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**COMMUNITY LEVEL IMPACTS OF
POLICY, TECHNOLOGY AND INSTITUTIONAL OPTIONS IN
LOW RAINFALL AREAS OF MOROCCO, SYRIA AND TUNISIA**

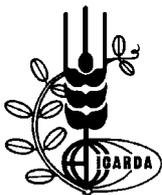
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Community Level Impacts of Policy, Technology and Institutional Options in Low Rainfall Areas of Morocco, Syria and Tunisia

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1. SYNTHESIS

For the past forty years, governments in the West Asia and North Africa (WANA) regions have been exploring new technical, policy and institutional options to promote agricultural growth, enhance the livelihood of rural producers and promote sustainable resource use and conservation in the low rainfall areas (LRAs). However, the lack of proper policy support tools to evaluate the potential impacts of proposed technical, policy and institutional on the behavior of rural producers in managing their resources and very compartmentalized research activities along disciplines have helped very little in conducting policy design and formulation for the dry areas.

The IDRC project is a component of the regional program on *Development of Integrated Crop/Livestock Production Systems in Low Rainfall Areas of the Mashreq and Maghreb Regions*, involving eight countries (Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia) and co-financed by AFESD (Arab Fund for Economic and Social Development) and IFAD (International Fund for Agricultural Development). Its overall objective was to contribute in filling these gaps and providing policy makers, local communities and researchers with means for better understanding and assessing likely economic, social and environmental consequences of the different policy, property right and technical options for improved range, livestock and crop management on the low-rainfall areas of Morocco, Syria and Tunisia.

The studies were conducted in four of the six selected communities in Morocco, Syria and Tunisia and multiple methodologies were used to implement the research program. Rapid Rural Appraisal (RRA) techniques were used to characterize the communities by understanding the opportunities and constraints that communities and farmers face in conducting their livelihood strategies; develop working mechanisms for ensuring farmers participation in the identification of the technical options to be tested at the community level and at later stage the development of a negotiated action plan; foster team building between the different component of the larger M&M project. Household surveys were conducted at the crop, field and household level to collect required data for community models and econometric analyses. Community models were developed to evaluate technology, policy and institutional options in the communities of Ait-Amar (Morocco) and Nouayel (Tunisia). Econometric analyses were conducted for the communities in Tunisia to assess the effect of the privatization efforts in the improvement of land resources and productivity and in Syria to assess the factors inducing the involvement of household female labor in the off-farm labor market.

1.1 Technical, policy and institutional options for the Ait-Amar community

Firstly, the model was used to simulate the feed block technology, which is one of the emerging M&M technologies for the dry areas, that is being proposed to fill the growing feed gaps in the dry areas and optimize the use of existing feeds and crop residues. The simulations for the Ait-Amar community indicated that amongst 11 proposed feed block formulas, only two were economically viable with the current feed pricing system (Formulas 8 and 11). The introduction of these two types of feed blocks led to increase in revenues and a drop in the overall income variability. Moreover, they changed their feeding strategies by reducing bran and concentrates the purchases while allocating more land to barley and bread wheat cultivation. In addition, farmers increased the number of ewes and young rams stocks suggesting a double household income strategy based on reproduction and fattening. This technology has a lot of potential for enhancing the revenues of small producers but will require a better-targeted strategy for disseminating available information about feed blocks.

Secondly, the model was used to evaluate a set of alternatives to the current drought relief policy by changing some of the key parameters set by the Moroccan government. This option was chosen because of the increasing dissatisfaction with drought relief policies due to associated costs and inefficiency in targeting the farmers that need support the most. The results suggested that the level of subsidization (in terms of price change) does not yield changes in the level of income with the current volume of feeds distributed on the site. However, changes in the volume

of feeds available could lead to substantial increases to community income up to 11%. For example, increasing the current limit of 500 tons for the community of Ait Ammar would induce substantial production and income increases. In addition, larger feed volumes resulted in a clear drop of the shadow price for the common rangeland suggesting to lesser pressure for this heavily degraded resource.

Finally, the model was used to evaluate the effects of a taxation schema on the use of common rangelands. The model results suggested that fixed tax rate did not have any impact in the use of rangeland but the application of differential tax rates according to herd size and intake induced medium-type farmers to reduce their use of rangeland resources and rely on their cropland to feed their animals. In the contrary, small and poorer farmers continued to use rangelands and experienced a reduction of their income levels. Differential taxation, however, promotes more equity in rangeland use and could provide community members with new opportunities to mobilize and re-invest collected contributions in rangeland rehabilitation.

1.2 Effects of privatization efforts in Tunisia

In recent years, privatization has been promoted as the panacea for inducing agricultural growth. It is generally assumed that farmers with more rights have a higher probability to invest on their lands because they have greater assurance to recoup the returns from their investments and better ease to get credit for making land improvements. This assumption was tested in Tunisia to evaluate the effects of privatization policies in dry areas.

The results of the different simulations showed that privatization and titling had increased the propensity of farmers to make long-term land improvements in trees and wells. The probability of investment in titled field was 33% higher than on untitled ones. Farmers invested \$121 more on these fields than untitled ones between 1975 and 1998. Regardless of the problems regarding the 1995 law that redefined the privatization of state domain lands, farmers invested in all the state lands that they purchased from other farmers. However, there was no significant difference of investment between rented lands and individually owned tribal or inherited state lands. This situation may have been the consequence of the popular use of the *Mugarsa* type of contract by many farmers to develop the lands that they received following the individualization of collective tribal lands. Under such contract, tenants invest by planting the rented field with the expectation to receive generally half of the planted land area once the trees reach maturity.

Regarding the demand for credit, the results suggested that the contribution of tenure variables in farmers' demand for credit was marginal even when they had titles. The most important determinant for credit demand was education. Household heads with primary, secondary and university demanded respectively 5%, 6% and 18% more credit than non-schooled farmers. Regarding input use, farmers put more fertilizer on rented plots than on their other fields. These results were outcomes of the development of vegetable and watermelon production on rented fields. Though, higher yield values were found for inherited tribal and state purchased lands with respectively 608 TD and 565 TD more than rented fields. This peculiar situation results from the fact that farmers have planted olive trees in most of their inherited tribal or purchased state fields.

The results of the simulation in Tunisia suggest that the privatization and individualization policies have promoted the development of higher value tree crops like olives, pistachios and irrigated summer crops, which have helped farmers to enhance and stabilize their income. In addition, education constitutes an important variable because farmers with higher education had better access to information on the procedures for getting credits.

