AN ASSESSMENT OF AGRICULTURE EXTENSION WORKERS' TRAINING NEEDS IN THE AREA OF MECHANIZED AGRICULTURE IN IRAN AS PERCEIVED BY THE PARTICIPANTS IN THE FIFTH NATIONAL MEETING ON AGRICULTURE EXTENSION HELD IN ISFAHAN, IRAN

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"He who does not thank people(for helping him), he has not thanked the Creator".

Prophet Mohammad, PBUH

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This study is dedicated to the hard-working farmers of Iran, and those who are trying their best in helping them to live a better life. This work is also dedicated to all the hungry children of the world, for whom I extend my prayers.

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CHAPTER I

INTRODUCTION

Iran, with a population of 51 million people, is becoming one of the few developing countries which has earned the highest population growth rate in the world. With an average growth rate of 3.2 percent in 1988, it has been predicted that Iran's population will reach 71 million and 104 million by the years 2000 and 2020, respectively (47). To adequately feed this ever increasing population, Iran must have a strong agriculture which can provide sufficient food.

Presently, Iran imports some of its major food requirements, such as wheat, rice, meat, sugar, and vegetable oil from other countries despite some increases in production of agricultural commodities in the last five years.

In an effort to decrease reliance on outside imported foodstuffs, the Islamic government of Iran has placed a high priority on agricultural and rural development by declaring agriculture as the basis for growth of the general economy. It is estimated that through devising a series of short-, medium-, and long- term plans Iran will reach self-sufficiency in food production.

An expansion in agricultural practices, e.g. an increase in land cultivation, and improvements in agricultural productivity, e.g. increase in yield per hectare along with proper price mechanisms and support programs, are key elements in solving the current problems in Iran's agriculture system. The expansion in land cultivation needs extensive planning, highlighting the availability of necessary equipment and machinery and training and educating farmers in proper use and maintenance of this machinery. This training will lead the way to opening the door to the application of modern farming systems instead of traditional practices. However, the integration of mechanized agriculture into the present agricultural system in Iran requires careful considerations, if successful results are expected in the long run.

A critical area which deserves close attention and scrutiny and substantial planning is where social and economical issues related to mechanization of agriculture must be identified and studied, then formulated into policy, and finally implemented. The process of mechanizing agriculture has implications beyond the mere technological and engineering solutions to agricultural problems and agricultural growth, rather, it includes complex social and economic relations within a given society which determine the success or failure of its development programs. Issues such as equity and social justice, land availability, and labor demand in non-agricultural sectors of the economy are

some of the topics that dominate the discussions on agricultural mechanization. These issues are relatively unconsidered in discussions of the technological innovations and engineering aspects of the mechanization in related literature on the subject.

It is, therefore, imperative that all related governmental agencies and private sector enterprizes, as well as the farmers themselves, become involved in a cooperative effort to identify the priorities and adopt relevant policies based on the needs of the country in regard to the mechanization of agriculture in Iran. The role of the agriculture extension agency in this process, if not more important, is equally important as the factors involved.

Statement of the Problem

The existence of well-trained personnel at different provincial and district levels is a key factor in successful implementation of educational programs and integration of mechanized agriculture into the present farming system in Iran. The role of the extension workers in familiarizing and educating farmers with modern farming practices related to mechanized agriculture must not be taken lightly by planners and policy makers if Iran is determined to reach self-sufficiency in food production. Therefore, the questions which needed to be answered in this study were "To what extent do the extension workers in Iran have training

and skills pertaining to mechanized agriculture and modern methods of farming practices required to meet the needs of farmers?" and also "How do the agriculture extension personnel view the socio-economical issues and policy implications related to agricultural mechanization in Iran in terms of future planning for agricultural growth and productivity?"

Purpose of the Study

The main purpose of this study was to identify and analyze the training needs of extension workers in the area of mechanized agriculture as perceived by the extension personnel who were in attendance at the Fifth National Meeting on Agriculture Extension held in Isfahan, Iran.

Objectives of the Study

The objectives of the study were:

1. To determine the degree of cooperation between agricultural colleges and the agricultural extension agency in Iran as perceived by the respondents of the study.

2. To identify the best time table and best location for training extension workers in the area of mechanized agriculture in Iran as perceived by the respondents of the study.

3. To identify the training needs of extension workers in the area of farm power and machinery and farming systems as perceived by the respondents of the study.

4. To determine the views of the respondents about issues related to mechanization, in terms of its present level and problems in Iran, its role and degree of contribution in boosting agricultural productivity, and the appropriateness of its technology.

Scope of the Study

The scope of this study was:

1. The study included only the farm power and machinery and farming systems aspect of mechanized agriculture.

2. The study included only the participants in the Fifth National Meeting on Agriculture Extension held in Isfahan, Iran.

Limitations of the Study

The following limitations were recognized by the author:

1. The respondents of the study were from all provinces of Iran but five. Nonetheless, generalizations could not be drawn from the results of this investigation, since the sampling procedure used did not represent a randomization approach. However, given the wide range of expertise and administrative level represented by the participants in the meeting, valuable information for policy formulation and/or further study of the problem could be drawn from the results of this study.

2. There were a limited number of extension workers participating in the study who could reflect on their training needs in the area of mechanized agriculture.

Assumptions

The following assumptions were made:

1. The respondents answered all questions honestly and completely.

2. The respondents of the study could provide useful and accurate information in regard to mechanized agriculture in Iran.

Definition of Terms

The following terms are defined as used in this study:

1. Need: A gap in educational outcomes or results. It is the discrepancy between the current results (not procedures or processes) and the desired or required results.

2. Needs Assessment: The formal process for identifying outcome gaps between current results and desired results, placing those "gaps" in priority order, and selecting the gaps of highest for closure. It is, then, an outcome gap analysis plus the placing of priorities among the needs.

3. Training: A continuous state or process in which certain skills, knowledge, or individual abilities are

upgraded and improved in order to meet the needs of the clientele, i.e. the farmers.

4. Agriculture Extension Worker: An individual with proper training received in various agricultural fields and/or in general agriculture in order to facilitate knowledge transfer from research centers to farming areas. In Iran, an extension worker typically has a diploma from an agricultural high school and provides advice to farmers from eight to ten villages.

5. Agriculture Extension Specialist And/Or Administrator: An individual with advanced training and education who performs supportive functions for extension programs and/or acts as an administrator who directs the extension programs in sub-divisional or district levels. In certain areas of the country, an individual may have both responsibilities as to administer as well as work as an extension specialist.

