



Abu Dhabi Food Control Authority



International Center for Agricultural Research in  
the Dry Areas

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## Enhance The Agricultural Extension, Technology Transfer Systems and Date palm Integrated Pest Management (IPM) In Abu Dhabi

### Synthesis of learning from ADFSC's model of extension and advisory services and recommendations for moving towards a research inspired innovation systems approach

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#### Summary

This report is a synthesis of an exercise undertaken in late 2015 which sought to understand and learn from the strengths and success of the Abu Dhabi Farmer Services Centre (hereafter FSC); and provides strategic recommendations aimed at improving the efficacy of delivery in extension and advisory services. One key challenge in this exercise has been the acquisition of data and qualitative information which had been requested by ICARDA and pertaining to the operations of FSC. The analysis undertaken herein is, therefore, largely based on interview data with key personnel, field discussions with farm labourers and secondary data obtained through a variety of sources. The latter includes feedback and reflections from Dr. Gaaya's engagement in the training of trainers for extension methodology and in the development of e-diaries; as well as Dr. Boussini's technical training on integrated pest management (IPM).

In late November 2015, a request was made by FSC to provide an opinion on a 2014 consultancy report executed by GRM International and entitled 'Development of Complete Farm Models'. More specifically, the request was made on the basis of an opinion on how to operationalize the models developed within the consultancy report in order to utilize them for foresight on farm profitability and in the development of strategies for both marketing and pricing of key commodities produced on farms within Abu Dhabi. Given interlinked arguments and connections between extension and marketing services undertaken by FSC, a section outlining recommendations has been added to this report as opposed to a separate stand-alone document.

Three key points emerge from the analysis undertaken of FSC services:

1. In somewhat stark contrast to global experience, where extension services are increasingly being privatized, and/or offered through public agencies on a fee for service basis, Abu Dhabi has opted to maintain gratis public provision of agricultural extension services. Historical policies related to farm settlement, coupled with the nature of mobility of South Asian and Egyptian farm labour necessarily requires a role for the state in the provision of extension and advisory services. The pertinent question is how much of a direct role does the Emirate of Abu Dhabi wish to play in the provision of extension and advisory services and for what purpose? Fostering an enabling environment through which farms within the Emirate are accorded equitable access to environmentally and economically sustainable production practices and associated technologies will require a more contemporary focus on 'agricultural innovation systems' as opposed to traditional (linear) methods of technology transfer.

2. Extension and advisory services are generally understood as relating to a process for imparting knowledge and education in order to address concerns of (economic and resource use) efficiency and aimed at improving farm profitability. Supervisory services are often ascribed to contract based (out grower) models wherein the supervision ensures output in terms of both quantity and prescribed quality standards. The current model adopted by FSC provides both extension and advisory services in the case of date palms and supervisory services in the case of vegetables. Implicit subsidization of date palm extension services through (contract based) supervisory services in the production and marketing of vegetables may be inconsistent with farm system optimization. A clear need exists for understanding and incentivizing optimality in farming systems and where optimality is based on economic, environmental and public good concerns. The need for achieving system optimality necessarily requires inclusion of livestock concerns, which are currently provided oversight directly through ADFCA. This returns us back to point 1 and the need for strategic vision on how best to foster an enabling environment for agricultural innovation, which is focused on optimizing farming systems, as opposed to maximizing returns on individual commodities.
3. One key area of engagement for ICARDA in 2015 centered on recommendations related to how best to foster broad uptake of Integrated Pest Management (IPM) within Abu Dhabi's date palm production systems. From a migrant farm labour perspective, the adoption of IPM may pose significant risks. Given relatively weak linkages between farm owners and field extension engineers, the decision to adopt IPM must be made by farm owners as opposed to migrant farm labourers and farm managers. The adoption of IPM is therefore likely to require regulatory oversight and enforcement and given the federal mandate of the Ministry of Environment, consensus among all Emirates. In the absence of an Emirate wide regulatory policy on IPM, broad uptake is likely only to be feasible through the introduction of new (marketable) commodities which are consistent with IPM (eg. flowering medicinal plants), thereby providing private economic incentives for adoption of IPM, supported through effective agricultural innovation systems and consistent with whole farm system optimization. In an ideal situation, private economic incentives would be consistent with regulatory ordinances on the practice of IPM.