1.3 Household determinants for female involvement in off-farm labor market in Syria

There is a growing interest in investigating the growing role of women in on-farm and off-farm activities and assess their contribution to household livelihood strategies. The research at the community of Umul-Amad (Syria) investigated the household factors that induce women to get involved in off-farm income generating activities. According to community members, women in

the Umul-Amad provided up to 80% of the agricultural labor force but they have very little access to productive resources like land. The results of the simulation confirmed that women spent more time on their household farms than men and this was the case for all crops. However, the contribution of male hired labor was higher than women hired labor.

Regarding the factors that influenced the involvement of women in the off-farm labor market, it was found that education, family size, size and fertility of their land resources and household land use patterns were the most significant factors. Women with primary education had a higher probability to work as agricultural laborers in their village than non-schooled women while women with secondary education had a lower probability to work as agricultural laborers. At the university level, none of the women contributed either to on-farm or off-farm activities. Moreover, higher household land holding reduced the probability for female members to work off-farm. For any additional hectare of land, women worked 0.34 working day less while any additional percent of fertile soil reduced the number worked outside the farm by more than 10 days. In addition, any percentage increase of the farm under tree cropping resulted on the reduction by 15 days of female work as laborers. Finally, any one-person increase on the family size induced women to work 2 additional days as agricultural laborers.

The results confirmed that resource poor households tend to exercise the options of using female household labor, wives and daughters, for generating additional household income. These demands on female members' time generally limits their ability to undertake higher education and this may explain the significance the involvement of women with primary education in the off-farm labor market.

2. RESEARCH PROBLEM

Mashreq & Maghreb countries have been exploring new policy alternatives to mitigate environmental degradation and promote sustainable resource use and conservation without decision making support systems that would allow them to evaluate the potential impacts of selected technology packages, policy and institutional options. Previous M&M researchers focused on farmers and herders without taking into consideration the potential effects of proposed interventions on different farm types and communities. Moreover, many institutional reforms, like privatization, have been tried in the dry areas to improve the ability of farmers to improve their production systems but there was little understanding on how farmers reacted to these opportunities and how have these reforms affected their overall livelihood strategies. The introduction of new technologies and implementation of new policies and institutions have changed the production and livelihood strategies of communities in the dry areas and are also affecting household labor allocation with a growing involvement of women on off-farm activities.

As a results, major research gaps were identified after the first phase of the project in term assessing the (1) potential impacts of crop, livestock, and resource management technologies; (2) effects of changing output and input prices on the adoption of sustainable agriculture technologies; (3) effects of drought management policies on community welfare and rangelands; (4) effects of changing land tenure regimes on land use and investment in land improvements; and (5) role of agricultural policies, technical and institutional changes in inducing migration from the dry areas to urban areas or other rural areas.

The research problems did not change during the life of the project because project was built around issues that emerged following many years of research. Secondly, most of the research was devoted to developing new approaches to work at the community level and develop methodologies to assess the effects of technologies, policies and institutions. Nonetheless, the research focus has changed in Syria to focus more on gender analysis because of the lack of adequate expertise in developing the model at the national level.

3. RESEARCH FINDINGS

3.1 Community characteristics

Economic and social changes in the dry areas are also fostering livelihood changes for many rural households. The main feature of communities in the dry areas is the differences in their resource endowment and their livelihood strategies. Villages blessed with access to some irrigation water are diversifying into value products such as fruit trees, vegetables and dairy cows, and are achieving much higher incomes than their rainfed counterparts. Access to water is, therefore, contributing to worsening income disparities between communities even as it enables some communities to escape poverty. Table 1 provides contrasting M&M project data from the Zoghmar and Nouayel communities in Tunisia. Nouayel has access to some irrigation water and is more diversified than Zoghmar which is a rainfed community. The difference in income levels is dramatic, \$4619 in Nouayel vs. a loss of \$599 in Zoghmar in what was a drought year.

More farmers are migrating today (often seasonally) or developing off-farm income sources to meet their household livelihood needs. As a result, women are taking over more of the day-to-day farming operations. But even they are entering the non-farm economy in a serious way. However, the strategies were different between communities that had rangeland resources (Ait-Amar) or flood water (Nouayel) and those that did not (Zoghmar and Umul-Amad). In both communities, off-farm revenues accounted for up to 60% of the household income in Umul-Amad of which 11% of the gross income was contributed by female members working in non-farm activities (Table 1). In addition, the level of inequalities of both assets and income was very high in all the different communities.

3.2 Community models simulations

For the community of Ait Ammar, three specific sets of options have been tested and evaluated using the model:

- (i) Technical options: various feed blocks formulas
- (ii) Drought management policy options in terms of feed subsidies and credit
- (iii) Institutional options with respect to access and use of the common rangeland.

3.2.1 Technical options: Feed blocks

Technical feasibility studies have identified eleven different feed block formulas to be transferred to farmers of the region. The model simulation indicates that only two of these formulas are economically viable with the current feed pricing system (Formulas 8 and 11). The introduction of these two types of feed blocks led to an increase in revenues and a drop in the overall variability of income. This suggests that the other alternative feed block combinations need to be revisited with respect to nutrient content and composition. The introduction of feed blocks has also implications in terms of crop and livestock production, and input use. Farmers responded by changing their feeding strategies and the volume and composition of their flocks. First, there is a reduction in the purchases of bran and industrial concentrates hinting to a lower reliance of the market and more crop-livestock integration on the farm. Second, as a response to changes in the demand for feeds, farmers adjusted by producing more barley and soft wheat and reducing their durum wheat land allocation. Third, sheep production shifted more towards reproduction than fattening as suggested by the increase in ewe numbers and consequently young animals. The implication of these findings is that the potential loss of income resulting from removal of feed subsidies or an increase in the cost of feeds bought from the market could well be mitigated with the adoption of these low-cost feeding alternatives. The introduction of feed blocks of the type retained by the model should be encouraged with a better information spreading strategy targeted at the farmers that need it the most.

