

THE NECESSITIES OF PILOT FARMS IN THE IMPROVEMENT OF IRRIGATION AND DRAINAGE NETWORKS MANAGEMENT

NECESSITE DES FERMES PILOTES POUR AMELIORER LA GESTION DES RESEAUX D'IRRIGATION ET DE DRAINAGE

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ABSTRACT

Experiences on the design and construction of main networks and sub-nets in regulated downstream water resources in Iran show that the half a century old irrigation networks technology still has a long way to go. The costs of initial investment and operation and maintenance of irrigation and drainage networks are enormous. Pilot farms give insight to the probable future conditions after the plan implementation. The purpose of providing the pilot farms is to utilize its results for scrutinizing and correcting the plan in the stages of design, implementation, and operation in order to refine the process of design and compile an optimal operation system.

In this article, the necessities of provision and implementation of pilot farms and the instruction of the work process are mentioned. This is followed by reports on the pilot farms within the Takestan irrigation and drainage networks (downstream of Nohob Dam) as a case study. An important aspect of the article is transferring professional technology and skills required for impounding and irrigation in modern networks to water users and highlighting the necessity of forming Water User Associations (WUA).

Key words: *Pilot farms, Technology transfer, Water Users' Associations, Takestan IDN.*

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RESUME ET CONCLUSIONS

Les expériences positives et négatives sont venues du design et de la construction de réseaux principaux et de sous-filets dans régulé et non régulé les ressources en aval d'eau dans le pays montrent que la technologie de réseaux d'irrigation qui date d'il y a moitié de siècle, a toujours une longue façon d'aller. Puisque les prix d'investissement initial et irrigation et opération de réseaux de drainage et maintenance sont énormes et parmi les facteurs de détermination de développement, les prix inutilisés seraient ajoutés aux plans sans présenter des plans pilotes. Les fermes pilotes, en fait, clarifient les conditions futures de la région après l'implémentation de plan et le but de fournir le plan de fermes pilote est d'utiliser ses résultats pour scruter et corriger le plan dans les stades de design, implémentation et opération pour réformer le processus de design et compiler un système d'opération optimal. Autrement dit, le feed-back de résultats et d'effets de l'étude pilote de plan et de l'implémentation dans l'optimisation de l'investissement de plan et des prix d'une façon appropriée qui cause l'augmentation dans l'efficacité pendant l'implémentation et l'Opération, est un des objectifs les plus significatifs de fermes pilotes.

À présent, la région d'entre tous atterrit en aval des digues et le régime naturel de fleuves dans le pays est environ 3.9 millions d'hectares desquels 1.7 millions d'hectares de réseau construit moderne et semi-moderne, 300 mille d'hectares de réseau sont en construction et sont 1.9 millions d'hectares de réseaux sont sous l'étude.

Il devrait être dit en passant que de tous ces terrains (3.9 millions d'hectares) dont une région de 1.7 millions d'hectares est équipée avec le réseau construit principal, seulement environ 0.75 millions d'hectares de sous-filets ont été construits. Aussi, environ 0.17 millions d'hectares de sous-filets sont sous l'implémentation qui sont l'environ moitié de la région de dans l'implémentation les réseaux principaux. De cette manière, environ 2 millions d'hectares d'entre tous pose en aval du manque de digues n'importe quelles activités dans le domaine de la construction sous-nette qui indique un retard dans le progrès de ces réseaux en comparaison des réseaux principaux. D'un côté, étude et implémentation d'irrigation et de réseaux de drainage implique haut des prix et de l'autre côté, nous sommes faits face avec financier et les restrictions de crédit. Ainsi, pour contrôler les prix et appliquer l'administration optimale dans l'implémentation d'irrigation et de réseaux de drainage, les fermes pilotes peuvent être utiles dans la valeur des activités de construction mécanique et causent l'économie dans les prix.

Dans cet article, au début, les nécessités de disposition et d'implémentation de piloter les plans et l'instruction du processus de travail sont mentionnées et dans les parties suivantes, les études de fermes pilotes dans les limites d'irrigation Takestan et de réseaux de drainage (en aval les terrains de Digue Nohob) seront expliquées comme une étude de cas. À côté de tous les cas mentionnés, le but de cette étude transfère la technologie professionnelle et les adresses exigées pour le fait de saisir et l'irrigation dans les réseaux modernes aux utilisateurs d'eau et à la nécessité de former des Associations d'Utilisateur D'eau (WUA).