A programme of socio-economic research, consistent with the above noted recommendations, is presented for 2016. Requests for data from the recently completed agricultural census survey were made in early 2015, but have not been entertained to date. In addition, a number of questions aimed at fostering a better understanding of the strategic dimensions of FSC operations were also submitted in November 2015 but have not garnered a response. **ICARDA fully understands the nature of sensitivity in the provision of data required to undertake the socio-economic research programme proposed for 2016. How best to allay fears or apprehension in the provision of this data will require a meeting between relevant ICARDA scientists, key FSC and ADFCA personnel in early 2016 in order to ensure that there is a common and mutual understanding of how the data will be utilized.** The acquisition of credible data ensures that recommendations made are based upon sound and credible evidence and aimed at assisting the Emirate of Abu Dhabi in providing an enabling environment for economically profitable and environmentally sound farming production practices which serve the public good.



## Contemporary thoughts on Innovation Systems

The rapidly changing (global) context of agriculture has resulted in a transformation of the manner in which knowledge is generated and applied. Over the years, perspectives on the role of agricultural research for development have shifted considerably, moving from linear Transfer-of-Technology (ToT) models in the 1960s to 'Farmer First' and Farming Systems Research approaches in the 1980s and 1990s. Participatory approaches which came into vogue in the 1990s contributed to technology generation and adoption which incorporated economic, market driven, value chain thinking into agricultural research and extension frameworks. However, neither participatory approaches nor value chain methodologies and focus have adequately addressed the organizational and institutional factors which are required to foster sustainable processes of innovation.

More recent discourse on knowledge generation and dissemination focuses on **Agricultural Innovation Systems** (AIS), which builds on systems thinking. **Systems thinking** is an approach to probing and dealing with the complex situations which actors face in a particular sector – considering the whole and analysing links between the various parts. Systems are defined as “relationships and linkages among elements within arbitrary boundaries for discourse about complex phenomena to emphasize wholeness, interrelationships and emergent properties” (Röling 1992). Integrated systems are complex wholes in which a range of social and bio-physical processes interact across various levels and scales. Re-orienting the dynamics of systems in favour of realizing desirable outcomes is essentially about changing the way people interact with each other and how they respond to shifting environments. (Leeuwis et al 2014). As such, recent approaches to agricultural innovation are increasingly rooted in (soft) systems thinking. The focus on actors, their perspectives, their intentions, and their interrelationships within the wider context makes it a useful approach for dealing with the complexity in which smallholder farmers operate. The new perspectives which emerge through focusing on actors and using a soft systems approach, challenge predominant reductionist, linear, transfer of technology approaches. (Sanyang et al, 2014)

An innovation system can be defined as “a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance” (FAO working definition). They are seen as a way of operationalizing interaction and learning among actors, and enable the reshaping institutions and relationships. (Swaans et.al. 2014) AIS perspectives are of significant utility in addressing systemic constraints shared by multiple actors operating in complex systems with competing forces at play given an emphasis on understanding the nature of relationships between actors, and the attitudes and practices that shape those relationships. Relationships promote interaction and interaction promotes learning and innovation (World Bank, 2007).

## Knowledge transfer systems within FSC

Promulgated under law number 4 of 2009, Abu Dhabi Farmer Services Centre (hereafter FSC) was established with an aim to 'bring strategic agricultural reform to Abu Dhabi, especially by introducing and encouraging the conservation of natural resources'.<sup>1</sup> Initially conceived and operationalized in collaboration with GRM international, an international development management firm, FSC now operates under the aegis of Abu Dhabi Food

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[https://www.abudhabi.ae/portal/public/en/departments/department\\_detail?docName=AD\\_DF\\_124654\\_EN&adf.ctrl-state=dotyt62th\\_4&afrLoop=16446576604985355#!](https://www.abudhabi.ae/portal/public/en/departments/department_detail?docName=AD_DF_124654_EN&adf.ctrl-state=dotyt62th_4&afrLoop=16446576604985355#!)

Control Authority (ADFCA), as a governmental entity, but with an independent legal status. Relative to institutions and practices globally, this parastatal status makes the centre somewhat unique in terms of the delivery of extension and advisory services.