Table 1: Socioeconomic Indicators for Selected Communities

Countries	Morocco		Tunisia				Syria	
Communities	Ait-Amar		Zoghmar		Nouyel		Um-Amad	
	Mean	Gini	Mean	Gini	Mean	Gini	Mean	Gini
Household productive assets								
Land holding (ha)	11.05	0.46	19.9	0.44	13.6	0.33	9.79	0.45
Number of trees			152	0.53	235	0.39	2	0.72
Sheep & goats (head)	21.51	0.47	51	0.43	24	0.37	27	0.8
Cows (head)(1 cow =7 sheep)	3.56	0.63	0.5	0.83	1	0.74	0.33	0.91
Household Gross Income (\$)								
Total Income	7682.4	0.51	4282.30	0.48	9656.6	0.51	3072.7	0.53
Crop-income	3816.5	0.58	591.60	0.60	7164.4	0.61	338.42	0.88
Livestock income	3552	0.56	2574	0.54	2168.7	0.4	1277.2	0.80
Off-farm	313.8	0.85	1116.7	0.61	323.56	0.89	1457	0.50
-Female	*		*		*		267.66	0.84
-Male	*		*		*		1189.4	0.54
Gross Income shares (%)								
Crop-income	50		18		60		11	
Livestock income	45		55		34		29	
Off-farm	5		27		6		60	
-Female			*		*		11	
-Male			*		*		49	
Household Net Income (\$)								
Total Income	4382.7		-599.51		4619.54		2095.42	
Crop-income	2874.6		-2091.46		3270.45		48.39	
Livestock income	1194.4		375.21		1025.54		590	
Off-farm	313.7		1116.73		323.56		1457.03	
-Female							267.66	
-Male							1189.37	
Number of households			40		40		90	

3.2.2 *Policy options: Drought relief programs*

Drought management policy has been the subject of various debates not only in Morocco but also in several other WANA countries. Governments have usually responded to recurring droughts by providing subsidized feed and debt cancellation. However, there is an increasing dissatisfaction with these policies because of their associated costs and their inefficiency in targeting the farmers that need support the most. The model was used to simulate a set of alternatives to the current policy by changing some of the key parameters set by the Government of Morocco and at the same time explore the principal determinants of agricultural credit in the community selected. The simulations conducted reveal some important limitations with respect to the way in which the current drought relief program operates. For example, it appears that the level of subsidization (in terms of price change) does not yield changes in the level of income with the current volume of feeds distributed on the site.

However, results show that changes in the volume of feed available could lead to substantial increases in community income up to 11% compared to the baseline situation. By raising the current limit of 500 tons for the community of Ait Ammar, substantial changes in terms of production and income could be obtained. This change in the policy would not only affect levels of income and production but also have important implications in terms of resource conservation. The simulations with a higher volume show a clear drop in the shadow price for the common rangeland hinting to lesser pressure for this heavily degraded resource.

Under drought management options, the identification of key determinants of credit demand was performed. The simulations show that this demand is very much influenced by output and input prices. While crop input and livestock prices affect positively this demand, crop output prices have a negative impact on credit. Aversion to risk was found to reduce demand because of its close association with the use of sheep extensive production systems (fattening). Starting wealth tends to negatively affect this demand. This latter finding suggests that farmers could have serious problems in starting the new season after a drought if no provision is made to be able to reconstitute an adequate level of liquidity.

3.2.3 Institutional options: Rangeland Taxation

The last set of simulations looked at ways to include farmers in the decision making process relative to the management and protection of the common rangeland by designing an incentive scheme that would reduce the "Tragedy of the Commons" type of behavior. This is done through the implementation of a taxation or fee-based system in which taxes are re-invested in the community. Two schemes were retained to evaluate the impact of taxation on resource use and degradation. The first scheme consisted of fixed fees regardless of the amount of dry matter collected while the second used differential taxes depending on intake. Various levels of taxation for the two schemes have been explored. Results show that the application of a fixed taxation system does not affect farmers' behavior. This indicates the importance of this resource in the feeding strategy and the absence of a less costly alternative.

However, the imposition of the differential tax system according to intake leads to a significant reduction in usage patterns. For example, medium-type farmers were able to reduce their dependence on the rangeland because of a higher reliance on their cropland for generating alternative feed sources. On the other hand, small and poorer farmers do not seem to substantially reduce their usage of the rangeland. As a result, income levels of the latter were negatively affected by the taxation scheme.

This institutional option could provide the members of this village with an opportunity to re-invest the contributions collected in rangeland rehabilitation programs. Furthermore, it could lead farmers to reduce the stocking rates since taxation depends on the number of heads put on the range. This should push farmers to constantly re-adjust flock sizes according to their contribution to the scheme. The direct implication of this system is a less inequitable rangeland use system where farmers contributing more have a commensurate benefit with the level of taxes paid and re-invested in the range. Farmers could look at this system and feel a lower level of frustration as a result.

The results of these various simulations have been presented to several members of the community during a restitution workshop. The different policy, technology and institutional options have been presented and findings of the simulations discussed. Given the enthusiastic response to the case made with feed blocks, farmers have requested from the Project Team to help them in establishing closer contacts with the community of Sidi Boumevdi where feed blocs are currently being produced. A local workshop will also be organized in the summer of 2001 to show the basics of feed block production. The audience has intensively discussed the results of the feed subsidization experiments. Obviously, this is a very critical issue for farmers who reiterated the deficient nature of the current program with respect to the quantities attributed to the community. With respect to credit, the community emphasized the crucial nature of land titling in the determination of the level of credit asked for. It was also felt that credit could play an

important role in helping farmers in managing their production plans. The last set of scenarios explored with the model and relative to rangeland taxation was received well. However, the community sees its involvement in this scheme only if assurance is made that the local authorities will commit to re-investing the money collected through taxation in a rangeland rehabilitation program.

Despite the warm reaction from the community to this scientifically oriented work to help it design its own development plan and the insights provided by the current modeling structure, the results should be handled with caution. This has been an attempt to guide local farmers and authorities in their own decision making process and should not be viewed as an opportunity to prescribe a particular course of actions. With this understanding in mind, the model could further be improved by constantly re-evaluating the information embedded in the technical production relations and behavioral rules assumed. The Project Team looks at this framework as a tool to help evaluate options that one has difficulties implementing because of their time-span or the lack of a full-information set on the costs and benefits associated. Its benefits go beyond the merits of an academic exercise if it is intended to help policy-makers design sustainable development frameworks directly designed with the communities they intend to reach.