Mots clés : *Fermes pilotes, transfert de technologie, Associations des usagers d'eau, Takestan IDN.*

(Traduction française telle que fournie par les auteurs)

1. INTRODUCTION

Today, different strategies are planned in the agricultural development programmers for transferring technology to the production areas for the benefit of the rural communities. It's essential to have rational approach in these programmes and carry out the required experiments for the localization of the technologies to be transferred to rural societies. The costs of initial investment and operation and maintenance of irrigation and drainage networks is high and many times are constraints to development. Hence, the target clientele (generally micro-farmers) often continue to be deprived of development benefits. A lot of obstacles are caused by the lack of designers' accurate perception of social and technical conditions and the production system of target society that are the final users of these structures. Other barriers in optimal operation of modern structures are the lack of required abilities of the users and their adherence to traditional methods of production and operation of the resources. In case the technology transfer model is designed accurately, and in a user-friendly matter, transfer of new technologies will succeed. Design, implementation, and operation of irrigation and drainage networks include multilateral technical, environmental, economic, social, and cultural studies. The systems, which distinguish the optimal strategies of implementation and operation and try to approach the optimal conditions are successful systems and prevent unnecessary costs. Construction, implementation, and operation of pilot farms in the framework of modeling of designing has started; implementing and monitoring of an appropriate model of the network would prevent probable damages and errors and decrease the cost and risk of this group of plans.

At present, the area of the whole downstream lands of dams and river basins in Iran is about 3.9 million hectares (Mha) from which 1.7 Mha have constructed modern and semi-modern networks, 300,000 ha is under construction networks, and 1.9 Mha of networks are under study.

Considering high costs of study and implementation of irrigation and drainage networks (each hectare of surface irrigation costs 7000-8000 \$; each hectare of pressurized irrigation costs 12000-13000 \$) on the one hand and financial and credit restrictions on the other, for the purpose of controlling costs and applying optimal management in the implementation of irrigation and drainage networks, pilot farms can act in the framework of value engineering activities and reduce a lot of costs.

2. STUDY PURPOSE

The purpose of preparing pilot farms plan is doing research, but solely for using its results for scrutinizing and correcting the plan during planning, implementation, and operation in order to compile an optimal operation system.

Other objectives, which the executive systems and consulting engineers should consider are as follows:

Executive systems and consulting engineers' acquaintance with the performance of the proposal.

- ◆ Gaining experience for controlling and correcting the bases of planning for adaptation to real conditions.
- ◆ Access to optimal methods of irrigation and drainage networks construction and implementation.
- ◆ Gaining experience for the preparation of guidelines for operation and maintenance, creation of Water User Associations (WUA), production and operation systems, transferring management and knowledge to end users.
- ◆ To recognize strategies of public participation in construction and operation.
- ◆ Farmers' acquaintance with new methods of irrigation and drainage and dissemination of these methods.
- ◆ The connection method of irrigation and drainage main and sub nets.
- ◆ The possibility of evaluating the methods' performance on a small scale and suggestion of a proper method for the region.
- ◆ Evaluation of investment costs in land, operation and maintenance.
- ◆ To examine the proposed cultivation model in the region and its acceptance by the farmers.
- ◆ To monitor the hydro-mechanical and electrical instruments' performance when used in the plan of pumping stations and pressurized irrigation.

3. EXAMINATIONS AND EXPECTATIONS OF PILOT FARMS

Consulting engineers examine and ascertain the expectations from pilot farms during first phase and accordingly, advise the clients for doing certain experiments. These experiments can be as follows:

- ◆ Working out the efficiency of elected systems in field conditions (climate, slope, topography, water, soil, etc.).
- ◆ Measurement and examination of the possibility of increasing the efficiency of irrigation by different methods.
- ◆ To review the planning capacities, determining the time and calendar of appropriate irrigation.
- ◆ Evaluation of the performance of irrigation and drainage systems.
- ◆ Evaluating the performance of cultivation model and suggest reforms in them.
- ◆ Optimize the depth, spacing and the specifications of subsurface drainage on the basis of existing standards.
- ◆ To measure the effects of leaching.

4. THE NECESSITIES AND OBLIGATIONS

The implementation of pilot farms is necessary in each of the following conditions:

- ◆ The area of the whole irrigation and drainage network is over 10000 ha.
- ◆ Area irrigated by pressurized irrigation methods is over 5000 ha.
- ◆ Area covered by subsurface drainage is over 5000 ha.
- ◆ Plan's counselor is responsible in optimization of system's components from technical and economic viewpoints.
- ◆ Cover the targeted area under the plans.