6. Agriculture Mechanization: A process which includes all replacement of human muscle power by machines and implements for performing various farming operations.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a summary of the literature related to mechanized agriculture and extension work in the developing countries in general, and in Iran in particular. The emphasis is placed on the aspect of farm power and machinery and problems associated with mechanization.

Importance of Agriculture in the Developing Countries

The importance of agriculture in the developing countries may be considered from several aspects, each contributing to the complexity of the situation faced by these countries in solving their problems of current food crisis.

It was only a few decades ago or less that many of the developing countries were exporting agricultural goods, while today, a majority of them have to rely on food imports from other countries. Paul (33) stated that the "food crisis" in the Middle East is a recent phenomenon. He maintains that:

> In 1960, the Middle East was exporting food commodities. Its exports totaled to more than

> one billion dollars until 1974. But, today this region imports more than half of its food requirements (p. 253).

"In general, food production is lagging behind rather than exceeding the growth of domestic demand, and there have been substantial increases in food imports" (13, p. 2) by the developing countries.

Exporting agricultural commodities was the main source of foreign exchange acquisition for the developing countries. Lawless (21) has reported on the Middle Eastern countries' problem of foreign exchange reserves depletion. He maintains that:

> The burden on foreign currency reserves is enormous and is growing. Iran spent over $2 billion on food imports in 1978, compared with $330 million in 1973-74; Saudi Arabia's import bill for 1980 was projected at $4.5 billion, a 50 per cent increase in a single year. In addition there was the very high cost of creating an enlarged system of warehousing, wholesaling, and distribution for the growing volume of food stuffs now reaching the cities of the Middle East not from their rural hinterland but from the coastal ports (p. 107).

Elsewhere, Lawless (21) has reported that Iran had spent $3,000 million in 1981 and in the subsequent year an estimated $4,500-5,000 million on food imports.

The examples of Iran and Saudi Arabia are illustrative of the dilemma faced by other developing countries, since these two countries are dependent on oil revenues for purchasing their food requirements. Other poorer countries experience even greater difficulty generating adequate foreign exchange for their food stuff imports.

Before the food shortages of 1973, the foreign exchange was used for further expansion of rural development projects and maintaining employment for the majority of the people who were living in rural areas. Today, the employment factor still plays an important role in agriculture in the developing countries. This is especially evident in large population countries "with high proportion of labor force in agriculture - 70 per cent in Sudan, 54 per cent in Turkey and 50 per cent in Egypt" (3, XI).

Alarming population growth in the developing countries is another reason why agriculture is important to these countries. Securing adequate food supplies has become an urgent responsibility on the part of the governments in the developing countries, especially after the food shortages in early 1970s. According to Knutson et al. (19), reliable estimates suggest that at least 450 million people in the world are malnourished. They maintain that:

> The world population passed the 4 billion mark in 1976, twice the 1940 population. Predictions of future world population growth cover a wide range. One prediction suggests that the limit of population growth would be reached in the year 2075, where world population would reach 8 to 9 billion people (p. 23).

They continue to say that:

> Food production in the developing countries is increasing at an annual rate of 2.9 percent, while the effective demand for food is increasing at a rate of 3.8 percent. The result is an increasing need to import food, primarily grain (p. 23).

As quoted by Molnar and Clonts (26), Schultz has said that because exponential population growth rates loom in

most developing nations, government officials and planners look to a self-sufficient agricultural sector as a first step toward a better future.

With the urgent need of securing food supplies for a growing population in the developing countries, the traditional agriculture and subsistence farming in these countries have to be replaced by modern farming practices applied elsewhere in the world. Serious attention must be placed on identifying different alternatives in order to reduce the risks of such a venture. The socio-economical and political impacts of such measures on the whole society, especially in rural areas, must be taken into consideration.

Related Issues of Mechanization in the Agricultural Development Process

According to Lonnemark, as quoted by Raoufi (35), there are both social and technical difficulties common to many developing countries which tend to inhibit rapid advances in mechanized agriculture. In regard to farm mechanization in the developing countries, Gemmil and Eicher (14) have made the following observation,

> One of the important decisions facing the developing countries is that of determining the most economically and socially desirable rate and type of farm mechanization. This decision is especially difficult in light of the limited cross sectional or time series research on the impact of farm mechanization on output, income, employment and income distribution, and in light of growing unemployment and underemployment in many developing countries (p. 1).

Agricultural mechanization refers to any mechanical means used in the processes of agricultural production. This includes hand-, animal-, and engine-powered equipment in the contexts of production, processing, transportation and marketing of agricultural produce, according to Kline et al. (18).

Binswanger (4) has studied agriculture mechanization from a comparative historical perspective in the developed as well as the developing countries. He stated that:

> Most recent discussions of mechanization concentrate on power sources: shifts from human to animal, to water or wind, to steam and eventually to internal combustion engines or electric motors. These shifts in power sources are clearly the most dramatic aspects of a long drawn-out process (p. 2).

However, to elaborate on his findings of the study, Binswanger has used, in his terms, a broader definition of agricultural mechanization. He continues to say that:

> Some discussions of mechanization have gone so far as to confine the definition of mechanization to the application of internal combustion engines and electric motors. This definition does not suit our purposes, however, because it tends to hide important historical and contemporary regularities. We shall, instead, use a much broader definition of mechanization which includes all replacement of human muscle power by machines and implements (p. 3).

In the analysis of the impacts of mechanization in the developing countries, researchers have reached different conclusions as to what constitutes the most desirable levels or rates of farm mechanization in any given country. Obviously, the two above mentioned quotations on farm

mechanization reveal some of the differing views on the definition of mechanization, perhaps indicating the complexity of the problem at hand. In this part of the chapter, two related areas of mechanization have been studied to further clarify some of the discussions on the social and economical impact of mechanization in developing countries. These areas are the role of mechanization in increasing agricultural productivity and production, and the socio-economic impact of mechanization on the structure of the rural areas in the developing countries.

The Role of Mechanization in Increasing Agricultural Productivity and Production in the Developing Countries

As the population has grown rapidly in the developing countries, more new land has been put into cultivation to meet the rising demand for foodstuffs. However, these have been the marginal lands with poor quality, low productivity and high cost to maintain. FAO (13) has reported that it is becoming clear that the long-term answer to the need for greater food production must be greater agricultural productivity.

