Discovering the quality incentive for increasing durum production in West Asia and North Africa

Tutwiler R.N.

in

Di Fonzo N. (ed.), Kaan F. (ed.), Nachit M. (ed.).
Durum wheat quality in the Mediterranean region

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 22

1995
pages 203-212

Discovering the quality incentive for increasing durum production in West Asia and North Africa

R.N. TUTWILER
FARM RESOURCE MANAGEMENT PROGRAM
ICARDA
ALEPPO
SYRIA

SUMMARY - The question of whether or not grain quality is a relevant factor when farmers decide what durum varieties to grow is examined. Available information from North Africa and Syria suggests that yield levels and economic incentives play an important role, but that no conclusion can be drawn regarding quality considerations. Future increases in durum production may be influenced by quality considerations, and there is a real need to identify quality parameters at the farm level. The paper concludes with a strategy outline for this research.

Key words: Durum wheat, grain quality, on-farm research.

RESUME - *"Découverte de la qualité comme encouragement à une plus forte production de blé dur dans l'Ouest de l'Asie et en Afrique du Nord". La question relative à l'importance de la qualité du graine lors du choix des variétés de blé dur par les agriculteurs est examinée. Les données disponibles sur l'Afrique du Nord et la Syrie montrent que les niveaux de rendement et les motivations économiques jouent un rôle important, mais qu'aucune conclusion ne peut être faite sur les considérations concernant la qualité. Les accroissements futurs de la production de blé dur sont peut-être influencés par les considérations de qualité, et il existe un besoin réel d'identifier les paramètres de qualité au niveau de l'exploitation agricole. Cet article conclue avec un plan de stratégie pour cette recherche.*

Mots-clés : *Blé dur, qualité du grain, recherche chez les agriculteurs.*

Establishing quality considerations at farm level

It is generally recognized that the direct participation of producers in agricultural research increases the effectiveness and efficiency of new technology generation and adoption. This paper explores some of the issues involved in developing a producer participatory approach to durum wheat improvement, especially with regard to the issue of quality in durum wheat in the countries of West Asia and North Africa (WANA).

We may consider the word *quality* as denoting a desirable characteristic. However, we must also recognize that what may be understood as a desirable characteristic by one person or group of people may not be recognized or understood as desirable by another person or group of people. Quality, we might say, is in the eyes of the beholder.

The contributors to this seminar have represented several different groups of people who may be considered as stakeholders in the further development and improvement of durum wheat. These groups are consumers, the food processing industry, scientific researchers, and producers. Each one has slightly different concerns when it comes to the issue of durum wheat quality. Consumers, for example, are concerned with taste, texture, appearance and cooking qualities, particularly with regard to traditional durum recipes such as pasta, couscous, burghul, tabouli, kibba, etc.

The food industry also pays attention to these food qualities, but their particular concerns are with qualities associated with processing and marketing. If dry pasta with a particular colour, for example, is associated with a higher price in the market, then the colour quality is of importance to producers. The scientific community is usually concerned with what might be termed as the technical aspects of

quality. Having recognized particular characteristics as desirable qualities, scientists proceed to identify the physical and biological determinants of these characteristics. The objective of most durum breeding programs is to produce new cultivars with increased yield, better grain quality, and stronger disease resistance than possessed by the durum varieties currently grown by farmers.

The basic assumption is that farmers desire a crop that is high-yielding and is resistant to environmental stresses. These are the qualities that concern them. Similarly, colour, texture, cooking quality, etc. are assumed not to be the farmer's concern unless these food and processing qualities are transparently related to the price level the farmer can obtain for the crop after harvest.

ICARDA researchers working in Syrian villages in the early 1980's observed that many wheat farmers continued to grow small plots of landrace durum cultivars after having adopted new improved wheat varieties on most of their fields. The reasons given for the persistence of the old landraces was their superior taste and cooking qualities in traditional foods. The landrace harvest was not sold, but rather kept for home consumption. The reason given for abandoning landraces in favour of the new high yielding varieties (HYVs) in the majority of the fields was simply that the higher yield resulted in higher income. An obvious conclusion is that the premium given to the superior quality of the landraces clearly did not match the economic benefit of the increased yield of the new cultivars.