This uniqueness comes about from three historical antecedents. The first relates to state security motives, under which settlements along border areas were promoted and incentivized through subsidies which encouraged agricultural production. Stemming from this, the second is that given limited precipitation, the potential for commercialized agricultural production (with the exception of date palms) is limited; and therefore owners are generally more inclined to maintain farmsteads for aesthetic and intrinsic values as opposed to profit motives. Given restrictions on land ownership rights, one hypothesis is that economic efficiency is likely to be lower than would prevail under a free land market. Lastly, the initial development of the FSC was based upon a corporate model wherein financial self-sustainability was a key guiding principle. While a strategic drive for financial sustainability would still appear to be alive, based upon discussions with key FSC personnel, a recent policy decision to provide inclusive and gratis provision of extension and advisory services runs counter to financial sustainability. Whereas the cost of providing extension and advisory services in the production of vegetables may be recouped through economic margins earned in the sale of vegetables at FSC retail centres, dates are sold directly from the farm gate to Al Fouah company; and therefore the provision of FSC extension services to date palm farmers provide an implicit (but unrecoverable) subsidy to Al Fouah.

*'Extension', 'Advisory' and 'Supervisory' services: is there a need for semantics?*

There are many schools of thought related to the term 'extension services' but what is commonly understood is that of a process of disseminating scientific knowledge, in the form of technologies and best production practices, and demonstrating the applicability of this knowledge to farmers. Over time, the concept has broadened to include a number of different theories and methodologies, but in essence, the principle of disseminating knowledge linearly, from research to extension to farmers continues. More contemporarily, there has been an appreciation for a greater need for a variety of additional public and private services to rural communities. These include, among other areas, services aimed at linking farmers to markets and addressing issues of occupational and public health in agricultural production. Where gender plays a role in agricultural production, attempting to ensure equitable and fair access to knowledge and productive resources for women farmers is also of concern for rural advisory services. It is not uncommon, therefore, to use the term 'extension and advisory services' in order to capture the role of both public and private agents in the provision of a myriad of multi-input services to agricultural communities.

Whereas extension and advisory services attempt to address economic and environmental efficiency concerns, 'supervisory' services are based on an out grower or contract model of agricultural production wherein the focus is on maximizing output and standardized quality. Based upon observation and available information, it would appear that the FSC is steadily moving towards a concentrated focus on supervisory service provision in the production and procurement of vegetables. This would appear to be natural, given a push for financial sustainability, and in light of a recent policy decision to cancel the previous programme for contracted extension services in date palm production. Focusing on moving greater volumes of vegetables through FSC retail centres would allow for generation of greater profits, potentially able to cover the cost of supervisory services, as well as to retain surplus to cover cost of operations and overhead. The latter would also naturally include the provision of gratis extension services to date palm producers.

Clear delineation between 'extension and advisory services' and 'supervisory services' provides a better understanding of how to best strategize the mandate for FSC and

particularly so given an overwhelming focus on financial sustainability. If financial sustainability is of key concern, there is a clear need for understanding the market demand for vegetables within local markets in Abu Dhabi, the nature of competition between imported vegetables (both outside of the UAE and within) and whether competitive volumes are sufficient to attain financial self-sufficiency of the FSC. To our knowledge, this exercise has not been undertaken or at least a report has not been provided to ICARDA for review. The importance however is underscored by the knowledge that prior to the creation of FSC, the government of Abu Dhabi was the sole purchaser of vegetables, a function which was relinquished in 2009 to FSC, which engaged in a model of contract farming and more contemporarily for a limited volume of vegetable purchase.

Research aimed at understanding the feasibility of financial self-sustainability of FSC may assist in policy discussions which uncover options for divesting extension and advisory services to the private sector, retaining certain aspects under public provision, and/or a hybrid model of fee for service provision which may involve a level of subsidy. This would be in line with more contemporary thought on innovation systems as outlined in the preceding section. In acknowledging that this is a politically sensitive area of endeavour, ICARDA has not opted to suggest this research endeavour in 2016, but is amenable to discussion on how best to assist FSC and ADFCA should there be a desire to undertake the same.