Kline et al. (18) indicated that agricultural production may be increased by either bringing more land under cultivation or by increasing the productivity of land already under cultivation. The use of chemical fertilizers along with the adoption of high-yielding crop varieties have

helped in increasing the yields dramatically in certain developing countries. The other promising area for increasing agricultural production is the use of machinery and implements in farming practices where farming intensity is of farmers' primary concern. Binswanger (4) has defined farming intensity as being the frequency with which a plot of land is cultivated. Mechanized farming can also be used where expansion in farming area is intended.

At this point, a definition of productivity is warranted and subsequently, a review of the discussions on the role of machinery and implements in increasing agricultural productivity is presented. Productivity has been defined as "a measure of the efficiency with which inputs are utilized in production" (13, p. 2). In agriculture, various inputs are utilized to increase the level of productivity. These inputs are categorized in three groups: land, labor, and capital. Capital consists of the investments on inputs, such as chemical fertilizers, pesticides, machinery and implements, irrigation, buildings, etc. Often, partial productivity is measured in agriculture compared to overall productivity. Partial productivity is "the relation of a single input or group of inputs to the total output or to a part thereof" (13, p. 3). However, it is believed that measures of partial productivity does not reveal the degree of change in total output attributable to any particular input. In terms of measuring productivity levels, FAO (13) has indicated that:

> The explanation of productivity levels is to be found in the properties and qualities of the various inputs, the manner in which they are combined and utilized for production, and effective market demand for the outputs. Thus increases in agricultural productivity are essentially the result of management decisions made by individual farmers: regarding their choice of inputs and their relative quantities, the techniques and skills with which they are utilized in the production process, and the outputs that they produce (p. 3).

Therefore, the concept of agricultural productivity can be visualized in terms of the farmers' decision making abilities as to the application of optimum levels of inputs categorized in the form of land, labor, and capital for the purpose of achieving an expansion in the volume of production and an increase in efficiency (lower cost per unit of output).

As previously mentioned, there are two ways for increasing production in agriculture. One way is to increase the productivity of the land already under cultivation by intensification of production processes through double cropping. The other way to increase production is to expand the area of cultivation by the means of mechanization schemes. However, there are certain requirements and conditions that deserve close consideration in order to apply any one method of increasing agricultural production.

Binswanger (4) believes that the pattern and speed of adopting existing designs of machines is influenced heavily by economy-wide factor scarcities and other macro-economic

variables. Binswanger has made a series of generalizations throughout his study of the patterns of mechanization development and adoption in the developed and developing countries. He has stated in his generalization 1 that:

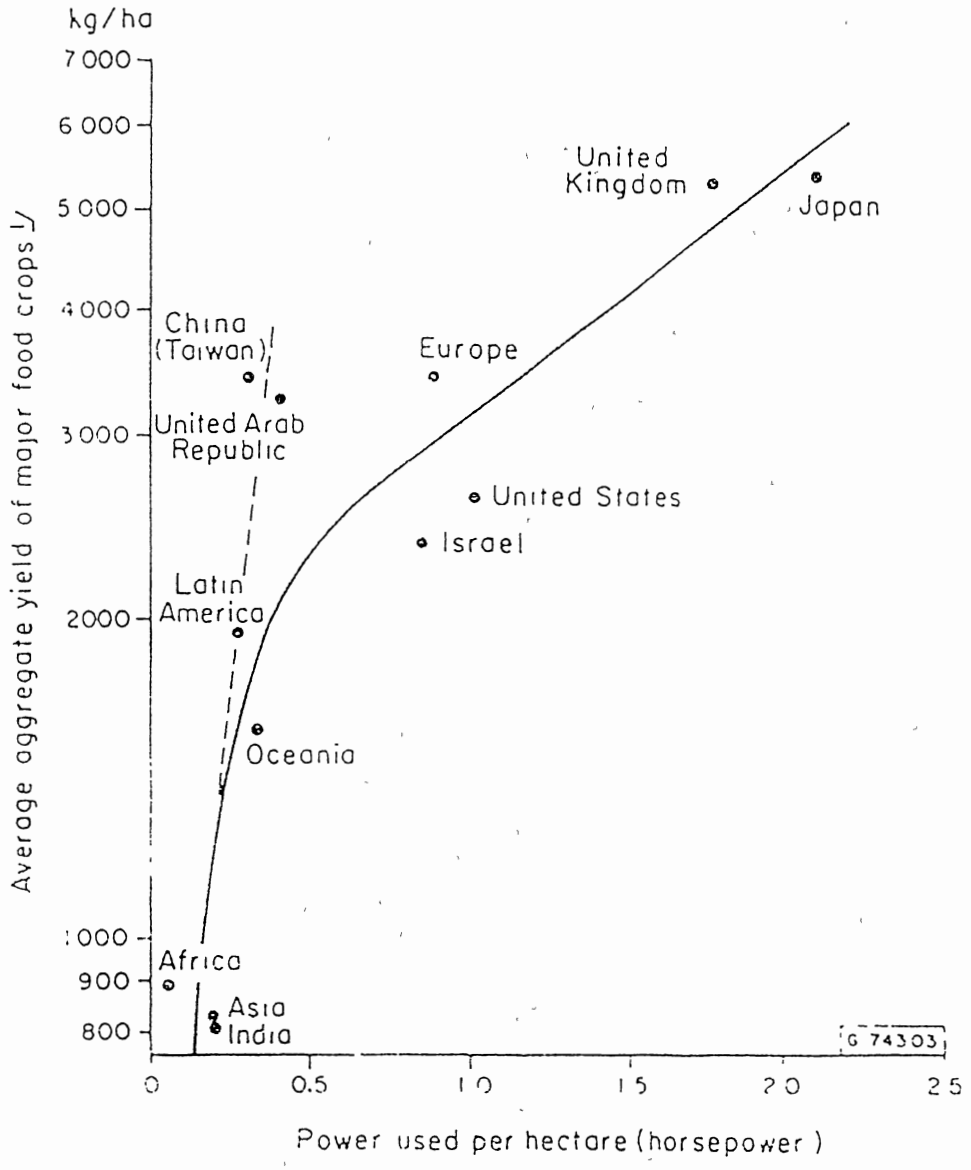
> The rate and the pattern of invention and adoption of agricultural machinery are governed to a substantial degree by an economy's land and labor endowments, by the non-agricultural demand for labor, and by conditions of demand for final agricultural products (p.5).

