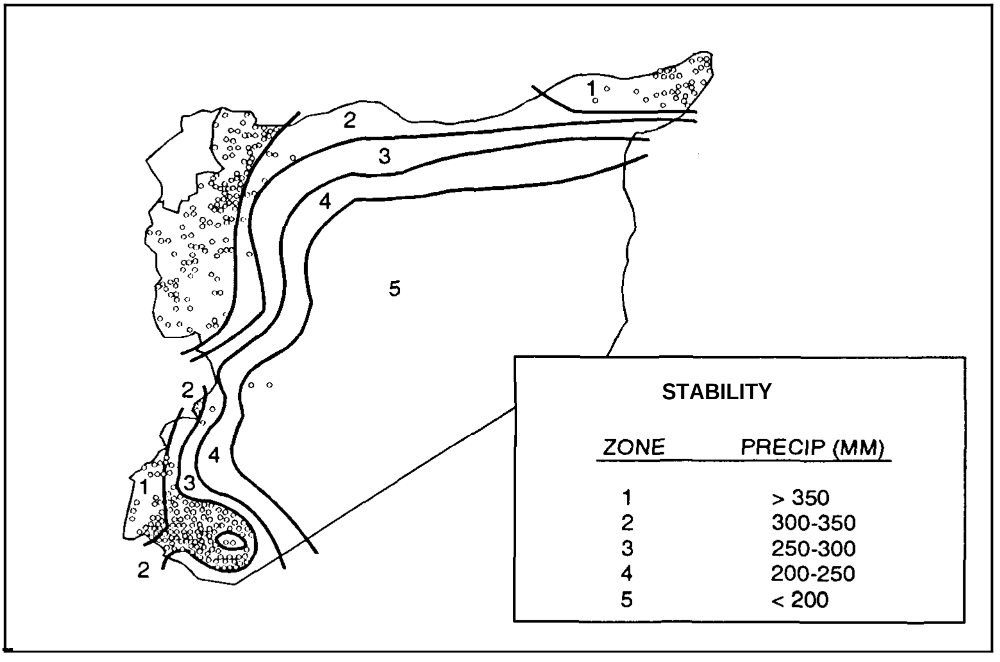
Winter chickpea technology is appealing in Syria because of its potential for stabilizing area planted and reversing the negative trend in yields. The first winter-sown chickpea cultivars in Syria were Ghab 1 (ILC 482) and Ghab 2 (ILC 3279), selected from advanced ICARDA lines and both released in 1986--one year before winter chickpea was released in Morocco.

The principal chickpea production areas fall within two of the rainfall-based agricultural stability zones established by the government (Figure 7). Zone 1 has a mean annual rainfall of over 350 mm and is located along the coastal plain, the coastal mountains, and the Jawlan plateau in the south. It also includes an area to the extreme northeast—in the Jazirah, near the Tigris River. Zone 2, which has an annual rainfall of 250-350 mm with no less than 250 mm falling during two-thirds of the years, lies adjacent to Zone 1 to the east and south behind the western mountains and across the Jazirah.

Within the two Zones, there are two geographical areas which together constitute about 95% of the chickpea area. These are the Southwest, mostly Zone 2, which has a median of 60% of the national area, and the Northwest, mostly straddling the line between Zone 1 and Zone 2. Chickpeas are of only minor importance in the Jazirah, where lentil is the favored legume. This distribution indicates the significance of the risk-aversion factor associated with spring chickpeas. Over half the median area lies in Zone 2, in which rainfall is less reliable than in Zone 1. In the northwestern Zone 1 there is greater danger of frost, and apparently farmers utilize their more favorable moisture conditions to grow other, perhaps more profitable, crops.

The Syrian National Program has followed a strategy for transferring winter-sown chickpea technology that is very different from the one used in Morocco. Rather than devoting themselves to a modest program of targeted demonstrations in the years following release, Syria undertook a large-scale program of seed multiplication using private farmers under contract to the General Organization for Seed Multiplication (GOSM). Multiplication was done on plots of one to twelve hectares. The results were encouraging. Yields were high, there was no major

Figure 7. Chickpea in Syria (one dot = 100 ha)



Source: Walker, *1992*

incidence of diseases or pests, and economic analyses showed high profit margins. Government marketing organizations set attractive purchasing prices for chickpeas. Once GOSM had accumulated sufficient stocks of certified seed, a media campaign and the extension services were used to inform farmers about winter chickpea's advantages and the availability of the new varieties.