Observations such as these raise the question of whether or not farmers recognize a quality incentive to increasing their durum production. Are there durum wheat quality aspects recognized by farmers, other than yield and net benefit levels, that should be incorporated into scientific crop improvement programs?

Preliminary observations

The first point to stress is that we know surprisingly little about the conditions under which durum wheat is produced and marketed by farmers in West Asia and North Africa. There are several reasons for this. First, although there have been many farm-level studies over the years (particularly in North Africa), they tend to be scattered over wide areas and lack temporal continuity. Farm level studies are rarely integrated either within the same countries or within the region, so no clear picture of production conditions has emerged.

The second point is that the purpose of most farm-level studies is purely technical, dealing with agronomy, diseases, pests, and similar disciplinary subjects. Socioeconomic aspects are generally limited to partial budgeting of production costs, and rarely is the farmer's perspective on the crop included or sought out by the researchers. Ignoring certain social dimensions may result in missed opportunities or in undiagnosed constraints. For example, partial budgets need to include labour inputs, usually calculated as person days that may or may not then be imputed as a money cost based on a prevailing wage rate. Whether or not the real labour used in production is family or hired labour or male or female is usually not considered by the researchers, although these differences may be of the utmost concern to the farmer when the decision is taken to change existing production practices.

The third point concerns national statistics. Many countries in the region do not differentiate between bread wheat and durum wheat in reporting areas planted and harvested, yields, and production, although North Africa is an exception. In any event, the available statistics are open to varying interpretations. It is safe to say that in virtually no case is it possible to characterize the types of farmers who produce durum wheat as opposed to other cereals. Nor is it possible to say whether or not some farmers tend to specialize in durum production. This situation makes it difficult to define a target group of farmers for participation in research to improve durum quality and productivity.

ICARDA and its national program partners in the WANA countries have been working over the past few years to rectify this situation. Surveys have been conducted in a number of countries, and progress has been made in compiling and sifting through the existing sources of information. A clearer picture is emerging, and in light of this it is useful to re-examine some of the common perceptions about the historical development of durum production in the region.

Present situation

Scientists in national and international durum breeding programs in the WANA region have traditionally concentrated on raising yield levels. The popular impression is that progress has been slow, especially in comparison with bread wheat improvement. Two principal reasons are cited. First, most released varieties are specifically adapted to the more favourable environments, including irrigated production. Second, it is thought that farmers tend to grow bread wheat in favourable areas, preferring durum in the marginal areas where the hardier traditional varieties may be better adapted and thus perform better in poor rainfall years. Third, as a consequence of the previous two reasons, durum wheat receives relatively less national research and agricultural policy attention than bread wheat. This idea of lack of success needs to be re-examined.

North Africa provides a good point of departure because of the overwhelming importance of wheat in the farming systems and the existence of reasonably reliable statistics that differentiate between wheats. The statistics in Algeria, Morocco, and Tunisia indicate a complex situation. While it is true that bread wheat has shown a remarkable yield gain during the 1980's in Tunisia and, to a lesser extent, in Morocco, durum wheat yields were also impressive at 50% and 20% growth in the two countries, respectively. Yield improvements have been less in Algeria, but here the relative achievements are reversed. Durum wheat yields improved by 18% during 1981-88, while in the same period bread wheat rose by only 6% (Tables 1 to 4).