The primary condition in which method one becomes applicable occure when productive land is in short supply, yet climatic conditions allow for more than one cropping every year. The requirements for farming intensity are good management skills on the part of the farmers and reliable systems for input supply which can deliver farming inputs where they are needed, and as they are needed. Also, extensive chemical fertilization and the use of short maturity crop varieties along with the use of pesticides for pest control are other factors required in the intensification of farming practices. Since farming operations, such as land preparation, planting and harvesting, become more intensive and the timing factor is more critical, mechanization can help to reduce thedemand for the seasonal labor. Mechanization would contribute to lower production costs as the labor efficiency (lower cost of labor resulting from lower labor hours per farming operation) increases. However, the size of the farm should be large enough to justify the high cost of machinery. For

example, Yagi (49) has reported that from the second half of the 1960s to the first half of the 1970s, vigorous technological innovations, such as the mechanization of agriculture and renovation of farming facilities, contributed to the development of labor productivity in Japan. He has shown that labor hours for rice production in Japan decreased from a level of 200 hours in 1950 to 56 hours in 1984. The application of certain machinery such as power cultivators, rice transplanters, power reapers, binders, and head-feeding combines, have contributed to this decrease in labor hours requirement. However, Yagi has indicated that despite the decrease in the cost of inputs for a rice crop, the expense of agricultural machines and farm appliances, in particular, remains a heavy burden for today's Japanese farm households. Yagi maintains that:

> In the current situation, increasing investment into the mechanization of agriculture to save labor is not necessarily effective in reducing production costs. One reason is that introduction of agricultural machinery has been promoted without any enlargement of farm business size. Furthermore, agricultural machinery can not be used effectively due to irregular, narrow or scattered plots. In order to augment the economic effects of farm mechanization, the enlargement of farm business size and more effective utilization of machinery through joint use by farmers' groups are both urgently required (p.4).

FAO (13) has reported that the intensification of agricultural production is in general associated with an increase in the utilization of power. Figure 1 shows the magnitude of the power input in terms of animal,tractor, and



Source: FAO, Smaller Farmlands Can Yield More (1969).

Figure 1. Power Used per Hectare in Relation to Yields of Major Food Crops per Hectare

human power in several countries and regions in relation to crop yields per hectare. According to FAO (13),

> A direct relationship between power input and yields is clearly visible. Even more marked is the association between the animal and tractor power utilized per hectare and the productivity of labor. Rising levels of labor productivity in agriculture are associated with higher inputs of power (p. 34).

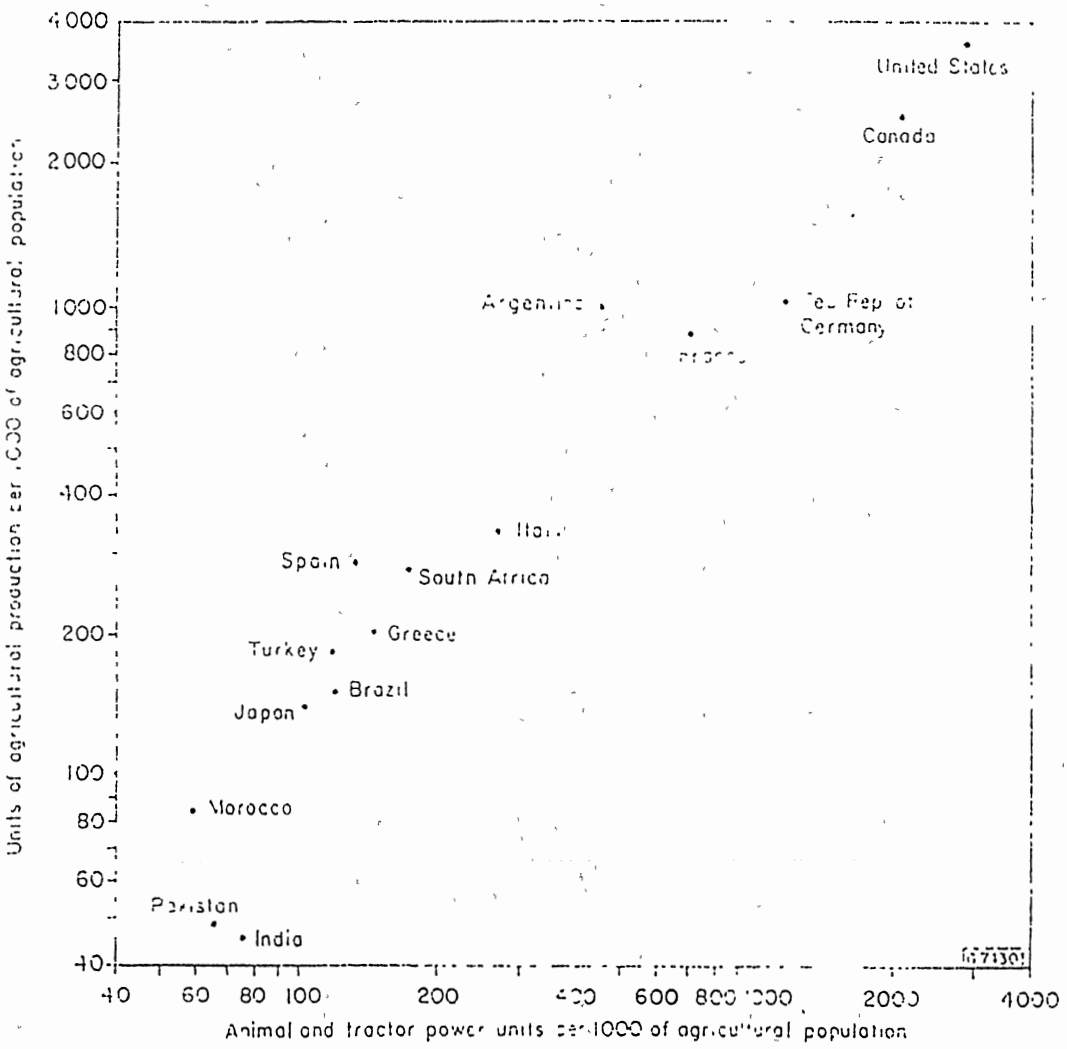
FAO's last point in regard to labor productivity in agriculture is illustrated by Figure 2. Contrary to FAO's viewpoint, Binswanger (4) has stated in his generalization 2 that:

> Mechanization leads to direct yield increases only in exceptional cases such as the application of seeds, pesticides or fertilizers. Thus, higher levels of mechanization usually substitute for labor, or - where they are already in use - for animals (p. 8).