Consistent with a recommendation for evaluating alternative options for providing extension and advisory services is the need to assess existing capacity development programmes for extension officers. Field discussions indicate that these officers are largely Egyptian, Jordanian, Somali and Sudanese nationalities with limited engagement of national staff. Anecdotal evidence suggests the existence of 144 officers at present, and this is expected to increase to 230 in the near future. With an estimated 24,000 farms within Abu Dhabi, the new cadre of extension officers would maintain a respectable and manageable portfolio of 103 farms per officer on average. Yet, a standardized evaluation of qualifications, contextually relevant skills, and in service training needs would appear to be not well developed. Connections with institutions of higher education, more specifically with agricultural universities and research institutes within the region would appear to be weak or not formally instituted. Anecdotal evidence suggests that current technologies tested and disseminated through FSC are either based upon engagement with the private sector (imported technologies) or on the basis of advice from FSC 'subject matter specialists' who identify key issues and appropriate technologies for dissemination. The recent engagement of ICARDA, and ongoing collaboration with ICBA is of strategic benefit in terms of access to new contextually relevant technologies, through participatory research undertakings, and capacity development where required; but does not limit the need for effective systems of agricultural innovation. This is a broad research mandate, unlikely to be feasible solely for Abu Dhabi and more relevant for analysis across the UAE.

What is feasible, however, is the need for the development of strategic and comprehensive criteria in assessing skill sets of international extension officers, away from a traditional concentration on technical expertise and more in line with the needs for both functional and technical expertise. How information is delivered, through the employment of theory and practical knowledge, in addition to contextually relevant social skills, are important aspects of functional expertise, without which technical expertise is of little value in fostering broad uptake of technologies. This requires an operating environment wherein extension is viewed as a profession rather than a job, and therefore in-service training as well as membership in an accredited professional body inculcates a spirit of continuous skills and knowledge upgrading. This is of particular relevance to Abu Dhabi where extension officers are for the large part international staff hired on renewable visas. The incentives for international extension officers in delivering efficacy in service provision are not entirely clear; and very much tied to the incentives for migrant farm labourers in adopting new technologies and best practices as well as successful engagement of both farm owners and labourers in the

process of agricultural innovation.<sup>2</sup> While we understand that a number of key performance indicators (KPI) have been identified for assessing the effectiveness of FSC operations, it is not clear how these KPI's are related to performance evaluation of the field extension officers as well as the challenges which they face with language of immigrant farm labourers and the incentives for adoption at the farm level. This is an important element of needed social science research, with strategic implications, and worthy of discussion and consideration.

### **Promoting broad uptake of integrated pest management on date palm plantations**

One identified area of engagement for ICARDA in 2015 was related to the uncovering of options for promoting broad uptake of IPM within the date palm sector. Technical considerations have been covered under the engagement of Dr. Boussini, but one area of immediate interest which has not been studied in depth is the understanding of incentive structures for both farm owners and farm labourers to embrace and adopt IPM. We suggest that this may not be clear cut and for reasons of both risk and lack of incentives. In terms of risk, farm labourers are accustomed to using pesticides. While there may be a lack of efficacy in controlling red weevils and other pests through conventional means, as long as other farms are equally challenged in controlling outbreaks, labourers are safe from reprimand (loss of employment) from farm owners. The decision for one farm to adopt IPM is therefore risky from a farm labourer perspective, in the event of a more serious outbreak relative to adjoining farms wherein the outbreak may be contained or less serious. An appropriate conjecture, therefore, is that either a critical mass of farms will adopt IPM simultaneously within a certain locality or very few will adopt due to risk concerns.



From a technical perspective, if understood correctly, an appropriate IPM strategy would be predicated on a shift in crop mix choices – away from a range of crops with foliage suitable

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<sup>2</sup> We define innovation as a sequenced process of invention and adoption. Invention is the application of knowledge embodied in a technology and is context specific. Innovation is accepted to have occurred when an invention is adopted else it continues to remain as an invention.

for weevil habitats and towards a system of landscape ecology which nurture habitats for natural insects and beneficial 'pests'. Will farm owners be amenable to such a shift in crop mix choices? The answer clearly depends upon whether markets exist – or can be found – for allied crops such as flowering medicinal plants and whether the economics justify a shift in crop mix choice. Equally important are issues related to soil salinity and access to water which support the choice of associated crops within a system of 'landscape ecology'.

These sets of challenges indicate a need for a better understanding of optimality in farming systems, based upon issues of environmental and natural resource constraints, economics in terms of markets for products produced and marketed, as well as socio-economic constraints to adoption of technology. It would appear that a contemporary concentration of FSC has been on the maximization of productivity for date palms and individual crops (predominantly vegetables) as opposed to a whole farm system analysis and optimization of farm profitability. The latter has the potential to suggest significantly different crop mix choices and production patterns and particularly so in consideration of relatively strong crop-livestock interactions which are not considered within FSC's current mandate.