3.3 Effects of privatization efforts in Tunisia

In recent years, privatization has been promoted as the panacea for inducing agricultural growth. It is generally assumed that farmers with more rights have a higher probability to invest on their lands because they have greater assurance to recoup the returns from their investments and better ease to get credit for making land improvements. Since late 1950s, the Tunisian government has introduced major tenure reforms to promote privatization by upgrading traditional tenure systems and individualizing tribal collective lands. These changes have led to the transformation of the landscape in the dry areas of Tunisia but there is a very little understanding on the effects of these reforms on the above assumptions. In the two selected communities, Nouayel and Zoghmar, we found five types of land rights: titled lands, privately owned but under extreme co-ownership¹, individualized tribal collective lands, state domain lands, rented lands. All these lands were acquired either through inheritance or purchase. Rented fields were used as the control variable to compare them with the other types of land rights other than titling, which was compared to all untitled the untitled fields including rented fields.

3.3.1 Privatization and land improvement

The definition of land improvements covered any long-term investments made by farmers to enhance productivity since the acquisition of the field. These improvements, including de-stoning, tree planting, and the digging of wells, were found on 42% in Tunisia. In both communities, besides titled lands, the traditional private lands (*mulk*) were under extreme co-ownership. The results of the different simulations showed that privatization and titling had increased the propensity of farmers to make long-term land improvements in trees and wells. The probability of investment in titled field was 33% higher than on untitled lands. Farmers invested \$121 more on these fields than on untitled ones. Moreover, farmers invested in all the state lands that they purchased from other farmers. However, there was no significant difference of investment between rented lands and individually owned tribal or inherited state lands. This situation may have been the consequence of the popular use of the *Mugarsa* type of contract where tenants invest by planting the rented field with the expectation to receive generally half of the planted land area once the trees reach maturity.

Regarding the proportion of the field area planted with fruit trees, all the different types of land rights had positive and significant effects. In general farmers planted trees on 27% more on their tribal collective and state domain lands than on their rented fields while planting 37% less on their co-owned fields. Moreover, farmers planted 35% more of their field area under titled than

¹ The high level of co-owners make any division unfeasible

untitled ones. These results were also confirmed when we estimated the effective area planted with fruit trees. For example, farmers planted 8 trees more on their titled fields. Furthermore, the probability to invest on well digging was 14% higher on titled fields than untitled ones.

In general, titling have had positive effects on the propensity of making long term investments as well as on the level of investment, planted area and number of trees. This confirms that titling provides enough incentives for farmers to invest on their lands and the hypothesis that titling induces more demand on land improvement.

3.3.2 Demand for credit

Since late 1970s, the promotion of agricultural credit and investment incentives has been two major government instruments for the development of the agricultural sector. In spite of multiple reforms and incentives, the impact of these policies remained modest and in 1995 only 8.4% of rural operators in majority big owners demanded credit. This low credit demand reveals the existence of constraints that are preventing farmers to use formal credit systems. The results of the analyses suggested that the contribution of tenure variables in farmers' demand for credit was marginal even when they had titles. The most important determinant for credit demand was education. Household heads with primary, secondary and university demanded respectively 5%, 6% and 18% more credit than non-schooled farmers.

3.3.3 Input use

The results of the simulations suggest that farmers put more fertilizer on rented fields than on their other fields. On state domain lands, inputs use per ha was 112 TD and 98 TD less on inherited and purchased fields respectively than on rented fields. On individualized tribal lands, input use was 100 TD less while on co-owned lands these costs were 113 TD and 128 TD less for inherited and purchased plots. These results suggest some marginal differences between different land rights and mode of acquisition. However, farmers used more inputs in their rented fields because they generally rent these fields to grow irrigated vegetable and watermelons. Regarding the effects of land use variables, the results confirmed that less input was used on cereals crops than on trees and vegetables. In addition, education variables had expected positive signed on the use of inputs with farmers with secondary training investing 75 TD per ha more than unschooled farmers.

3.3.4 Yields

The results were positive but very variable between land rights. For state domain lands, the yield values per ha were 394 TD and 565 TD more on inherited and purchased fields respectively than on rented fields. On individualized tribal lands, the yield value was 608 TD more on inherited lands. On co-owned lands, yield values per ha were 323 TD for purchased lands and 297 TD for inherited lands. These results suggest a lot of variability within and between land rights compared to rented fields. This peculiar situation results from the fact that farmers have planted olive trees in most of their inherited tribal or purchased state fields. Education did not have any significant effect on yields but growing vegetable and watermelon yielded 577 TD.

The results of the simulation in Tunisia suggest that the privatization and individualization policies have promoted the development of higher value tree crops like olives, pistachios and irrigated summer crops, which have helped farmers to enhance and stabilize their income. However, in the studied communities the assumption that privatization and titling would promote the demand for credit was not found but education was an important variable both in the demand for credit and input use. Farmers with higher education had better access to information regarding inputs and procedures for getting credits and are more likely to exercise these options. This does not, however, mean that privatization should be used as a panacea for the development of the dry areas because many of these resources are easily degradable and require collective action. The results were discussed in a meeting between policy makers in the Sidi Bouzid district, community members and the M&M national team. It was clear that farmers were concerned about the

changes that occurred on the 1995 law which redefined the procedures for privatizing land under state domain that have been distributed to farmers since late 1940s.

3.4 Female involvement in off-farm labor market in Syria

There is a growing interest in investigating the growing role of women in on-farm and off-farm activities and assess their contribution to household livelihood strategies. Women accounted for 11% of household heads but 80% of these women heads were located in the villages of Tal-Hassan Bacha and Umul-Amad. The research at the community of Umul-Amad (Syria) investigated the household factors that induce women to participate in off-farm income generating activities. These factors were classified into four categories: labor quality (age and education), household assets (land and livestock), land use (cereal and tree crops), and village variables to capture the differences between villages

3.4.1 Labor quality variables

The results suggested that family size was an important variable that induced women to work off-farm. Any increase of the family by one person results into a 4% increase in the probability of women to work off-farm both inside and outside the village and an increase of the revenue generated by women by 502 SYP and the days worked outside the family farm by 2 days. Women with primary education had a higher probability (8%) to work as agricultural laborers in their village than non-schooled women. However, under the same level of education, daughters work more on off-farm activities. Women with secondary education have lower probability to work as agricultural laborers and at the university level, none of the women contributed either to on-farm or off-farm agricultural activities. The preeminence of women with primary education indicates that women start to work at a young age, which prevents them in most cases to go beyond primary education. During the workshop that was organized for women in the community, women raised education as the major mean for escaping from the hard agricultural labor and having a good job. However, they were concerned also on the limited opportunities that were available for women to get good jobs.