Table 1. Durum wheat area and yield in North Africa, 1964-1980 (National Agricultural Statistics), (Ministry of Agriculture and Agrarian Reform of Algeria, 1989; Ministry of Agriculture and Agrarian Reform of Morocco, 1964-89 and Ministry of Agriculture of Tunisia, 1990)

	Durum wheat area (1000 ha)		Durum wheat yield (kg/ha)	
	Mean	CV %	Mean	CV %
Algeria	1462	11	573	17
Morocco	1395	8	967	19
Tunisia	887	20	559	29

Table 2. Durum wheat area and yield in North Africa, 1981-1988 (National Agricultural Statistics), (Ministry of Agriculture and Agrarian Reform of Algeria, 1989; Ministry of Agriculture and Agrarian Reform of Morocco, 1964-89 and Ministry of Agriculture of Tunisia, 1990)

	Durum wheat area (1000 ha)		Durum wheat yield (kg/ha)	
	Mean	CV %	Mean	CV %
Algeria	993	16	678	18
Morocco	1151	5	1160	31
Tunisia	788	15	841	44

Possible factors contributing to these differences include a concerted national campaign in Morocco to increase bread wheat production under high input conditions in irrigation perimeters. This is part of an import substitution strategy that inevitably results in less emphasis on improving the durum wheat presently grown under less favourable conditions. In Algeria, there was no similar concentration of effort on high-input wheat production. Most wheat in Algeria is grown under low-input conditions, whether it is durum or bread wheat. Tunisia's bread wheat area is small and getting smaller, although it is in the higher rainfall zone and some of it receives supplemental irrigation.

Despite the impressive yield gains in both durum and bread wheat, total production has increased only by a modest 16%. Most of the growth can be attributed to increased bread wheat area in Morocco

(+75%). Although durum production has remained about the same overall, areas have declined in all three countries, most precipitously in Algeria (-32%). Bread wheat area has also fallen in Algeria (-21%) and in Tunisia (-26%).

Table 3. Bread wheat area and yield in North Africa, 1964-1980 (National Agricultural Statistics), (Ministry of Agriculture and Agrarian Reform of Algeria, 1989; Ministry of Agriculture and Agrarian Reform of Morocco, 1964-89 and Ministry of Agriculture of Tunisia, 1990)

	Bread wheat area (1000 ha)		Bread wheat yield (kg/ha)	
	Mean	CV %	Mean	CV %
Algeria	659	19	658	22
Morocco	475	10	917	26
Tunisia	163	35	747	41

Table 4. Bread wheat area and yield in North Africa, 1981-1988 (National Agricultural Statistics), (Tutwiler and Mazid, 1992)

	Bread wheat area (1000 ha)		Bread wheat yield (kg/ha)	
	Mean	CV %	Mean	CV %
Algeria	522	15	698	18
Morocco	831	33	1276	32
Tunisia	121	26	1319	41

From the perspective of the producer, and particularly the small farmer, several points should be made. Fig. 1 indicates that yield improvement in durum wheat in North Africa can be roughly divided into three periods corresponding to the 1950's up to 1963, the 1964-80 period, and the 1980's. These proceed step-wise, and can be seen more-or-less clearly in all three countries. More research is needed before this pattern can be adequately explained, but two possibilities exist at the farm level. In the first scenario, the steps are due to cohorts of farmers adopting new technologies, especially modern varieties, a different times. Each of the three cohorts corresponds to one of the steps, with the last cohort only taking up new technology in the 1980's. The second scenario does not follow the cohort concept, but rather explains the step increases in terms of replacement of successive technology generations. That is, there is general adoption among farmers of an improved technology once it becomes available, and that the steps correspond to the history of varietal releases and/or other technology advances.

It should be expected that reality falls somewhere between the scenarios, and that the story is slightly different for each country. However, very preliminary findings from recent research in Tunisia indicate that, at least for the higher rainfall areas, the successive technology replacement scenario may be more appropriate. This indicates a high degree of positive farmer response to new technology options as they become available. The key indicator in this case is the rapidity and breadth of technology replacement.

A second feature of the national statistics for North Africa is the apparent year-to-year variation in yields. The coefficients of variation (CVs) for durum wheat yields increased between the 1964-80 period and the 1981-88 period, although the increase was not significant in Algeria. However, in Morocco and Tunisia the jump was marked, and the durum yield CVs reached those of bread wheat for the first time. This may question the perception of durum as a crop better suited to the moisture stress prone environments.