### **Comments on a GRM consultancy report:**

In late November 2015, at the behest of the acting head of the Farm Business Unit, ICARDA was requested to review and comment upon a consultancy report by GRM international in relation to the development of 6 complete farm models:

1. Date palms with field vegetables
2. Date palms with conventional greenhouses
3. Date palms with greenhouse hydroponics
4. Date palms with livestock and fodder
5. Date palms with broiler poultry
6. Date palms only

The analysis conducted therein is generally sound, although there are a number of minor errors related to assumptions which need to be considered and edited within the excel tables provided. The analysis and the conclusions drawn are in line with the objectives defined under the terms of reference. The utility of the models, however, are somewhat questionable in the sense that the combination or choice of pairings would appear to have been contrived in order to meet a defined and prescribed objective for farm profit. In addition to a number of objectives related to productivity and guidance in decision making on investment potential, one key objective was to identify farm models which were in line with FSC's KPI related to minimum annual profits of AED 50,000.

- i. The rationale for focusing on AED 50,000 as a KPI is not clear and particularly so given that the value of public subsidies are implicitly embedded into the net returns within the 6 models analyzed. What are the net returns for each of the 6 models when actual market values are applied to subsidized inputs? Understanding farm gate margins at market values would be a more strategic exercise in order to understand the policy implications of potentially shifting away from a system of subsidized agricultural extension and input provision and into a mix of both public and private provision;
- ii. Model 4 on integrating livestock and fodder with date production is highly simplistic and does not take into account the value of offspring gained through on farm breeding and culling, as well as the cost of veterinary services. The report is also somewhat silent in terms of how representative this model is of existing farm operations. While mention is made for the need to adjust parameters as desired, representativeness remains unclear and thus the ability to generalize may be compromised;

- iii. Broilers are inherently prone to disease outbreaks, particularly in dry desert environments and more so in environments where zoning regulations do not limit the number of barns within a certain range of proximity. Model 5 has assumed a mortality rate of 5% for broiler production, which is consistent with highly efficient operations in North America and Europe. It is highly unlikely that this can be achieved on small scale broiler operations within desert environments. Indeed, experience from pre-conflict central Syria indicates that mortality can average 25% (inclusive of periods with 100% mortality) in the absence of effective veterinary support services and only in a limited number of cases has mortality been lower than 10%. An assumption of live slaughter weight at 0.85 kg is also inconsistent with both technical and farm level data which indicate average live weights of anywhere between 2.2 and 2.4 kilogrammes at 42 days of age. How feasible broiler production is within Abu Dhabi requires much more research analysis, at least in terms of small scale commercial production, and particularly so given heavy demands on water input for both drinking supply and in the cooling of barns;
- iv. In all cases, a historical model of FSC's date palm management contract has been utilized. Based upon our understanding, this model of contracted service provision has since been discontinued, and extension services will now be provided on the basis of gratis provision, with materials and supplies available for purchase at subsidized (lower than market rates) from FSC retail outlets. Given that the anchor for any farming operation with Abu Dhabi is date palm production, a more appropriate starting point for understanding feasible combinations of production choices, associated with date palms, is to assess the incentives for agricultural production and the role that associated crops have in smoothing out income streams throughout the calendar year in order to cover farm operational costs. There is anecdotal evidence to suggest that many farms are not profitable, but little evidence or conjecture related to why this is case. It would appear reasonable to first understand the nature of farm loss, if indeed this is generally true, and to thereafter uncover options for improving farm profitability;
- v. Partial budgets for individual crops serve a valid purpose in assessing profitability as well as opportunity costs in relation to replacement with alternative crops. The exercise should, however, be undertaken with actual farm data as opposed to data obtained on demonstration sites. Alternatively, one could see value in validating demonstration site data with actual farm data in order to understand the gap in productivity and to assess reasons for such gaps. One may not be surprised to find that on-farm productivity surpasses demonstration site productivity. On the flip side, post-harvest loss issues from handling, storage and poor transportation may alert FSC to areas of intervention in order to improve marketable surplus from the farm-gate and farm profitability;
- vi. Assessing whole farm profitability is complicated and much more elaborate than fixing a targeted profit figure and assessing combinations of production possibilities in order to attain the chosen target. The models developed are silent on how costs of farm labour are apportioned across income generating activities and how economies of scale factor into the investment decision. A more detailed analysis could also be undertaken wherein concerns for the environment are aligned with private profitability interests and public interests; and to then assess the feasibility of such an optimal system against existing operations;
- vii. The report is valuable in the sense that it has prepared the groundwork for further analysis and can be utilized as a springboard for setting up a system of monitoring and evaluation for FSC's business unit. This will require a system of robust data collection from farmers at critical points in the agricultural season, tied together with monitoring of market prices for key vegetable crops and sound economic calculations on the cost of