General distribution of the new varieties began in 1989. In the same year, the Socio-Economic Studies and Training Section of the Syrian Scientific Agricultural Research Directorate, together with ICARDA scientists, organized a farm-level survey to assess the performance of the new technology under farmer conditions. This included evaluation by the farmers themselves of the potential for adoption and positive impact.

The survey was conducted for two successive years, and the sampled farmers were selected from lists of farmers growing winter chickpea in different locations (the lists were provided by the Ministry of Agriculture and Agrarian Reform and GOSM). This included farmers who had taken part in the multiplication program. Due to limited resources, it was not possible to include those who had obtained seed outside official release channels for example, from other farmers, who might have received them through farm trials with the Ministry and ICARDA. Nonetheless, the lists of farmers purchasing seeds were a suitable starting point for establishing a baseline for evaluating the adoption process.

The sample contrasted farmers on the basis of their experience with winter chickpea: those growing for the first time in 1989190 or 1990/91 (68% of the sample), and those with at least a year's previous experience (32% of the sample). About a third of the farmers were also growing spring chickpea. The sample was distributed over Zone 1 in three provinces in 1989/90: Aleppo and Hama (Zone 1, northwest) and Hassakeh (Zone 1, northeast Jazirah). In 1990191, Daraa province (Zone 2, southwest) was added to the other three locations. The Northeastern Jazirah province of Hassakeh was included because research trials indicate it has great potential for maximizing winter chickpea performance and impact.

The locations contrast in terms of predominant farming systems. Aleppo and Hama are characterized by broken terrain with rolling hills and shallow valleys. Average farm size is in the middle range at around 15 to 20 hectares, although there is considerable variation. Most of the farms are owner-operated, and there is very little incidence of sharecropping or annual rental contracts. There is a high incidence of hired hand labor, particularly for harvesting (although tillage and planting operations are often mechanized).

The cropping system in Aleppo and Hama is very diverse. Cereals constitute about one half the arable area, with food legumes and tree crops together covering about 17% and fallow about 7%. A range of industrial and market crops, such as vegetables, account for some 27%. Many farmers have recently invested in tube wells used for supplementary irrigation of wheat, sugar beets, and potatoes in the rainy season and fill irrigation of cotton and vegetables in the dry season.

The Hassakeh region, by contrast, is the bread basket of Syria. Farms are large and virtually all production operations are mechanized, including aerial spraying of herbicides. Cereal monoculture is common, and wheat and barley together cover over 80% of arable area. Industrial crops, primarily cotton, constitute about 14%, with fallow at only about 2%. Food legumes, mostly lentils, cover some **3%,** but this area appears to be declining in the face of the high cost of hand harvesting.

In contrast to the Northwest and Northeast, the Southeastern province of Daraa represents a much more "traditional" Middle Eastern dryland farming system. A wheat-legume rotation is common, with a high degree of fallow (27% of arable land, on average). There are few other crops, although olives and grape vines have been expanding in recent years in response to market incentives. Farms are slightly larger than in Aleppo and Hama, and they are mostly owner-operated and dependent on family labor. There is a reasonable degree of me'chanization, but hand harvesting is common. The stony soil of the Hauran plain in Daraa province acts as a deterrent to the harvesting of wheat and other field crops by combine. Although Daraa has the largest average annual chickpea area among the provinces surveyed, it is in this area that the risk avoidance nature of spring chickpea is most evident (Walker 1992).

Winter-chickpea acceptance and adoption were defined in the same way as in the Moroccan study. Overall, of the 185 farmers surveyed in the two years, 55% found the new cultivars acceptable and had adopted them. As in Morocco, the total average masks differences in the year-to-year and location-to-location acceptance rates. In 1989190, the acceptance rate in the three provinces covered averaged 57%, but it ranged from only 32% in Hama (where there were killing frosts and little rain) to 58% in Aleppo and 78% in Hassakeh (in the latter, temperatures were mild and rainfall adequate). Acceptance among farmers growing winter chickpea for the first time in 1990191 averaged 50% over the four provinces covered that year. Again, Hama (50%) and Aleppo (29%) were disappointing. Daraa had a rate of 45%, and Hassakeh 90%. Acceptance over the two-year period by province are: Hama 36%, Daraa 46%, Aleppo 53%, and Hassakeh 81%. These results indicate that the Syrian National Program strategy of encouraging winter chickpea in Hassakeh province was successful (Table 6).