In fact, Binswanger's viewpoint is further strengthened by FAO's own statement reporting that:

> In India, seed drills incorporating an attachment for fertilizer placement have been shown to increase yields by 12 to 40 percent, and to require 30 to 40 percent less time than broadcast seeding (p. 34).

Binswanger believes that his generalization 2 represents the <u>substitution view</u> of agricultural mechanization, in contrast to the <u>net contribution view</u>, which assumes that higher levels of mechanization, particularly focusing on tractors, directly lead to yield increases or other output gains, regardless of the economic environment in which they are introduced.



Source: FAO, Smaller Farmlands Can Yield More (1969).

Figure 2. Animal and Tractor Power in Relation to Labor Productivity

Elsewhere, Binswanger (5) has reported on the relationship of yield increases and tractor farming and power utilization on a survey-basis study. He concluded that out of 118 instances, five or six instances revealed large yield differences in the absence of equally large or larger differences in fertilizer use. The rest of the instances of yield increases reported by Binswanger were accompanied with the use of higher fertilizer and/or High Yielding Variety (HYV) of crops by farmers, and the results of the studies surveyed "fail to provide much support for the yield increasing effect of tractor cultivation" (5, p. 37).

The second way of increasing production is through the expansion in the area of cultivated land. This is mainly practiced on marginal lands with low productivity. The required conditions for this method are the availability of land and open land frontiers, as was the case in the U.S., and shortage of an agricultural labor force. Mechanization would enable farmers to cultivate more land, while they face no severe labor shortages. Dorner (9) has mentioned that agriculture in the U.S. developed under conditions of plentiful land and scarce labor. Binswanger (4) has indicated in his generalization 3 that:

> Mechanization is most profitable and contributes most to growth where land is abundant, where labor is scarce relative to land and/or where labor is being rapidly absorbed into the non-agricultural sector (p. 8).

Thus, the small farmer in the developing world is faced with a situation in which he must decide on using optimum levels of powered machinery and farming equipment, which improve labor productivity, and justifying the added cost of initial investment and operating these machines in his total cost of production. Obara (30) has stated that:

> The economic justification for tractor operation is determined by the tractor costs and the value of the higher yield. It is clear that with low value food crops, the increase in yield must be substantial to justify the costs of mechanical cultivation (p. 116).

Mechanization would also enable farmers to prepare their land, plant, cultivate and harvest their crops with more precision and timeliness. In recent years, the practice of custom farming has expanded in various developing countries as a way of justifying high cost of machinery. Certain owners of machinery, who are themselves mostly farmers, render their services to other farmers in the form of performing the small farmers' power-intensive farming operations for specified amount of money or share of the crop being planted.

Another factor which contributes to the increase in agricultural productivity through mechanization is the market demand and the development of commercial outlets for selling additional produced foodstuffs. Kline et al. (18) have said that:

> Mechanization is an important input which facilitates increasing agricultural productivity, but

> it is impractical unless there is also means for profitably disposing of the resultant increase through commercial outlets (p. 1-1).

While Binswanger accounts for the elasticity of final demand for agricultural products provided by export markets, Dorner also contends that agricultural growth in the South was due to the demand for cotton in the export market, particularly in Europe, hence, the crucial role played by mechanization in the process of agricultural development in the U.S.

Therefore, for the developing countries to increase productivity, the commercial economy has to be established as part of the economic development programs wherein the purchasing power of people enables them to buy extra food produced through agricultural mechanization and the industrial sector could meet its demand for raw material produced by the agricultural sector.

Constraints to Achieving Higher Agricultural Productivity Through Mechanization in the Developing Countries

Various factors have contributed to the difficulty in achieving higher agricultural productivity through mechanization in the developing countries. For many years, farmers in developing countries have been using small traditional implements that work by either hand- or animal-power. The inefficiency of such equipment has always contributed to lower productivity and smaller acreages

cultivated by individual farmers. This inefficiency coupled to the small amount of land owned by each farmer has contributed to the lack of proper grounds for establishing a viable program of mechanization in the developing countries.

Efforts have been recently directed towards the improvement of small-scale hand- and animal-powered equipment in increasing the efficiency of operations as a first step in implementing agricultural mechanization programs in the developing countries. Kline et al. (18) have indicated that:

> Considerable improvements can be made in present designs if metal parts are made of properly tempered high-carbon steel which lasts longer and holds a cutting edge. Design improvements for all tools should consider balance, manipulation and weight. Tools which effectively utilize man's strength, without being too heavy or causing undue fatigue, would be a marked advance toward greater efficiency (p. 1-9).

Also related to this same subject, FAO (13) has reported that:

> While the type of agricultural tool is usually well adapted to the prevailing system of land use, in many developing countries these implements are still made of poor material, crude design and inefficient. Their replacement by improved tools would enable a greater volume of work to be accomplished with less effort (p. 34).

Obara (30) mentioned farm fragmentation as another constraint to agricultural mechanization in the developing countries. He maintains that a "fragmented farm is one where land input comprises two or more pieces, termed *parcels* separated by land which is non-contiguous to the farmstead and which most commonly is part of another farm

unit. Apart from the fact that fragmentation does not facilitate easy farm management, intercropping, mixed farming, crop rotation, land disputes, and the fact that land parcels are often widely dispersed, badly shaped and tiny, render machine operation all the more difficult" (p. 113).

Also, Morris (28) has made the following observation in regard to the problem of farm size in relation to mechanization in the developing countries:

> Some 80-90 per cent holdings in developing countries are below five hectares, and often 50-60 per cent are two hectares or less. Complex land tenure arrangements and excessive farm fragmentation may further limit the scope for sophisticated farm power systems more suited to large contiguous holdings (p. 28).

Other constraints include the high price of machinery and the financial inability of farmers to afford it, machinery unsuitable for the average farm size, the farmers' lack of education and training to apply available machinery efficiently and properly, and the socio-economical conditions pertinent to developing countries. This last point will be discussed in the following section of this chapter.

Socio-Economical Impact of Mechanization in the Developing Countries

As has been previously mentioned, there are socio-economical considerations in mechanizing agriculture in

developing countries which outweigh its technological and engineering aspects. The magnitude of the food requirements for a rapidly growing population has forced the governments of these countries to resort to devising programs for the substitution of traditional subsistence farming with modern scientific farming practiced in the industrialized world. A primary factor in this transitional process has been the transfer of technological elements from the developed countries to the developing nations. It has been only in the recent years that attention has been directed toward the study of the impact of technology transfer on the social and economical conditions of these countries, not to mention the political impacts and consequences.

