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Proposed Strategy for Public Extension in the Absence of Harmony with Scientific and Applied Research: Input Supply System

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Abstract

Agricultural extension and scientific research in the private sector in Jordan has been successful in the manner of providing inputs to farmers and finding solutions for rural development. This is due to the capitalist ability of the private sector to open marketing channels for modern agricultural and technological inputs. Technologies such as improved radiation mutagenesis and foliar fertilization deserve research work on them and their introduction to rural societies, instead of traditional agricultural solutions such as local varieties adapted to drought. This opinion article recommends active participation in attending regional agricultural exhibitions and opening the door for contracting with advanced Chinese companies in the field of electronic sensors and biopesticides or contracting with Indian companies specialized in fertilizer technology and biopesticides. With the necessity of shifting towards agricultural mechanization and contracting with Turkish and Chinese companies to introduce farm machinery in the agricultural market in Jordan. This opinion aims to review and balance the effectiveness of scientific research and agricultural extension in the public and private sectors by highlighting the strength of the input supply system extension in rural development in Jordan.

Keywords: *Extension; Research*

Discussion

The integration between agricultural scientific research, applied and academic sciences, and agricultural extension and farmers' experience plays a coordinating and important role in rural development in developing societies. Especially if the farmers are aware of the importance of specialized agricultural cooperatives, which constitute a basic ground for agricultural development in all fields. The central and coordinating role of agricultural extension in this area can never be overlooked. Here, the importance of the article lies in the role of the rural extension in explaining a simplification, coordination, and structuring of harmony between the needs of farmers and the path of applied and academic scientific research. The planning of agricultural projects should be done in partnership with farmers and should not be imposed on them.

For example, and not limited to, the public agricultural extension cooperated with the scientific research in Jordan during the years 2011 and until 2018. They have been able to motivate farmers to adopt triticale and rye grass crops production as an appropriate and economical alternatives for both wheat and barley, especially in conditions of climate change and the presence of drought, which necessitated the use of treated wastewater. Saline conditions are common in Jordan and these results suggest that triticale might be a productive crop in these areas [4]. In the future, Jordan will suffer from severe drought and salinization of the soil, which requires shifting from the cultivation of rainfed wheat and barley due to the fluctuation and inconsistent distribution of rainfall. There is no need to waste time and effort in carrying out research projects that do not lead to significant benefit, especially in light of the fragmentation of agricultural holdings. There are to be economically productive alternatives at the level of smallholdings and able to adapt to future climate change conditions. It was reported that the economic analysis for the forage crops irrigated with treated wastewater in Jordan indicates that rye grass is the highest profitable forage crop for growers [3]. However, even if the production of rainfed wheat and barley continues, scientific research should be directed to varieties other than local landraces and genotypes. For example, the research experience in Egypt was used to find improved mutations enhanced by radiation (mutagenesis), which can be a system for scientific research and private extension based on supplying Inputs to be adopted and promoted between farmers in Jordan.

From a personal point of view, the extension scholar should be trained to work in an integrated spirit as both a researcher and an extension agent. Here are many agricultural issues that are overlooked in public scientific research and related to the production of crops. For example, developing the capabilities of the extension scholar to schedule irrigation and fertilization, as well as scheduling crop rotations, and planting dates of cultivation using electronic digital sensors that measure the relative humidity and temperature of air and soil in addition to using sensors measuring the salinity and acidity of soil and irrigation water. The use of sensors that measure the basic soil elements (nitrogen, phosphorus, and potassium) are very important in scheduling fertilization, irrigation, crop rotations, and planting dates. The use of these sensors will assist the researcher and the extension scholar in determining the most appropriate decision in the field.

Due to the salinity, drought and over-fertilization that caused problems threaten the sustainability of the soil, the trend towards foliar fertilization may be a fundamental solution as one of the methods of integrated pest management (IPM), especially diseases [6]. Other studies concluded that the use of biopesticides in food legumes production in Jordan is a critical strategy in integrated pest management [5]. This is what can be achieved in partnership with agricultural extension based on providing inputs (input supply system).

It is necessary to schedule crops by season and planting dates to organize and model crop rotations. Crop rotations are long-term plans that improve sustainability and profitability [2]. Similar findings were reported for forage agronomic crops in Jordan using treated wastewater [3]. Agricultural crop rotations are environmentally safe methods to control pests and procedures for obtaining a healthy food product. It is very important to determine the optimal planting dates for all types of crops and to determine the agricultural patterns of each region, to address the risk of various agricultural pests, insects, and weeds as well as to maintain soil fertility and water retention from the principle of management of inputs [2].