The starting point for assessing adoption decisions is initial expectations from the new technology (Table 7). Some 86% of the surveyed farmers said that the higher yields promised by winter sowing was one reason they chose to grow the new cultivars. The actual yields reported by farmers correspond closely with their adoption decisions. Those farmers with yields from winter chickpea that were disappointing in comparison to anticipated spring chickpea yields in the same year and place tended to find the new cultivars unacceptable.

Related to higher yield is the incentive of higher net benefit. The potential higher profitability of winter chickpea was cited by 40% of the farmers, and this reason was significantly more important for the large-scale producers in Hassakeh

Table 6. Syria: Winter chickpea acceptance by location

Location	Adopters no.	Non-adopters no.	Acceptance rate
Aleppo (n=74)	39	35	53%
Daraa (n=20)	9	11	45%
Hama (n=44)	16	28	36%
Hassakeh (n=47)	38	9	81%
Total (n=185)	**102**	**83**	**55%**

Sources: 1990 and 1991 surveys.

Table 7. Syria: Initial expectations from winter chickpea. Frequency (in percentages) of reasons given by farmers by location

Reasons	Location				Total sample n=185
	Aleppo n=74	Daraa n=20	Hama n=44	Hassakeh n=47	
Higher yield	78	100	87	89	86
Higher net benefit	31	5	43	64	40
Possibility of mechanical harvesting	18	15	18	81	34
Earlier maturity	39	10	32	19	29
Frost resistant	27	10	50	17	28
Disease resistant	23	5	18	19	19
Pest resistant	7	5	7	19	10
Utilize available labor	3		7	13	6

than in the other locations. Similarly, Hassakeh farmers saw winter sowing as a way of reducing costs through mechanical harvesting, although this was of lesser interest to farmers in other provinces. Demonstrating an acute awareness of climatic conditions in their own environment, Hama farmers disproportionately cited frost tolerance as an incentive, although, at least in the 1989190 season, they were to be disappointed.

Climatic conditions were the factor most frequently cited as the biggest problem encountered by winter chickpea producers. Not surprisingly, this was mentioned more often by non-adopters than those who decided to adopt the new varieties (Tables 8 and 9). It would appear that frost and low rainfall were the most discouraging factors in Hama and Aleppo provinces, even though winter chickpea actually performed as well as, or better than, local spring chickpea in these locations during the two years. Low rainfall was also a factor in Daraa, where a number of farmers said that they would not have planted spring chickpea in 1990191 because of the disappointing rains. In contrast, mild temperatures and adequate rainfall in Hassakeh allowed farmers the full yield advantages of winter sowing.

Table 8. Syria: Production problems encountered by winter chickpea producers. Frequency mentioned (in percentages) by location

Constraints	Aleppo	Daraa	Hama	Hassakeh	Total
Climatic conditions	42	55	75	36	50
High costs	26	25	21	30	25
Weed problems	7	10	20	17	13
Labor availability	12	5	18	11	12
Input availability	7		14	19	11
Other factors	22	5	2	23	15

Table 9. Syria: Production problems encountered by winter chickpea producers. Frequency mentioned (in percentages)

Inputs	Adopters	Non-adopters	Total
Climatic conditions	43	58	50
High costs	27	24	25
Weed problems	14	12	13
Labor availability	11	14	12
Input availability	16	5	11
Other factors	19	11	15

Economic constraints appeared less important than adverse climatic conditions. Only 25% of farmers cited higher cost to benefit ratios for winter as opposed to spring chickpea. This is in sharp contrast to Morocco, where winter chickpea suffers poorer prices, and additional weed-control requirements raise production costs and lower profit margins for many producers. Syrians consume chickpea primarily in ground and pureed forms, so seed size has little aesthetic value. There was no significant price difference between winter and spring varieties in Syria; winter varieties tended to outyield spring chickpeas; and weed control was not reported as a major constraint.