Technology transfer, as it is referred to in the literature, covers a wide array of features and elements intended to aid in accelerating growth in agricultural production. It includes the techniques in using chemical fertilizers and pesticides and the knowledge base for developing High Yielding Varieties (HYV) of crops in combination with mechanical elements which contribute to better utilization and more efficient use of the land and labor.

Nonetheless, the high expectations for achieving higher production rates through technology transfer soon were transformed into severe setbacks for the farmers and those countries involved in the process of technology transfer.

Results of machinery imports, such as the tractor project in Pakistan, and the introduction of hybrid corn varieties to some other countries revealed that these measures not only did not solve the problems of low production, but also they have exacerbated the problem already at hand. Brown (6) has made the following comments in this regard,

> Time limitations placed on development projects often force the development team to go for an "immediate impacts". Subsequently, this philosophy pursues a path of "do it the way we do at home" the "Texas Syndrome" of bringing in big machines, big fields, big co-ops and working with our technology and resources rather than those of local farmer. For the most part, we have failed in our efforts to help the subsistence farmer... (p. 42).

As a result, the focus has been placed on studying the social and economical factors associated with the process of technology transfer to the developing countries. Here, an attempt has been made to summarize some of the socio-economical aspects of technology transfer for mechanization of agriculture in the developing countries from a huge volume of research publications and books written on the subject.

It does not take much time and effort to identify some of the terms and concepts used in the literature on the socio-economical impacts of mechanization in agriculture. Terms such as "social classification", "social equity and justice", "income distribution among farmers," and "appropriate and inappropriate technology" are frequently used to describe and explain a fairly complex social,

economic, and political issue facing not only the developing countries, but the developed one as well. It is the context within which mechanization has evolved that makes policy issues unique to the developed and/or developing countries. In fact, Binswanger (4) has argued that a similar pattern of invention and adoption of mechanical elements in agricultural production exists in the developed and developing countries on the basis of historical development of mechanization. However, the contributing economy-wide factor scarcities, as explained by Binswanger, have created a different setting for mechanization in the developing countries which were overlooked in the technology transfer process.

The question of technology transfer becomes even more complicated where different regions and countries are considered within the developing countries. Morooka (27) has indicated that:

> It has been widely recognized that the effectiveness of new technology differs from region to region and from nation to nation, because it is restricted by local agro-environmental and socio-economic conditions. Recently, it has also been noted that the gap between depressed and developed areas has grown, in terms of economic viability and social justice (p. 1).

The transfer of new technology into the developing countries agricultural sector was seen as a quick solution to the problem of low agricultural production. However, the growing population and scarcity of productive land in

these countries have created a situation in which labor-displacement and, consequently, poverty and social inequity have become widespread. The inability of the industrial sector, if in existence at all, to attract the replaced agricultural labor force is perhaps the crucial cause for the mechanization programs relative failure. Francis Blanchard, the Director-General of the International Labor Office in Geneva, Switzerland has made the following remarks in his forward to Singer's (40) book, *Technologies For Basic Needs*:

> It has been increasingly recognized that employment-oriented development must not be based only on the direct transfer to the developing countries of the technology found in the industries of the developed world. The creation of greater indigenous technological capability must therefore be one of the major objectives of the developing countries, both as a development objective in its own rights and as an instrument for the reduction of poverty within a basic-needs strategy (p. V).

Blanchard further elaborates on his points and continues to say that:

> "Technologies for productive employment" suggests new criteria for establishing socially oriented technology policies in the developing economy. It shows that a middle course can be charted between labor-intensive and capital-intensive technologies, argues that it is possible to reduce the dependence of the developing countries on technologies transferred from the already industrialized world, and demonstrates how technology in policy and practice, can be related to the fundamental objective of satisfying basic human needs... Technology should be regarded as the servant of social and economic objectives, and not the master, scientific and technological efforts should be directed towards the improvement of the welfare of the villager, the peasant and the worker in small-scale industry...(p. VI).

Singer (40) has stated that if the technological levels in the rural and urban informal sectors are to be raised, it is essential to adopt those technologies to which the small farmers, artisans, and other small producers have easy access with their limited cash resources. In identifying the socio-economic categories of farmers, Roling, as cited by Swanson (43), has suggested a more accurate ategorization of high-access and low-access farmers. Swanson says that these terms explicitly recognize that farmers have different access to land, water, labor, inputs, markets, capital, and information. The significance of such a categorization stems from the fact that the intention of policy makers and governments in the developing world was to create opportunities for employment and more equitable income distribution through the technology transfer process in the rural areas. However, it has been extensively documented that these technologies for the most part benefited those farmers with greater economic and financial ability, hence contributing further to the social classification and greater economic and social gap between various farmers groups in the developing countries. This transitional process has created a majority of disadvantaged farmers with low access to land and capital and low incomes compared to a minority advantaged farmers' group with high access to production resources. This trend has been even true in the delivery of extension programs. Karami (17), for example,

has reported that extension programs reached only 20 percent of farmers in Iran.

Roling (37) has touched upon the fact that extension services have focused their information transfer efforts on more progressive farmers rather than on the small farmer. Speaking on the "appropriate technology," Roling has considered the pre-requisite of "appropriate opportunities" for small farmers, and has noted that:

> If service agencies hope to extend small-farmer approaches to a significantly larger scale they must be prepared to respond to an increasing capacity of the rural poor to make claims; they must create the space for a gradual shift of their constituency from the most resource-endowed to the less well endowed (p. 19).

On the issue of income distribution, Stevens (41) has indicated that:

> Agricultural technology change is generally a blunt instrument for greatly affecting the relative distribution of income. However, technology transfer is likely to cause changes in the distribution of income. Where new technology is adopted, some will gain and some will lose, at least relatively. If a capital intensive technology is adopted in a farming area, those who supply that technology to farmers are likely to gain, and laborers are likely to lose. If it is a labor intensive technology, laborers will probably gain relative to others (p. 67).