3.4.2 Household assets variables

The effects of household livestock assets on the propensity of women to work off-farm were positive for daughter regarding sheep and negative for wives regarding cows. These results illustrate the ongoing household livelihood strategies. Daughters worked as agricultural laborers during the harvesting periods while their fathers are renting crop residues. This explains the positive relationship between sheep and off-farm. The negative relationship found between wives and cows could be explained by the fact that wives are generally in charge of milking and tending household cows and consequently not involved in off-farm activities.

Household land holding reduced the probability for female members to work off-farm. For any additional hectare of land, women worked 0.34 day less while any additional percent of fertile soil reduced the number worked outside the farm by more than 10 days. These results suggests that more than the size of the land, the quality of the land is the most important factor that induces women to work off-farm.

3.4.3 Land use variables

The introduction of fruit trees is contributing to a rapid transformation of the landscape in many communities rural Syria. In the community of Umul-Amad, the implementation of the green belt project in the 1980s has resulted in the development of tree crops, which account for 1600 ha, 17% of the community lands. Such transformation has a real impact on household income as well as on the allocation of their labor. The results of the analyses suggested that planting an additional 1% of the family farm with fruit tree increases the probability of working on their family farm by 38% while reducing the probability of their involvement in the agricultural labor market by 31% and the number of days worked outside the farm by 16 days. However, increasing the

areas of cereal crops by 1% increases female contribution in on-farm activities by 42% but do not significantly change their involvement in the agricultural labor market.

3.4.4 Village variables

The four villages (Khubul-hat, Sneida, Tal-Hassan Bacha, and Umul-Amad, composing the Umul-Amad community have different resource endowment and are using different labor allocation strategies. Three of the villages were compared to the village of Tal-Hassan Bacha. The results have shown very interesting women labor allocation patterns. Women of the Khubul-hat village are mainly involved in on-farm activities and have a probability of 35% more to be involved in on-farm activities, 13% less on off-farm activities and 1370 SYP less than the village of Tal-hassan Bacha. There were no major differences between the villages of Sneida, Umul-Amad and Tal-Hassan Bacha. However, women in the Sneida village have a lower probability to work as laborers in their village while wives in Umul-Amad tend to work less than those in Tal-hassan Bacha.

The results confirmed that resource poor households tend to utilize female labor, wives and daughters, for generating additional household income. These demands on female members' time generally limits their ability to undertake higher education and this may explain the significance of the involvement of women with primary education in the off-farm labor market. The development of fruit trees is being promoting in many countries and an important mean to reduce the vulnerability of poor households. However, the results of the simulations suggest that this may induce women to reduce their off-farm income generating activities and devote most of their times on on-farm activities. The question that arises is who controls women's income generated from off-farm activities and what is the income they receive working on the family fields? However, policies or interventions to improve women's conditions in the rural areas must be well targeted because in the same community, villages located between 3 and 5 km apart are using different strategies. The joint project between ICARDA and University of Guelph, funded by CIDA's Linkage Fund, will further investigate these issues in different rainfall zones and production systems.

4. FULFILLMENT OF OBJECTIVES

The overall objective of the IDRC project was to provide policy makers, local communities and researchers with means for a better understanding and assessment of likely economic, social and environmental consequences of the different policy, property right and technical options for improved range, livestock and crop management on the low-rainfall areas of Morocco, Syria and Tunisia.

This overall objective was met satisfactorily. The first benefit of the project has been the community approach that fostered different researchers from different disciplines to work together and build models for evaluating the extend to which selected technical, institutional and policy options may impact on communities and groups. Moreover, the assessment of privatization policies and their impacts on the ability of farmers to improve their production systems and livelihood strategies constitute an important contribution to helping policy makers target institutional reforms that would enhance the decision making environment under which farmers in the dry areas operate. Furthermore, the development of a methodology for identifying the factors that contributed to women involvement in the off-farm labor market will help target further policies seeking to support the development of women and the improvement of rural livelihood strategies.

- (1) Develop and validate an analytical framework (models) for integrating economic, social, and environmental impact assessments based on the community, with typical households of characteristic subgroups as units of analysis;

This objective has been partly completed with the development of the model in Morocco. The Model in Tunisia is being calibrated and will be used to evaluate the options that were identified by the M&M team. The community model in Syria was not constructed because of human resource constraints. However, we can consider that model development was successful because it was a very difficult and time-consuming exercise that required a lot of efforts from different resource people. The econometric models used to evaluate property rights and gender issues are an important tool to evaluate the behavioral changes resulting from institutional reforms and household labor allocation strategies.

- (2) Compare the likely consequences of different combinations of policy, property rights and technical options, in terms of effects on economic growth, poverty alleviation and environmental sustainability at the level of the community;

This objective was not fully addressed at this stage by the project. However, the Moroccan and Tunisian national teams are committed to improving the model and undertaking new simulations to evaluate the tradeoffs and welfare gains of combined policy, institutional and technical options.

- (3) Assess the likely incidence of consequences of different development options on subgroups within the community and identify the gainers and losers under of each option: interest groups or vested interests; disadvantaged groups (women; landless; small farmers),

This objective was fully covered by the community model in Morocco that looked at the effects of different technologies, policy and institutional options on the welfare of different farm types ranging from small to large. In addition, the econometric analysis in Syria was able to shed some light of the factors that are pushing many households in the dry areas to promote women's involvement in the off-farm agricultural labor market.

- (4) Assess the effectiveness of various institutional options for rangeland management, by understanding the social contexts in designing and implementing desired interventions; and

This objective was not investigated within the project because new funding was obtained from the System-wide Program on Collective Action and Property Rights (CAPRI) and the Ford Foundation to evaluate institutional options in rangeland management in Jordan, Morocco, Syria and Tunisia. The institutional options have been identified and will be tested in community models at a later stage.

- (5) Disseminate the results through an iterative, participative research process that involves community members, national technical experts and policy makers, and through publications. Policy improvements are anticipated through use of this process.

Besides the community workshops that were organized by the teams with the communities and other stakeholders and the Marrakech policy workshop, very little dissemination have been done. However, teams are working on their papers to be included in the workshop proceedings

5. PROJECT DESIGN AND IMPLEMENTATION

Working at the community level required the teams to work with different qualitative and quantitative research methodologies to grasp a good understanding of the communities and their members' resource opportunities, constraints and strategies developed by farmers/herders and communities to manage their resource base. These methodologies were also complementary in triangulating the type and quality of the information.