What does show up in the survey results is the relatively greater economic incentives to adopt winter chickpea felt by the larger, commercially-oriented farmers than smaller producers. Perhaps inevitably, large producers are ahead of small ones in mechanization of production. The large producers, who are mostly in Hassakeh, tend to have mechanized all operations, including weed control by spraying herbicides and harvesting winter chickpea by combine, whereas small producers continue with more costly hand-weeding and hand-harvesting. Large producers are evidently more willing to take the rainfall and frost risks associated with winter planting of chickpea (Table 10).

Table 10. Syria: Winter chickpea adopter - non-adopter comparisons (calculations based on latest survey year per farmer)

Characteristics	Adopters		Non-adopters		Total	
	avg	SD	avg	SD	avg	SD
Farm size (ha)	180	572	52	81	123	432
Food legume area (ha)	11	44	2	9	7	33
Fallow area (ha)	6	30	1	5	4	22
Winter yield (kg/ha)	1254	640	741	672	1038	700
Spring yield (kg/ha)	811	359	730	513	781	420
Selling price (SL/kg)						
government agencies	18.1	3.3	17.3	3.3	17.7	3.3
market	17.6	3.2	16.1	2.3	17.1	3.0

Although adopters of winter chickpea have a much larger average farm size than do non-adopters, this figure is distorted by the very large farms and the high rate of adoption in Hassakeh. When adoption and non-adoption is divided between farm size categories, some 44% of small farms (i.e., those less than 35 ha) have adopted the new varieties. The adoption rate among large farms is 68%. Perhaps more indicative of the impact of winter chickpea is the area sown to either type of chickpea in the year following the adoption or non-adoption decision. Winter chickpea adopters, both large and small size farmers together, will increase their chickpea area by 25%. Those who do not adopt will increase their (spring) chickpea area by only 1.2%. If this trend continues, then substantial progress will be made towards the objectives of stabilizing year-to-year area differences and increasing yields.

The survey demonstrates that winter chickpea is considered a commercial crop by Syrian farmers. Only about 1% of production is being withheld for home consumption. Some 6% is kept for next year's seed, and the remaining 93% is sold either to government agencies or to the private market. Prices do not vary much between these two outlets or between winter and spring chickpeas. This is due in part to the fact that government purchasing agencies play a major role in the marketing of field crops, and they set prices in advance. Moreover, the vast majority of chickpeas are consumed in Syria in the form of a ground paste mixed with sesame and spices and used as a dip with bread. Seed size is not the overwhelming factor in consumer preferences in Syria that it is in Morocco.

On the whole, there seem to be few technical or economic problems for winter chickpea producers. The principal constraints during the two survey years were the frosts in Hama and Aleppo provinces and the low rainfall in Hama, Aleppo, and Daraa. It should be noted that spring chickpea producers in these areas suffered just as much from these factors as did winter chickpea producers during the survey years. But would-be spring producers had the option of waiting to see if the rains were sufficient to warrant planting in 1989190 or 1990191. Winter producers did not, and many of them in Hama and Aleppo suffered low (and unprofitable) yields. In retrospect they felt that, given the risk of adverse weather, they could not justify planting winter chickpea again. Whether or not they would have been more amenable to the new varieties had the climatic conditions been more favorable in the particular survey years remains an open question.

Bearing in mind the different acceptance rates across locations, it is interesting to consider what options adopters see for expanding winter chickpea cultivation. The most obvious possibility is substituting winter for spring chickpea. This is primarily an option in Aleppo and Daraa provinces, where chickpea production is now concentrated. However, on the basis of constraints that farmers mention (Table 1 1), there are still serious concerns about risk in Daraa and uncertainty in Aleppo. Another concern expressed in Aleppo is the possible negative effect of winter chickpea on following crops in the diversified cropping rotation of that province. Many farmers feel that winter chickpea uses more moisture than spring chickpea and therefore depresses yields in the following crop.

There are, however, some indications of substituting winter for spring chickpea. Among the sample farmers in 1989-90, winter chickpea constituted 84% of land sown to chickpea. Despite the fact that 53% of the farmers said they would not grow winter chickpea in 1990-91, the proportion of winter chickpea was expected to increase to 90% of the total chickpea land grown by adopters and non-adopters together in 1990-91. Why was this?