If increases in yield variability at the national level is translated to similar fluctuations at the farm level, then the possible implications for farmers are obvious. It could be argued that the increase in CVs

represents an increase in risk for durum producers, and that this eliminates one of the incentives for continued durum production by small, resource-poor farmers. Nevertheless, one should remember that although CVs increased, the minimum annual yield levels were higher in each successive period of yield increase. About all that can be said at this point is that the issue of increasing risk while raising yield potential needs to be investigated. We have very little information from North Africa, or from any other parts of WANA, regarding farmers' perceptions of risk and to what extent these perceptions influence production decisions.

The second prevalent view that needs closer attention regards the environmental circumstances of durum production. The perceived wisdom is that durum has been traditionally relegated to marginal environments in WANA. Marginal environments are those with a high probability of moisture stress, particularly towards the end of the growing season. Durum's place in the marginal environments is said to be due to two factors: (i) Durum performs better under harsher conditions than bread wheat (and presumedly bread does better than durum under favourable conditions), and (ii) Durum has historically been less commercial than bread wheat, serving more for household consumption by the poorer farmers of the marginal areas.

Recent developments have called this view of durum as a disadvantaged, poor people's crop into question. The country reports from North Africa and the Middle East presented during this seminar illustrate the range of environments where durum is now grown. The growth in regional and world trade in durum and durum products shows the commercial potential. Unfortunately, as is the case with our understanding of WANA farmers' responses to new technologies or their perceptions of risk, we have very little quantified information concerning where durum is grown, by whom, and for what purpose. Most commentaries are either impressionistic or anecdotal in nature. We know that durum is grown in a range of environments, but we cannot say how much is produced in a particular place relative to another.

In order to begin the process of quantifying wheat production by agroecologies and cultural practices, the Syrian national program and ICARDA have conducted for the past three seasons extensive surveys of wheat producers. From the data collected it has been possible to determine the present distribution and performance of an array of new wheat production technologies, including durum varieties. Information on the history of technology adoption was collected from individual farmers along with the post harvest disposal of the crop.

There were a number of surprising results (Table 5). Durum does not appear disadvantaged in comparison with bread wheat in terms of production environment. It is of particular interest to note the high proportion of durum grown under irrigation, especially if one recalls the apparently low incidence of durum irrigation in North Africa. Much of the Syrian irrigated durum is supplemental irrigation. This is the fastest growing type of irrigation in Syria, where it is based on individually owned drilled wells. The use of supplemental irrigation on durum indicates farmer decisions to allocate their own on-farm resources to durum as opposed to a variety of other crop options. Durum is obviously of great importance to Syrian farmers.

The yield figures from the Syrian surveys are also significant. Durum out yields bread wheat in less favoured rainfed areas, as one would expect from the conventional wisdom. But apparently modern durum varieties also out yield bread wheat under irrigated conditions. One may suspect that some of the yield differences are due to varietal characteristics, as bread wheat in Syria tends to be older germplasm and less specifically adapted to Syrian conditions.

In this regard, it is important to understand something of the history of varietal adoption of wheat in Syria. Early adoption in the 1970s was mainly bread wheat varieties originating from Mexico. As the Syrian national breeding program matured, modern durum varieties were released along with more specifically adapted bread wheats. However, the behaviour of the Syrian farmers has been to stick with the same varieties that they initially adopted. There is a low incidence of varietal replacement after initial adoption. Farmers experience a jump in yield when they first adopt a new high yielding variety and associated cultural practices, but thereafter their yields tend to remain fairly stable because they are not taking advantage of newer technologies as these become available. The Syrian experience corresponds more closely to the first, or cohort, scenario outlined above in the discussion of North African durum yields.