operations for FSC's marketing operations. One could potentially see the value of such a system in terms of assisting the FSC with the determination of prices paid to farmers which are: (i) incentive compatible, (ii) able to generate an economic return to FSC operations and (iii) competitive against imported vegetables from other regions within the UAE and abroad. The latter would also require intelligence and monitoring of imported vegetables - a process which one would assume that FSC currently undertakes in its existing operations;

viii. In addition to a business function of monitoring and evaluation (M&E), there is an argument for tying together applied research to the M&E function in order to understand decisions on natural resource use, depletion and soil health at the farm level. This would be in keeping with the unique mandate of the FSC in providing both extension and advisory services as well as marketing services for vegetables. Given a drive for financial sustainability of FSC, the overarching objective in this case would be to ensure that public policy interests are in line with sustainable private (farm) economic interests, with financial sustainability of FSC operations, and with reasonable confidence that production systems are based on sound environmental underpinnings. ICARDA is able to play a beneficial role in assisting the FSC with the conceptualization and operationalization of such a system should there be a desire to undertake the same.

### **Recommendations for research**

Notwithstanding a number of research areas highlighted within the text, at least three research initiatives would appear to be of key (immediate) importance, in so far as they result from a review of the GRM consultancy report and a review of FSC's model of service provision to date palm and vegetable operations:

- i. What is an 'optimal' crop mix on farms categorized by access to irrigation and levels of salinity?
- ii. An assessment of market demand for key (non-date palm) crops produced by farmers in Abu Dhabi;
- iii. A better understanding of the coverage of historical FSC provision of advisory services, through an intensive analysis of the 2014 agricultural census undertaken by ADFCA in collaboration with the Abu Dhabi statistics centre

The first recognizes the contextual relevance of environmental constraints to production in Abu Dhabi in terms of access to and quality of natural resources and coupled with attractive opportunities for production through: (a) public funded support in the form of subsidized inputs and advisory services, (b) guaranteed markets for dates at premium prices, and (c) quota based access to minimum guaranteed prices for a range of vegetables marketed through the farmer services centre. In recognizing that relatively strong crop-livestock interactions exist, with varying intensity within Abu Dhabi's production systems, forage production is an integral component of production systems together with a historical affinity for date palms and more contemporarily the production of vegetables. An 'optimal' crop mix is defined as one which is underpinned by acceptable trade-offs between environmental services, aestheticism linked with contextual aspirations for income generation and profitability, and public policy related to environmental sustainability. Understanding 'optimality' in this manner is likely able to provide a better understanding of options for ensuring sustainable and profitable production systems through contemplation of reforming existing public policy or enacting new policy to provide appropriate incentives for production and marketing aimed at both public and private gain.

The latter is linked to the second and complementary initiative which is aimed at understanding: (i) the comparative advantage of both vegetable and forage production within Abu Dhabi; (ii) avenues for exploiting this comparative advantage; and (iii) options for introducing a range of economically profitable 'alternative' (associated) crops which are amenable to providing reasonable incentives for the adoption of IPM (and organics more generally) in date palm production.

Taken together, an understanding of 'optimality' in crop choice and comparative advantage in marketing can be effectively utilized in order to provide recommendations for enhanced efficacy of innovation systems, inclusive of the current provision of advisory services by the farmer services centre, but bolstered by participatory engagement of applied research with farmers and relevant stakeholders. When coupled with an intensive analysis of the most recent agricultural census, these recommendations will strive to ensure that advisory and extension services are better targeted for inclusivity, through the identification of more pluralistic (public and private) avenues for access to farm services and support, and an enabling environment to support efficacy in sustained innovation.

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