There were two reasons. First, winter chickpea adopters intended to increase their chickpea area by substituting winter for spring cultivars and also to marginally increase their total area planted to chickpea. Second, the non-adopters in Aleppo and Hama (and, to a lesser extent, Daraa) were not only stopping production of winter chickpea; but were also sharply reducing the total area they planted to spring chickpea. If farmers did do as they stated, then area planted to chickpea following rejection of winter chickpea will represent a reduction of 22% of the previous year's area, but winter chickpea will be a higher proportion of the total than in the previous year. This is similar to the tendency seen in Morocco.

Table 11. Syria: Constraints to increasing area of winter chickpea by individual farmers. Frequency (in percentage) of response by farmers by location

Constraint	Aleppo	Daraa	Hama	Hassakeh	Total
Unsure profitability	30	40	48	19	32
Small seed size	19	25	66	2	27
Seed availability	9	5	11	38	17
Negative impact on next crop	12		9	13	10
Risky yield	4	60		6	9
Weed control	5	5	5	4	5
Climatic factors	8				3

A second possibility for expanding winter chickpea area is to reduce fallow. But this is unlikely to make much difference. The survey data show that fallow, except in Daraa, is only a small percentage of arable land, and it is unlikely, even if all fallow land were to be planted with winter chickpea, that large production increases would be achieved. This is particularly true if Daraa farmers are reluctant to forego the fallow option in their traditional rotation.

In Hassakeh, where chickpea is not traditionally grown, winter chickpea has a tendency to replace lentils, primarily because of the problems associated with harvest mechanization and the consequent reliance on increasingly expensive hand harvesting of lentils.

When farmers were asked their opinion of constraints to adoption by other farmers, the most popular response in Hassakeh and Aleppo where winter sowing has higher acceptance rates, was that not everyone knew about or understood the new technology (Table 12). Whether they would adopt if they did know was another question, and it drew a mixed response. But farmers generally assumed that if other farmers experienced high yields and good economic returns, then logically they would adopt.

In Hama and Daraa, where there was less enthusiasm for winter sowing, there was a contrast between Hama farmers, who were concerned about commercial potential and profitability, and Daraa farmers, who were worried about risky yields.

Table 12. Syria: Constraints to widespread adoption of winter chickpea. Frequency mentioned by farmers (in percentages) by location

Constraints	Aleppo	Daraa	Hama	Hassakeh	Total
Lack of knowledge	50		21	32	33
Chickpea prices	19	30	45	11	24
Small seed size	18	15	59	4	24
Seed availability	7		7	21	10
Risky yield	4	70			9
Weed control	5	-	14	4	7

The small-seed-size response, particularly evident in Hama, is puzzling. It was mentioned by about a quarter of all farmers surveyed, but they were equally distributed between adopters and non-adopters. Small seed size is probably not the reason Syrian farmers would have for non-adoption. The reason is much more likely to lie in the relatively lower economic return than possible from other alternatives within their farming systems and climatic conditions. It could be argued that seed size affects prices and therefore has a negative effect on economic benefit (as in Morocco), but Syrian eating habits do not support this argument. Anyway, neither do farm-gate prices. The government role in marketing is much greater in Syria than in Morocco, and Syrian policy has been to offer a uniform price for spring and winter chickpea. With large-seeded, ascochyta-resistant varieties in the pipeline, this factor may one day be of less importance in Morocco, too.

4. Conclusions

This paper began with the problems posed by spring chickpea to planners and farmers alike: low productivity and highly variable annual planted area. This makes production uncertain from one year to the next. Although spring planting allows farmers to escape the risk of crop failure due to poor rainfall, it also means they must accept lower production and less-than-optimal land-use intensity. Since pressure on land is increasing dramatically, the economic benefit farmers can get from chickpea is arguably in decline relative to other crops in the farming system--except where, as in Turkey, government financial resources are being used to encourage chickpea production relative to other land uses.

Winter-sown chickpea promises to solve these problems through higher yield potential and more productive use of land. In principle, winter-sown varieties could not only raise yield but also serve to stabilize the area planted to chickpea, allowing planners and farmers to allocate resources more rationally than they can now.