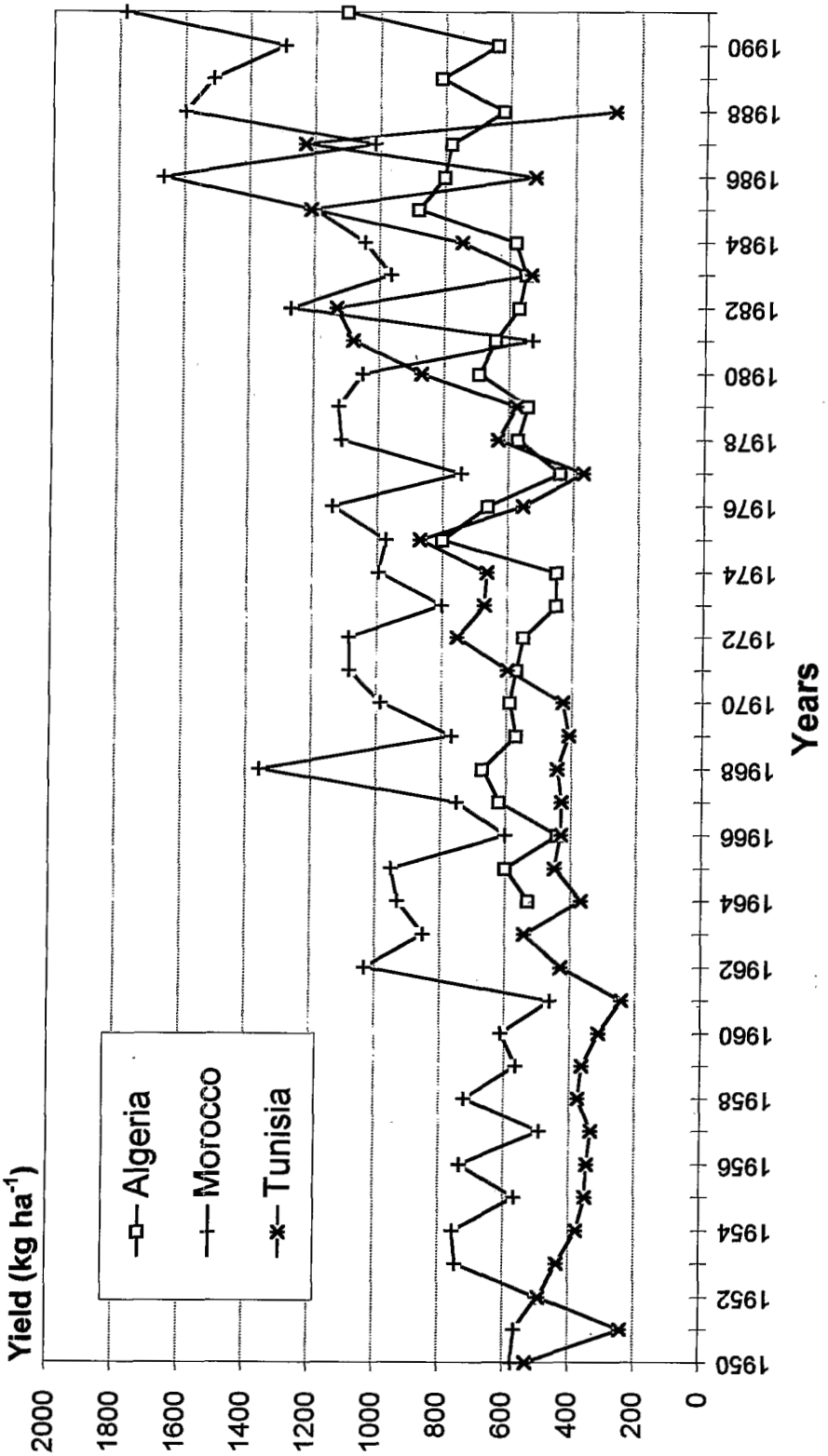

Fig. 1. Durum wheat yields in North Africa (Ministry of Agriculture and Agrarian Reform of Algeria, 1989; Ministry of Agriculture and Agrarian Reform of Morocco, 1964-89 and Ministry of Agriculture of Tunisia, 1990).