5. THE EFFECTIVE FACTORS IN DIVERSIFICATION AND FINDING THE LOCATION OF PILOT FARMS

- ◆ Natural environmental conditions including the variety in soil, land classification in terms of topography and slop.
- ◆ To supply safe water, inform water rights, ensure water supply and measurement system.
- ◆ Presence of influential leaders and progressive farmers in the region of plan implementation, access to agricultural mechanization services and diversity in irrigation methods.
- ◆ Equitable distribution of land and possibility of land consolidation to permit effective and efficient layout of irrigation, drainage and roads.
- ◆ Social criteria and participation in the construction of sample farms and agricultural water distribution management.
- ◆ The size of pilot farm is needed to be equivalent to the size of one unit of farm so that the allocated areas to agricultural and garden crops will have sufficient size based on the cultivation model and analysis of the collected data will be reliable.
- ◆ Criteria of having access and being near to the population and agricultural centers for using support facilities and implementing promotion methods and ensuring public participation in the region
- ◆ Selection of existing farms for comparison and evaluation of sample farms' findings with existing users' conditions.
- ◆ Availability of hardware needed for carrying out applied research and creating needed infrastructure.

6. STUDY BACKGROUND IN THE FIELD OF PILOT FARMS

Positive and negative experiences resulted from design and construction of main networks and sub-nets in regulated water resources regions in the country show that irrigation networks technology which dates back to half a century ago still has a long way to go. So far, different pilot farms have been planned and operated for the purpose of examining the planned irrigation and drainage networks model and comparing them with farms under users' conditions in Behbahan, Moghan, Tajan, Zarineh Rud, Doroudzan, Tazeh Abad, Sabalan, Zabol, and Khoda

Afarin irrigation networks and Abadan drainage network and Tabriz Plain irrigation network. In addition, extensive studies have been carried out in this field in Orumieh Lake and Hableh Rud water basins, and Garmsar Plain.

7. A CASE STUDY OF PILOT FARMS IN THE LIMITS OF TAKESTAN IRRIGATION AND DRAINAGE NETWORK (DOWNSTREAM LANDS OF NOHOB DAM)

Having done the first phase studies of Takestan irrigation and drainage network (downstream lands of Nohob Dam) by Yekom Consulting Engineers Company in 2008 for the purpose of evaluation of natural, technical, social factors, and operation system, the selection of pilot farms' location and establishing them were put in the agenda. The area of the study region was 10,500 ha.

Pilot farms were selected and the details to be implemented there were suggested according to the study results and the existing reports from the first phase studies and considering the effective criteria and factors in finding the location, as described earlier.

Firstly, the study areas were classified into 8 zones based on land use map, diversity of soil types, topography and slope. For water accessibility, the farms were selected so that the traditional ditches were in the vicinity. For smaller areas, furrow irrigation method of water application was selected. According to the water table record, no farm needed subsurface drainage. In choosing the area of sample farms, other factors such as irrigation, current agricultural status, remoteness or nearness to population centers, the limits of existing industrial centers, and other natural, social and environmental factors which have impact on the plan's future were also taken into consideration. With regard to probable users' participation, several villages were visited by the study teams, which interacted with the local farmers and other influential persons and organizations, as well as industries. The need for integrating the lands, creation of access road and irrigation and drainage canals was discussed as a key factor in these meetings.

In the next phase of the study and on the basis of analysis of all the collected information in the first phase three villages (Narjeh, Nudhak, and Nahavand) as representative of population centers, and 16 farms with different areas were preliminarily chosen. Then, based on finer criteria, finally three farms with the areas of 58, 37, and 40 hectares, one each in the above mentioned villages were chosen. This was followed up by further consultation with the farmers when it was revealed that the farmers of the selected farms in Nahavand village were not very enthusiastic to participate and hence, Nahavand's farms were omitted from the selected list. Fig. 1 illustrates the location determination of Takestan Plain irrigation and drainage network and the location of selected sample farms.