5.1 Rapid Rural Appraisal (RRA)

Rapid Rural Appraisal (RRA) was an important tool for mobilizing the synergies of the different teams members towards assessing the problems and needs of the selected community. Moreover, it was an important mechanism to develop relationships with the selected communities and get to know some of the farmers and the ongoing dynamics at the community level. The RRA had two components: (1) a general component that involved all team members; and (2) focus groups that were organized along disciplines to facilitate direct interaction between the team specialists (livestock, cropping, rangelands and socio-economics) and the farmers/herders identified in the community as the people with extensive knowledge in the focus activity. A guide for conducting RRA was developed and given to each team. Modifications were made according to the local context. The RRA were also an important contribution of the project in building team spirit and the capacity of NARS partners in the design and implementation of this research tool.

5.2 Household surveys

Prototype questionnaire, which was given to each team, was adapted to the national context by the principal investigators. To reduce costs and maximize benefits, a careful investigation was conducted to assess and collect available secondary data. The questionnaire included different sections to capture activities and income sources of the communities (crop, livestock, rangeland and socio-economics), physical characteristics of their fields and rangelands and production strategies. Selected and interviewed households were 109 households in Morocco, 100 households in Syria and 80 in Tunisia.

5.3 Community models: Evaluating the effects of policy, technical and institutional options

The community models were used as a tool to evaluate new technologies, analyze key policy reforms and simulate institutional and property rights changes. They were, particularly, intended to help identify the nature of key policy measures and assess the impacts of these measures on the cereal and livestock sectors in the selected rural communities.

The community modeling was implemented in Morocco and Tunisia. In Syria, it was difficult to carry out the modeling work because of many human resource constraints. In addition, at this stage, only the community model developed in Morocco is working. For the Nouayel community (Tunisia), a model was developed to explore various options and restate its results to the community. The development of the platform has taken more time than expected because of the complexity in modeling features related to land allocation across the three types of land (irrigated, rainfed and Oued el Feka flooding). With the presence of alternatives to rainfed agriculture, this community represents a rural development pathway that could well spread over the low rainfall environment landscape in the region with increasing awareness on the necessity to manage water resources. This work is still ongoing on within the larger M&M project.

Mathematical programming, the tool used to build the community models, refers to a set of procedures dealing with the analysis of problems in which a decision maker wishes to optimize a measure of wealth or satisfaction by selecting values for a set of decision variables subject to some constraints dictated by the environment and beyond his control. The modeling approach used in Morocco and Tunisia includes four modules: (i) a farm-household module that specifies the underlying behavioral relations between household resource allocation and consumption priorities; (ii) an input-output module for crop and livestock activities that details technological coefficients for current and potential activities; (iii) an optimization procedure to evaluate household responses to changes in the market environment (e.g. changes in policy instruments); (iv) an aggregation procedure that tackles tradeoffs between individually owned production factors (land, labor and capital) and access to common resources at the community level.

The community model represents an abstract and simplified picture of an aggregation of typical whole-farm systems found in low rainfall areas in WANA. The smallest unit of analysis is the farm, which is assumed to have minimum cash requirements to be met by crop and livestock

income or off-farm employment either within or outside the community. Farm families have different resource endowments for crop-livestock production in terms of land, labor and capital. The individual farms are linked not only between themselves in terms of exchange of factors of production but also to the market for input purchases and output sales.

The model used in the community studies relies on a standard mathematical programming formulation of the type:

$$\begin{aligned} \text{Max } Z &= \bar{C}X \\ \text{st. } \quad AX &\leq b \\ X &\geq 0 \end{aligned}$$

where \mathbf{C} is a vector of net average returns, \mathbf{A} a matrix of input-output coefficients, \mathbf{b} a vector of resource endowment levels and \mathbf{X} a vector of decisions related to land allocation, input use for crop production, sales and purchases of animals, sales and purchases of feed, labor allocation, and financial farm management. Farmers in the community model have been grouped into farm types. We have maximized a weighed profit function where the weights α_j represent the importance of each farm type (the frequency of which is n_j) in the sample or population of size N .

$$\begin{aligned} \text{Max } TW &= \sum_j^h \alpha_j \pi_j ; \\ \alpha_j &= \frac{n_j}{N} \end{aligned}$$

The determination of the total number of types h , which was chosen according to the distribution of farm types at the community level, is justified on computational and policy recommendation grounds. The use of policy recommendations is warranted only if farmers are clustered according to similarities, within the same class and differences across classes, in their production systems and resource endowments. Moreover, to capture crop-livestock integration, an important feature of the production system found in arid zones, crop outputs were classified into grain, straw and stubble. Such distinction also relates to the qualitative and quantitative herd feed needs as well as herd composition.

The feeding strategy was specified according to animal type, sex, age, and nutritional requirements (dry matter, crude protein and energy) for different physiological stages. The constraints of the problem included one set for the minimum requirements in terms of energy and protein, and one set for the maximum requirements for dry matter. These two sets of parameters, which are needed to setup the feeding system according to feed origin and nutrient composition, are covered either from the farm, purchased from the market or accessed through monetary or non-monetary contractual arrangements. In addition, private and common resources endowments are taken into considered along with technical, market and institutional constraints. Moreover, the model was designed to allow for crop-livestock integration and analysis of equity issues as related to growth objective.

Risk and uncertainty are important factors in dryland agriculture because of erratic and variable rainfall patterns. In addition to crop and livestock production risks arising as a result of weather and performance based factors, pricing policies and institutions reforms tend to modify the nature of price risk faced by farmers in the LRA. In order to incorporate the nature of agricultural decision making under uncertainty, the conceptualization of decision problems under risk in low

rainfall environments was done through various formulations developed and tested in the area of risk and uncertainty.

5.4 Econometric Analyses

The econometric models analyzing the effects of property rights on croplands (Tunisia) and the role of women in agricultural production (Syria) were developed and used to evaluate propensity of farmers to make long term investments, assess the level of that investment.

5.4.1 Effects of property rights on long term land improvements

The relationship between land rights and land long-term land improvements was estimated using Stata software and survey data of 80 households from the Nouayel and Zoghmar communities in the Sidi Bouzid district of Tunisia. Probit models were used to estimate the ability of farmers to make long-term investments and demand for credit to make improvement. In addition, Tobit models were used to estimate levels of investment, investment choices, input use and the relationship between productivity and land rights. These relationships were estimated using the following equation:

$$y_{pi} = b_0 + b_i x_i + b_p x_p + b_r D_{rp} + u_{pi}$$

Y_{hp} is vector of dependant variables for plot (p) of household (i); x_i and x_p are vectors of household and plot characteristics; D_{rp} is a vector of dummy variables for different land rights and mode of acquisition; D_v is a vector of village dummies; U_{pi} unobserved factors affecting the dependant variable and b_0 , b_i , b_p , and b_r , are coefficient vectors to be estimated.