Determining the distribution of wheat varieties through survey work at the farm level proved to be very useful in improving the *fit* between germplasm and target environment. In the 1989-90 survey year, for example, it was discovered that Cham 3, a durum variety developed for semi-arid rainfed conditions, was, in fact, mostly being grown under irrigation. In contrast, some older bread wheat varieties originally intended for irrigated conditions were now being grown under rainfed, and particularly semi-arid, conditions. In neither case were the varieties performing at their potential yield levels. These results led the institutions responsible for seed distribution to adjust their patterns to better fit variety to target environment, and subsequent surveys documented the effectiveness.

The surveys indicated greatly increased levels of adoption of modern durum varieties. The new durum cultivars have primarily replaced local durum landraces. This trend is interesting because it indicates farmer response to market incentives. Nowadays it seems that the practice of retaining a small landrace plot is no longer followed. The new modern durum varieties are popular with farmers and have replaced the landraces, but they are grown for sale, not for home consumption. In fact, virtually the entire Syrian wheat production is sold, mostly to government agencies that offer very attractive prices. The price of bread is subsidized in Syria, and even wheat producers prefer to sell their harvest and rely on purchased bread in order to save money. There is no strong evidence that new durum varieties are actually replacing the older improved bread wheat varieties. However, since the new durums seem to be preferred by recent first time adopters, the overall balance of wheat areas in Syria has tipped in favour of high yield durum varieties.

The North Africa and Syria cases support the contention that farmers are concerned primarily with yield levels and economic returns in deciding what wheat varieties to grow. In none of the data presently available is it possible to discern a concern for maintaining grain quality, as defined by consumers and the food industry, by the producers. This is not to say that the concern is not there, however. The point is that at present we have no way of knowing if it exists or not.

Future prospects

The evidence from North Africa and Syria indicates that production gains in durum wheat are not likely to come from area increases. In fact, the trend in all countries is decreasing wheat areas. This does not seem likely to change unless there is a drastic movement upward in farm gate durum prices, but for most WANA countries the likely prospect is lower producer prices because of pressures to reduce supports and input subsidies to wheat. Nor are gains very likely from simply increasing input levels unless there is a major shift in input availability and costs. Again, the general trend in the region is to adopt *structural adjustment* measures that would tend to raise costs and lower producer prices.

Increasing wheat area under irrigation is a possibility in the short run to increase production. This is certainly taking place in Syria and Morocco. Wheat is not always the most profitable crop if irrigation water is available and the farmer has the freedom to choose what to produce and how to market the harvest. Irrigation water is not unlimited, and its cost of application, presently heavily subsidized by WANA governments, is likely to increase in the medium and long terms.

Finally, gains are not likely from replacing low-yielding landraces, because this has been mostly accomplished.

Future productivity gains are most likely to come from better adaptation of improved germplasm, better targeting of improved technologies, and improved crop and resource management at the farm level. This conclusion brings us to the point of considering how adaptation, targeting, and technology transfer can be best achieved. I would argue that achievement of these goals is most effectively done through consideration of the point of view of the producers themselves, and especially the conditions of production and marketing experienced by the farmers.

Table 5. Distribution of wheat varieties in Syria† (Tutwiler and Mazid, 1992, and unpublished survey results)

	Rainfed 1		Rainfed 2		Supp. irrigation		Full irrigation		Total/average	
Varieties	Area (%)	Yld (t/ha)	Area (%)	Yld (t/ha)	Area (%)	Yld (t/ha)	Area (%)	Yld (t/ha)	Area (%)	Yld (t/ha)
HYV durums	23	2.3	17	1.6	11	4.1	12	4.2	63	3.2
HYV breads	14	2.4	6	0.9	2	4.0	3	3.3	25	2.2
Local durums	5	1.4	7	1.1					12	1.2
Total/average	42	2.2	30	1.2	13	4.0	15	4	100	2.6

†Rainfed Zone 1 average precipitation is above 350 mm. Rainfed Zone 2 is between 250 and 350 mm. This table does not include wheat grown below 250 mm rainfall. Overall yield average for rainfed wheat said to be in region of 1.65 t/ha