Farrington et al. (12) have noted that mechanical technologies supplemented the biological ones, mainly modern varieties (MVs) of rice, in six Asian countries during 1971-72. They have indicated that 37% of rice farmers growing MVs used tractors, against only 16% in the year of MV-adoption. They maintain that:

> Concern in the 1970s shifted from the potential of MV technology for increasing production towards the influence that various types of technology had on the distribution of increased product among various groups in the society...A second major area of concern regarding the distributive effects of MV technology lies in the impetus they have given to mechanization. Two issues can be identified: first, that the pressure to reduce turnaround time between crops will be highest in those relatively wealthy areas where water supplies permit multiple cropping; second, that most mechanized technologies involve large, indivisible units of investment, so that, in mixed economies where private ownership of farm capital is the norm, it will be the most wealthy members of the farming community who are best able to take advantage of the opportunities offered by mechanization (p. 4).

A subsequent result of such patterns of technology transfer to the farming regions of the developing countries has been the change in the land tenure patterns of these countries. Generally, richer farmers have taken the advantage of mechanization to purchase and rent additional land parcels, and expand their farming operations. Eventually, small farmers with lower income levels have been forced to sell their land in response to their inability to justify the high costs of mechanization on their small scale farming operations, and gradually their social status has changed from owner-cultivators to tenants, and finally to landless farm laborers. It is on this basis that Farrington et al. (12) concluded that the distributional effects of technological change are more difficult to treat, both conceptually and empirically than the production effects.

Characteristics of Appropriate Technology for Mechanization

In evaluating the socio-economic impacts of new technology in agriculture, social scientists, researchers and development strategists have advocated the idea of "appropriate technology" for the development of rural areas and agriculture in the developing countries. On the other hand, they have referred to whatever kind of technology which is not considered as compatible with social and economic conditions of the developing countries as being "inappropriate technology".

Brown (6) has identified "inappropriate technology" as one of the problems which have prevented the realization of agricultural independence in the developing countries. Thiesenhusen (45) has indicated that:

> If technology is inappropriate, it will have strong and probably undesirable side effects (viz., unemployment may accompany the production of a marketable surplus) which detract from the major reason the technology was introduced in the first place (p. 236).

According to Jedlicka, as quoted by Thiesenhusen (45), appropriate technology is "one that effectively utilizes the manpower, resources, and environmental, and institutional realities...in a given country" (p. 237). The main question is, then, that how planners and decision makers decide about or distinguish between what is appropriate or inappropriate technology for agriculture in a country or region. Schumacher, as quoted by Thiesenhusen (45), has offered some criteria for appropriate technology as following:

1. Jobs have to be created in areas where people are living now - not primarily in metropolitan areas into which they tend to migrate.

2. These must be cheap enough so they can be created in large numbers without requiring an unattainable level of savings and inputs.

3. The production methods employed must be relatively simple so demands for high skills are minimized - not only in the production process itself but also in matters of organization, raw material supply, financing, marketing, etc.

4. Production should be largely from local materials (p. 237).

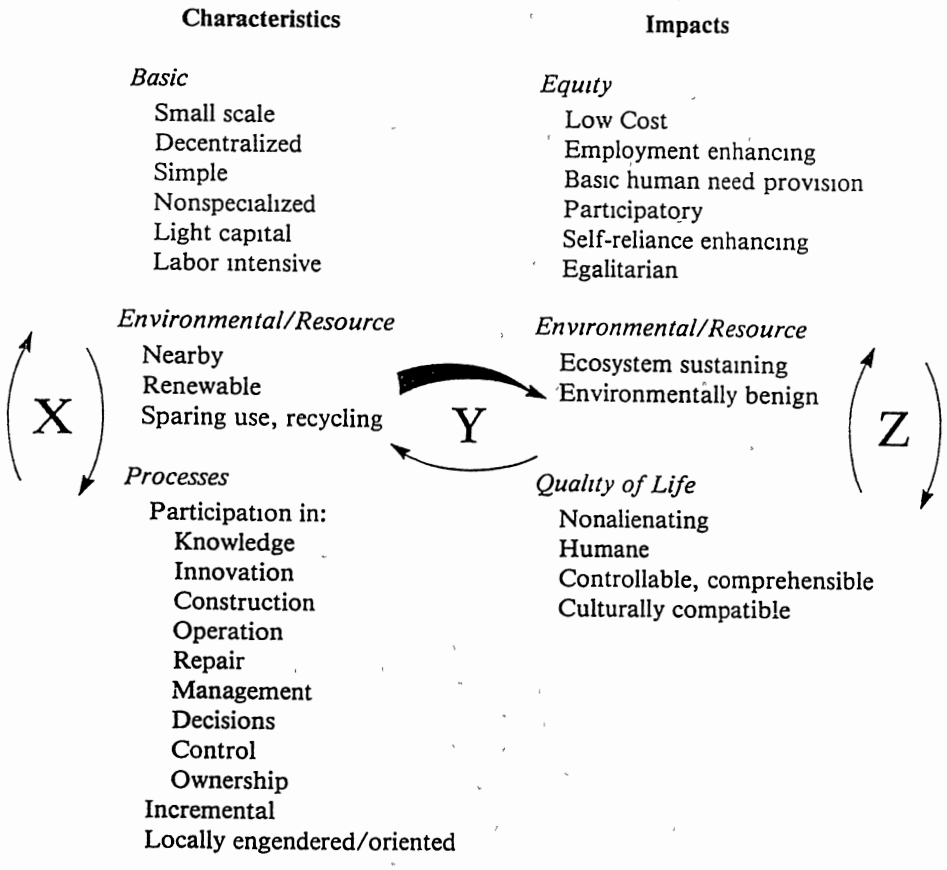
Morrison (29) has spoken of appropriate technology (AT) as a social movement, and has attempted to describe its sociological nature. He says that:

> At is a deliberate attempt to mobilize collective action to advocate and promote change, change that is regarded by those mobilized as both morally right and urgent. At advocates hold that much, perhaps even most, current technology creates (a) inequitable social impacts, (b) impacts on the natural environment that irreversibly damage it and which lower its capacity to sustain life, and (c) impacts that in other ways decrease the quality of life. Such impacts are termed "hard" by AT advocates (i.e., hard, difficult, unmanageable) and the technology that is claimed to create such impacts "inappropriate" or "hard technology" (p. 198).

Morrison continues to say that:

> In turn, advocates of this viewpoint regard as imperative changing to an "appropriate" technology that will create impacts that are socially equitable, environmentally benign, and enhance the quality of life - hence the notion of "soft" (i.e., pleasant, manageable) impacts and use of "soft technology" as a synonym for AT (p. 198).