This is what can be achieved in partnership with the private sector and the application of agricultural extension based on providing inputs (input supply system), especially in the absence of harmony and coordination between agricultural research (applied and academic) and public agricultural extension.

Input supply system (Real models from Jordan)

Herbicide

The (*Cyperus esculentus* L.) plant is a perennial weed with rhizomes connected to tubers. It blooms in March through December. It spreads to specific areas in Jordan (Jordan Valley, Jerash, and Rusayfah). In the Rusayfah region, its distribution was helped by the use of infected plows, as it caused farmers to stop the cultivation of potatoes as it penetrated the tubers. Other crops are spread in the Rusayfah region, the most important of which are sugar beet, carrot, cowpea, onion, turnip, garlic, radish, and parsley.

Scientific research and input supply extension system in the private sector was able to use a specialized herbicide for this weed that contains the active ingredient (Quizalofop-P-Ethyl 5%) and it is a selective herbicide that is sprayed on the leaves after the growth of annual and perennial weeds as it works to inhibit Acetyl-CoA Carboxylase Enzyme and thus impede the growth of weeds grown in tomato, carrot, bean, pea, potato, garlic, radish, parsley, turnip, and sunflower fields. The spray rate is 100 - 300 mm per 0.1 hectares, With a safety period ranging from 21 to 45 days, depending on the type of crop. Massimi M [1] concluded that selective herbicides kill certain targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often based on plant hormones. Herbicides are generally a fast and efficient method in terms of results and time-saving.

Machinery

There are harvesting machines for green forage crops (Chinese and Turkish machines), priced at (500 - 700 Jordan Dinars; i.e. 704 - 986 US $), where they are used to harvest alfalfa, Egyptian clovers, silage corn, forage sorghum, sweet corn, and Sudan grass. There are two types: one with a 6-horsepower engine (shear width 90 cm) and another 7.5-horsepower engine (shear width 120 cm).

Efficiency was estimated through the experiences of farmers in the Hashmyahh region, where it consumed a gallon (4 liters of gasoline) to cut forages in 0.4 hectares at an average consumption of 1 liter per hour per 0.1 hectares. It was found that alfalfa and Egyptian Clover crops produce approximately 4 - 6 tons with consumption of one gallon. Whereas, corns, forage sorghum, and Sudan grass crops production equal 12 tons with the same amount of gasoline. The machine needs a cost of two Jordan Dinars (2.82 US $) (for a change of an engine lubricant) every 10 tons and the cost of a worker for loading of 5 Dinars per ton (50 Jordan Dinars equal 70.42 US $). Whereas traditional manual labor costs 15 Dinars per ton for cutting, assembling and loading (10 tons costs 211.27 US $), as well as a new sickle for the worker, costs 4 Dinars (5.63 US $) every 10 tons harvested. The time saving equals 3 hours for every ton produced.

Agricultural scientific research and public agricultural extension have been unable to provide farmers with this technology, while agricultural extension has succeeded in the private sector (based on the input supply system) to provide it to farmers. In Jordan, neither applied and academic scientific research nor public agricultural extension (associated with scientific research or ministry based extension) succeeded in providing this technology. Massimi M., *et al.* [3] stated that research and extension are supposed to attempt improving profitability through enhancement of farm machinery.

Conclusion and Recommendations

In summary, agricultural extension and scientific research in the private sector in Jordan has been successful in the manner of providing inputs to farmers and finding solutions for rural development. This is due to the capitalist ability of the private sector to open marketing channels for modern agricultural and technological inputs, whereas, the governmental public sector is busy separating agricultural scientific research from agricultural extension and raising generations that do not value the true value of meaningful joint and collective work.

This study recommends working to support teamwork and integrate scientific research skills, agricultural extension, and academic studies to serve rural development. Technologies such as improved radiation mutagenesis and foliar fertilization deserve research work on them and their introduction to rural societies.

This study also recommends active participation in attending regional agricultural exhibitions such as the annual Antalya Fair in Turkey (Growthtech) and opening the door for contracting with advanced Chinese companies in the field of electronic sensors and biopesticides or contracting with Indian companies specialized in fertilizer technology and biopesticides. With the necessity of shifting towards agricultural mechanization and contracting with Turkish and Chinese companies to introduce farm machinery in the agricultural market in Jordan.

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