Gaining the producers' perspective

If farmers are not convinced of the benefits of a new durum technology, then they will not accept and use it, and the development of the technology itself will have been of little benefit. Based on this logic, understanding the producers' perspective is of fundamental importance in the process of technology generation and development. The above discussion of data from North Africa and Syria demonstrates that there have been major advances in improving durum productivity over the past twenty years or so. These improvements were based upon a strategy of increasing yield performance under farmer conditions. This strategy has been largely successful, but relying on yield performance alone has possible limitations. As farmers are drawn into the national and international market networks, prices for inputs and outputs become important factors to consider in making production decisions. A high yield level, if associated with correspondingly high costs and low sale prices, is not always enough to persuade farmers that a crop or a new technology for an existing crop is beneficial and worth a probably risky investment of scarce resources.

There is an array of methods and techniques available for gaining the producer's perspective on crop selection and crop production. Given our present state of knowledge about durum production by WANA farmers, I would suggest a three step approach.

First, researchers should inventory and assess the content of available information on competing enterprises in the prevailing farming systems of the major WANA durum producing countries, including resource competition among the enterprises and their relative economic and/or utility returns to producers at the farm level. Wheat, and especially durum, is very important in these systems, but the comparative advantage of wheat over other crop options has not been adequately measured or established.

This exercise would necessarily be extended to an investigation of the actual marketing arrangements experienced by farmers. What, for example, is the farmers' experience of prices for durum wheat as compared to bread wheat and other possible crop choices? On what bases are prices differentiated in the marketplace? For example, what is the relative importance of timing *versus* quality characteristics? To what degree are these known and understood by producers? How much can the farmer predict the price he will obtain, i.e., how dependable are the prices?

In terms of our present concern with quality in durum wheat, the crucial marketing question is whether or not farmers experience differential prices based on quality discrimination. What quality characteristics do farmers identify and recognize in their produce? Are these characteristics of any consequence in determining the prices that farmers receive?

The next step would be to establish, on the basis of present knowledge, quantified parameters for comparison among durum wheats and between durum wheat and other crop options in the farming system. The following parameters are suggested for initial comparisons:

(i) Yield performance, including: level of productivity, year-to-year stability within a target environment, stability over a range of environments.

(ii) Quality of resistance to environmental stresses: abiotic stresses, biotic stresses.

(iii) Straw and other by-product yields: uses and values, desirable quality characteristics.

(iv) Enterprise budgets for durum wheat in different WANA environments.

(v) Complementarities with other elements in the farming system (e.g. durum straw used as animal feed).

Having completed the first two steps using existing information, the third step is to initiate fieldwork studies at the farm level. I would suggest that *dual nature* studies be undertaken. Dual nature means that the studies incorporate both the technical quality aspects and the producer recognized quality aspects of durum wheat. Of obvious critical importance is whether or not the farmers recognize the

quality dimensions that have already been defined by consumers, the food processing industry, and scientific researchers.

If there is a link between perceptions of quality among the various stakeholders in durum production, then what are the implications for further development of improved varieties and associated technology? If the quality perceptions concerning durum wheat are mutually exclusive between producers, on the one hand, and the users, on the other hand, then in what ways can the gap be bridged to the mutual benefit of all?

Acknowledgements

The contribution of Malika A. Martini to the collection and tabulation of the statistical data presented in this paper is gratefully acknowledged.

References

Ministry of Agriculture and Agrarian Reform (1989). Superficies et Production. *Statistique Agricole*, Séries A and B, Algiers, Algeria.

Ministry of Agriculture and Agrarian Reform (1964-89). *Statistiques des Productions Agricoles*, Rabat, Morocco.

Ministry of Agriculture (1990). *Enquête agricole de base*, Tunis, Tunisia.

USAID/Tunis (1983). *Wheat Development Program: Project Impact Evaluation Report* No. 48, Tunis, Tunisia, October 1983.

Tutwiler, R. and Mazid, A. (1992). Impact of modern wheat technology in Syria. In: *1992 Farm Resource Management Program Annual Report.* ICARDA, Aleppo, Syria.