5.4.2 Contribution of women in on-farm activities and off-farm income generation

The study in Syria focused on the gender issues because this main feature of this community was low level of adoption of improved cultivars and the importance of female labor in agricultural production. Farmers reported that women performed up to 80% of crop and livestock activities but had very limited access to productive resources. Moreover, very limited number of households used improved barley cultivars even though the office of the extension services is located there. The main hypotheses were (1) whether households with good resource base (land, tree and water) tends to diversify and utilize their female labor mainly on the farm while households with poor resource base compensate for inadequate household agricultural income by exercising labor allocation options for male and female household members and (2) whether households specialize in exporting or importing female labor depends on their resource endowment (land, sheep, trees and water) and the property rights that they hold over land.

These hypotheses were estimated using Stata software and household and field level data for 97 households in Syria. Probit analysis was used to estimate the propensity of women (wives and daughters) to get involved in off-farm labor activities and Tobit models were used to estimate the level of women involvement in farm production and income generation. The relationships were estimated using the following equation:

$$Y_{hi} = b_0 + b_h x_h + b_i x_i + D_p + u_{hi}$$

Y_{hi} is vector of dependant variables for household (h) of community (i); x_i and x_h are vectors of household and community characteristics; D_p is a vector of production system dummies; U_{hi} unobserved factors affecting the dependant variable and b_0 , b_h , and b_i , are coefficient vectors to be estimated.

5.5 Participatory research: building teams and involving farmers and policy makers

This was the most challenging but interesting and rewarding aspect of working at the community level. One of the main goals of the project was to integrate team members from different disciplines and use participatory methods involving the selected communities and policy makers in identifying firstly the constraints and opportunities within the communities and secondly the technical, policy and institutional options that would relieve some of these constraints. This was a major shift in the research process in all the three countries because researchers were mainly accustomed to work with farmers and separately. The implementation of the community approach required taking many steps to foster team building and community acceptance and participation. The following sections describe the different elements of this participatory approach.

5.5.1 Meetings with selected communities and stakeholders

Many meetings were held between the team members and community members and with local administrative officials to explain the objectives of the project and discuss its implementation. Community members attended all the meetings between the M&M team and administrative or NGO agents. Likewise, the different stakeholders were associated to the different meetings that took place at the community level. Such interaction and mutual involvement was critical because the policy makers at the level of the districts gave their support to the project and in some cases proposed to directly contribute in the implementation of the research program.

5.5.2 Developing working mechanisms to ensure team work and community participation

Developing working mechanisms with selected communities was an essential step for ensuring full community participation in the project and that the agreed research agenda will be implemented successfully. Moreover, the participation of other stakeholders (government agencies, administration, NGOs) intervening in the selected communities promoted direct dialogue and partnership. Each country team created a Community Steering Committee (CSC) composed of selected community members, agricultural/extension agents working in the area, and team members. The role of the CSC was to facilitate the interaction between community members and researchers and monitor the implementation of the agreed research agenda with the community. In addition, CSCs were directly involved in the drafting and implementation of the work plans and deliverables.

5.5.3 Community workshops

Each team organized two community workshops. The first workshop, which was organized after the RRA, was a restitution workshop where researchers presented the RRA results and proposed potential technologies that would mitigate the constraints on their production systems. This was an interesting experience for all the teams because it helped strengthen their relations with the community and broaden their understanding. Moreover, community members gave their opinions and suggestions regarding selected technologies and made the final selection of proposed technologies. The second community workshop was organized at the end of the research to discuss and validate some of the options that could enhance the production systems and livelihood strategies of the farmers in these communities. The most interesting workshop was the one organized in Syria for the women to discuss the issues they face and investigating potential options to improve their conditions.

Furthermore, these workshops were great opportunities for policymakers and other stakeholders involved in community activities to intervene and identify areas where they could get involved and help the project during the implementation phase. The participation of local administration officials and other stakeholders was also the first step towards ensuring the sustainability of the project and the potential use of this approach as a model for state intervention in the low rainfall areas.

6. PROJECT OUTPUTS AND DISSEMINATION

The participatory meetings and community workshops were the forum used by the teams to get all the parties to agree to a research agenda and expose project conception and design. The impact of this process of iterative sharing of problem definition and results with community members and policy makers was an improvement of policy dialogue from the viewpoints of stakeholders and community members.

6.1 Reports and proceedings

Each country has drafted a report that needs to be finalized and translated into French, Arabic and English for wider dissemination of project results and methodologies. The community approach and the tools being used to evaluate selected options have raised a lot of interest both at the level of policy makers, farmers and communities. The proceedings of the Marrakech Policy workshop will be published and a paper will document the approach and methodologies that were used to conduct the community studies.

6.2 Training workshops

The principle investigators used two types of workshops to work with NARS partners, national and regional. The national two-day workshops were organized at the beginning of the project to discuss community selection, develop work plans for the implementation of the project, discuss methodologies and explore the potential working mechanisms for working with communities. This was followed by a hands-on approach where the investigators worked with the teams and monitored the progress made in implementing the research programs.

The regional workshops, "Integrated Policy, Property Rights and Technology Transfer Modeling", were organized in Algiers (June 5-9) for M&M teams from the Maghreb region (Algeria, Libya, Morocco and Tunisia) and in Lebanon (July 3-8) for the M&M teams in the Mashreq region (Iraq, Jordan, Lebanon and Syria). Each workshop was a 5-days program with the combination of technical presentations and working groups. This was an opportunity to assess the progress made by the teams and work on the models and data with them. These kinds of working mechanisms between national teams and principal investigators must be institutionalized within research projects because it allows cross-fertilization between countries and help develop a stronger partnership between NARS. This is one very successful feature of the project because stronger NARS partners are helping weaker NARS to implement their own research program. Such collaboration in most of the cases emanated from these workshops.