However, even if winter sowing stabilizes crop area, there remains the question of whether it will stabilize yields and economic returns. With spring planting, in a dry year a farmer may decide not to plant. He gets no yield, but neither does he lose his investment.

Of course, this advantage does not hold true for all producers. The results of the survey research in both Syria and Morocco indicate that large-scale commercial producers have little interest in the fallow option. They are interested in intensification, and winter chickpea is clearly an option if higher yields can be achieved and additional costs minimized.

Perhaps the most important conclusion of the surveys is the significance of annual variations in climatic conditions on adoption. One year is not an adequate test, or even an adequate sample, of farmer adoption response. The impact of the 1988189 ascochyta epidemic on winter chickpea acceptance in Morocco is striking. The shortage of rain and the late frosts in Syria, particularly in Hama province, distorted adoption responses by masking performance differences between winter and spring chickpea. Under these conditions, there could not be an adequate test of the effects of weeds and/or diseases and pests. Similarly, the favorable weather in Hassakeh probably painted too rosy a picture of the new technology. In fact, in 1992193, in the year following the adoption surveys, there was a devastating ascochyta attack in Hassakeh, and the Syrian government response was to ban the planting of chickpea of any type--spring or winter--in that province for three seasons in an attempt to control the future spread of the disease.

Farmer evaluation of the new technology has been useful in both countries for setting medium-term priorities. In terms of breeding, the results confirm that Morocco should emphasize increasing seed size while strengthening resistance to ascochyta blight. In Syria, cold tolerance combined with ascochyta resistance is paramount and seed size is of lesser importance. Associated agronomic practices, particularly in terms of weed control and mechanical harvesting, need to be further identified and refined for extension messages.

But the survey results in both countries indicate that cultivar performance and resistance to biotic and abiotic stresses, although very important, may not be the final answer to the challenge of the adoption of winter sowing. This statement is based on several observations.

First, both acceptance patterns and farmer responses to evaluative questions indicate a strong inclination to judge winter chickpea on the basis of economic return. Yield is not the objective in itself. Rather, farmers are interested in monetary returns. There is little if any indication that production for household use is an important factor in the adoption process.

The second observation is related to the first. In terms of volume of production, winter chickpea is being immediately adopted as a commercial crop, primarily by large-scale farmers. Larger-scale producers in both Morocco and Syria had slightly lower per hectare costs and spent proportionately less on weed control and harvesting. (This should be treated with caution, however; it relies upon a coincidence of large-scale cultivation, high yields, and high adoption rate that can be strongly affected by climatic and disease conditions).

A third observation is that farmers' evaluation criteria change with time. In the first year of cultivation, a high yield is very important for deciding to adopt. The implicit comparison is with spring chickpea. However, the second season's outcome may be judged not so much on yield as on net revenue. Other, more subtle variables come into the calculation. Prices, seed and input availability, seed quality, land-use allocations, weed control, and other factors become important, from the standpoints both of continuing winter chickpea and deciding planting areas.

Early in the adoption process, winter chickpea serves as a substitute for spring chickpea. However, once the substitution has taken place, then the decision for or against winter chickpea becomes subject to different issues, broader than chickpea itself and extending to the place of chickpea in the farming and market systems. Ultimately, the extent of adoption may depend mainly on the comparative advantage of chickpea and other food legumes vis-a-vis alternative crops in the farming system. A hint of this important area for research was given by the farmers in both Morocco and Syria when they identified low selling prices as a constraint to expanding winter chickpea area. They were not referring to winter versus spring chickpea prices, but rather to chickpea prices in general as being too low to sustain present production area.

It is no coincidence that non-adopters, taken as a whole, do not intend to plant as large a chickpea area following experimentation with winter chickpea as they did before. They express reservations about the future of chickpea and even food legumes in general as being risky and having declining profitability relative to other land-use alternatives. They are clearly looking for a solution to the challenges of the wider economic environment.

The largest factor contributing to an overall decline in chickpea area in the sampled farmers is the decline in spring chickpea among non-adopters. Winter chickpea adopters are slightly increasing their area planted to the new varieties and, therefore, their chickpea area in general. Thus, the answer to the chickpea challenge continues to be mixed, but where winter sowing has been successfully introduced, the results are encouraging.

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