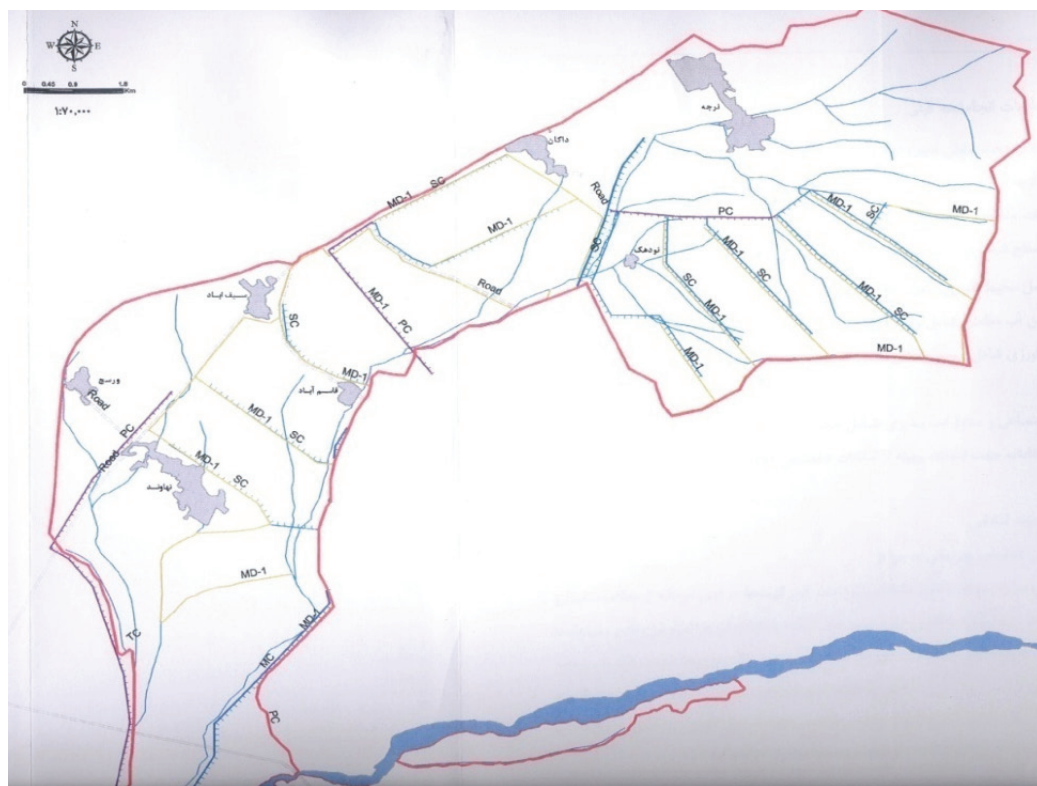


Fig. 1. The location determination of Takestan Plain irrigation and drainage network (La détermination d'endroit d'irrigation Simple Takestan et de réseau de drainage)

Pilot farms construction and performance is a good chance for the users and farmers to improve their professional skills for connecting to the modern network which will be formed in development conditions. Transfer of the required skills for irrigation, method of using impoundment instruments and the necessity of forming Water User Associations in line with constructing pilot farms is taught to the beneficiary farmers and users. It is evident that in the period of holding pilot farms, there isn't adequate time for transferring the required professional skills to all the target audiences. However, the client has so much time that forerunner farmers and local leaders who are trusted by the region's users can get familiar with the plan's issues and conditions in order that expected technical and social changes in the area would be managed with the least challenge.

8. CONCLUSIONS AND RECOMMENDATIONS

Since costs of initial investments and irrigation and drainage networks operation and maintenance are enormous and they are the determining factors of development, pilot plans help reducing the avoidable costs, particularly in operation and maintenance phases. It is necessary to document the effects of implementing pilot farms in a way that its impacts will be identified in the following cases:

- ◆ Adaptation of the plan to the applied results obtained from the pilot farms.

- ◆ The manner of applying changes and optimizing in dimensions and technical specifications of the initial plan.
- ◆ Evaluation of the used structures in farms and revision in their planning and implementation in the main network, if necessary.
- ◆ To compile operation and maintenance instructions and determine the effects of operation and maintenance.
- ◆ To evaluate the proposed cultivation model according to the farmers' reception and water and soil resources.
- ◆ The comparison of the initial plan and the results obtained from the pilot farms and technical and cost impacts of the results.
- ◆ To estimate the economized costs due to the implementation of pilot plan and reduce or omit the unnecessary costs.
- ◆ To determine the farmers' reception of the pilot farms on the basis of poll forms.
- ◆ To determine the way of financial participation or operation by farmers.
- ◆ Applied recommendations for establishing the required formations in future.

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