6.3 Regional policy workshop

The policy workshop on "Technical, Policy and Institutional Options for the Development of Communities in the Dry Areas" was organized by the M&M project in Marrakech, Morocco, January 23-25, 2001. Eighty participants including farmers and policy makers (Morocco, Syria and Tunisia) and researchers (Algeria, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia) attended the workshop. The workshop opened by Dr. IRIFI, the head of INRA-Morocco, and was also attended by Dr. Peter Hazell, Director of the Environment, Production, and Technology division at IFPRI. The first day was devoted to the presentations of the research results from Morocco, Syria and Tunisia and from similar work conducted in Algeria and Jordan.

On the second day participants were organized into three working groups. The first group focused on issues related to working with communities to assess what has been done within the project and discuss potential options for better enhancing this framework. The second group discussed the different technical, policy, and institutional options that are being proposed for the dry areas and explored the enabling mechanisms required to ensure the success of these options. The third group focused on the tools and methodologies used by the project to discuss their adequacy and assess some of the problems that teams faced in implementing the project.

The third day was devoted to a field trip in the community of Sidi Boumeهدي to visit the feed block unit that was funded by a Moroccan NGO. This was a good experience, where the national M&M contributed in developing community development action plans and attracting two Italian and Moroccan NGOs to help support the community development efforts. This was a good opportunity for the farmers from the other communities to share ideas with the community members and the potential outcomes of the community approach.

7. CAPACITY BUILDING

This was an integral part of the project and of working with NARS, besides the training workshops that were presented in previous sections. Investigators worked directly, hands-on with their NARS partners at different stages of the project and provided guidance and suggestions in implementing the different activities. It was truly heartwarming to see the partners from the biological sciences presenting the results of the model simulations and socioeconomic results in general. This shows the level of integration that has happened and the awareness that was raised in understanding the importance of socioeconomic aspects for the success of technologies. There are no longer doubts amongst team members of the M&M project and policy makers in the eight M&M countries that technical options require the support of policy and institutional options if any success is to be achieved for eradicating poverty in the dry areas. The training and institutionalization of this type of research amongst the NARS in the eight countries constitutes a major capacity building achievement for the project.

8. PROJECT MANAGEMENT

Administratively, the IDRC component was directly linked to the existing M&M working mechanisms for managing the research and the financial resources. The activities in Mashreq and Maghreb were managed and coordinated by the respective ICARDA Regional Coordinators and their offices in Amman and Tunis, who were responsible for all logistical and administrative organization and for liaison with national programs. They also were responsible for helping national programs interact at the regional level through the exchange of research results, germplasm and other material, technological developments, and information; exchange visits between countries; organization of regional workshops and annual regional technical meetings; and, coordination with research scientists, arranging for training both within and outside countries. The flexibility in the management and existence of this structure contributed greatly in the implementation and coordination of the research program. Both Regional Coordinators must be complemented for their unfailing support and for helping manage the financial resources, organize workshops and other logistical supports.

At the research level, the project also benefited from existence of the M&M Steering Committee that includes designated National Coordinators for each country, ICARDA's Regional Coordinators, ICARDA's Director of International Cooperation, an IFPRI representative, and donor representatives. The Committee meets once a year to review, amend and approve annual work plans and budgets. In addition, a Regional Research Coordination and Planning Meeting is held annually in which all scientists collaborating in the project, from NARS, ICARDA and IFPRI, review the results of the past work and finalize plans for the coming season. Selected national scientists are responsible for research leadership, management and coordination of specific components of the research program in their country. This second mechanism was responsible for monitoring the progress made and the quality of the research.

9. IMPACT

The impacts of the project have been outstanding and there are few areas that need to be mentioned like:

- (1) *Institutionalizing this type of research at the NARS level:* the project contributed in pushing further the development of these types of research amongst NARS. Researchers see a value of having tools to provide policy guidance to their policy makers. This also supports them in identifying the policy and institutional options that would make the developed technologies more appealing to communities and farmers.
- (2) *Contributing in the developing integrated development framework for the development of the dry areas:* the community approach and its different components contributed in changing the paradigm of research and development in the dry areas. This approach includes different tools and methodologies that take into consideration individual as well as collective behaviors of community members and puts communities and their institutions at the center of the policy design and technology transfer.
- (3) *Developing policy support tools* that will allow policy makers to:
 - (a) better evaluate the target options;
 - (b) assess the potential impacts of these options on the different groups using the model to conduct ex-ante analyses;
 - (c) assess how farmers responded to the different opportunities that were provided by tenure reforms;
 - (d) better frame rural development approaches by paying more attention to the roles being conducting my women and seeking to develop appropriate policies that would take into consideration women's welfare;
 - (e) foster a tripartite dialogue between policymakers, communities, and researchers.
- (4) *Development of a new project for Algeria and Jordan:* The interest that the other M&M countries showed in implementing similar research in their countries have induced the development of community studies project in Algeria and Jordan and funded by FEMISE. These national teams benefited from the work that was done in Morocco and Tunisia. For example, Mr. Bendaoud, the senior modeler at INRA-Settat, worked directly with the Algerian team to help them in developing their community models.
- (5) Getting policy makers at the local and national level to realize that policy, technical and institutional options are not and cannot be dissociated from each other if one seeks to foster rural development is by itself a tremendous impact.

10. OVERALL ASSESSMENT

The project has been over-optimistic in aiming to construct three community models and additional econometric analyses in the three countries. However, regardless of many difficulties that the scientists faced in obtaining the required data, the project succeeded in constructing two models with one already running (Morocco) and the other one at a calibrating stage (Tunisia). The national teams and their ICARDA and IFPRI partners must be commended for developing these different policy support systems and contributing to the development of a research framework that have direct development implications.

In addition, the timing should have been linked to the timing of the overall M&M project. This had many implications on the technical options to be tested. During the past three years, the selected communities were suffering severe drought conditions that did not allow the technology component of the overall M&M project to get any results from the farmers that selected some of the proposed technical packages.

11. RECOMMENDATIONS

The development of these methodologies is very important for the development of rural communities. Governments, development agencies, and researchers have been for the last century trying to foster the development of the rural areas in the dry areas but with very little

success. These efforts have been most of the time based on assumptions that if the technology is good, rural producers will adopt it, forgetting the need to include many indirect incentives in the form of policies and institutional reforms.

Support to this kind of research in the dry areas needs to be continued. It is a win-win investment because, first, it allows researchers to listen and be more sensitive to farmers' needs, rather than focusing mainly on technology development; second, farmers place a great value in seeing their suggestions and advice taken into consideration; and finally, policy makers and development agencies have tools that will allow them to assess any option that they may wish to implement in a given community.