Figure 3 is a representation of major appropriate technology characteristics, impacts, and interrelationships



Source: Dorner, Technology and U.S. Agriculture (1983).

Figure 3. Major Appropriate Technology Characteristics Impacts and Interrelationships

as offered by Morrison (29). He has identified three subcategories- basic, environmental/resource, and processes- for the AT characteristics, and three subcategories- equity, environmental/resource, and quality of life- for the impacts of AT. He has further indicated that there are relationships and interrelationships between various categories and subcategories. Morrison says in this regard that:

> Technologies with certain appropriate characteristics will have appropriate equity, environmental/resource, and quality of life impacts. Some of the soft technology "characteristics" are themselves desired "impacts" and all the "characteristics" are claimed to be the cause of other desired "impacts". For instance, participation in technological decisions is itself an intrinsically desired impact in the soft technology notion, but participation is also a part of the process of insuring that technologies produce employment and address basic human needs. The quality of life is viewed as inseparably related to these features of the productive system (p. 204).

On the impacts interrelationships, Morrison has made the following comments:

> Important interconnections among the impact categories and sub-categories become apparent when concrete technologies are considered. For instance, wood burning for cooking and heating in open fires brings deforestation and soil erosion. These impacts, in turn, are, over time, related to deprivation from basic human needs. It is claimed that simple mud stoves made locally will burn wood more efficiently and thus have positive environmental impacts at the same time that they improve equity for women and improve the quality of life for women and children by reducing time spent in wood gathering. Alternatives such as kerosene stoves are hard technologies because they are not within the means of most and also decrease local self-sufficiency (p. 206).

One final observation on the selection of appropriate technology for mechanization has to do with the patterns of adoption of machinery in farming practices. Binswanger's (4) observations tend to suggest that farmers adopt machinery based on their farming operations power needs and the labor wages. He has stated in his generalization 8 that:

> When new power sources become available, they areinitially used only for selected operations where they have high comparative advantage. Power-intensive operations are shifted most rapidly to new power sources. Control-intensive operations are shifted to more highly mechanized techniques when wages are high and/or rapidly rising (p. 17).

Binswanger has stated that primary tillage and transport are two of the first operations to be mechanized when a new power source is introduced. Other operations which follow primary tillage and transport are secondary tillage, harvesting and crop husbandry.

Guidelines and Recommendations for Agricultural Mechanization in the Developing Countries

Kline et al. (18) have given the following recommendations and guidelines designed to improve agricultural development through mechanization. These are:

1. To strengthen national research and development programs in agricultural power and land use;
2. To adopt a program of selective mechanization of small farms;
3. To establish facilities for the improvement

and development of small tools and implements;

4. To establish farmers' animal-power training facilities;

5. To develop facilities for training in the use of farm implements and power units;

6. To supply training institutions with adequate funds and equipment for instruction in agricultural mechanization;

7. To develop adequate support in repair and maintenance service;

8. To develop service branches to facilitate the use of mechanized agricultural technology;

9. To encourage private farm mechanization and private ownership of agricultural machinery;

10. To incorporate large-scale commercial enterprises as economic catalysts in rural development planning;

11. To coordinate regional research and development in agricultural power and land use at the international level (p. 1-59).

Also, Ateng and Mereithi (1) have suggested the following considerations for agricultural mechanization in African countries which may also be applicable to many other developing countries.

1. Mechanization should facilitate the optimum use of economic resources;

2. Mechanization should be ecologically relevant, that is, it should be designed and adopted to suit the ecological conditions in which it is to be used;

3. Mechanization should also be versatile, that is, it should be applicable in as many conditions as possible so as to minimize the costs of research and adaptation;

4. The machinery used should be simple and easy to use. It should not require extensive use of skills which are in short supply, nor should it call for a level of education and experience

which is beyond the command of most small farmers in Africa;

5. If the equipment is to be used by small farmers, it should be applicable to small-scale production units, since the domestic market is limited and most of these farmers own small units of land;

6. The mechanization designed for small farms should use local materials rather than depending on imported supplies as has been the case in farm mechanization in the past (p. 29).

Problems of Agricultural Mechanization in Iran

The problems of agricultural mechanization in Iran basically follow the same patterns as in other developing countries. A variety of socio-economical and political factors have contributed to the lack of proper mechanization patterns throughout the country even after some fifty years of first introduction of tractors into the farming system in Iran. According to Raoufi (35)

> Major problems of agricultural mechanization in Iran, as in other developing nations which have been pointed out earlier, are characterized by the following factors: small farm size and irregular fields; lack of skills in use of modern machinery, especially in tractor maintenance, lack of repair facilities; ...(p. 13).

An inconsistency in agricultural mechanization patterns exists throughout Iran today due to the fact that the development of mechanization in Iranian agriculture varies from area to area based on the agroclimatic conditions of each region or area. Okazaki (31) has indicated that:

> Amongst the various provinces, the more fertile regions show a higher concentration of tractors.

> Tehran, Mazandaran (including Gorgan), Azarbaijan and Isfahan were the most developed regions in terms of agricultural mechanization (p. 183).

Political as well as economic motives and interests during the past forty years have contributed to the creation of large-scale farming operations in certain provinces of Iran, namely Gorgan, Khuzestan, and to some extent in Azarbijan.

Okazaki (32) reported that in Iran, since 1949 the establishment of large-scale mechanized farms by merchants, landlords, and politicians has progressed mainly in the Gorgan area, in Northeast Iran.

The lack of adequate attention paid to small farmers a majority of whom had lands less than few hectares, resulted in a situation where highly mechanized farms were operating along the farms where traditional implements such as ox-driven plows were the only means of working the land. According to Okazaki (32):

> One tractor is needed for every 90 hectares of cotton land. On the farms of Gorgan, more than one tractor in many cases was introduced for each 90 hectares of cotton land (p.22).

Fallah (11) has indicated that the government wanted to encourage mechanized agriculture by making available financial credit for purchasing machinery and establishing large-scale farming units. However, the use and distribution of this machinery among farmers was not in accordance with different farm sizes. He also maintains that the policies of the Agriculture Development Bank were designed to provide credit for large-scale farms while

small-scale farms were unable to meet the requirements for getting the loans. They simply did not have necessary mortgages for securing the loan, and consequently, "the main promoters of mechanization in Iran were agro-capitalists and land owners" (31, p. 185). Hooglund has stated, as quoted by Okazaki (31), that:

> Such increasing mechanization of agricultural production inevitably resulted in the reduction of the number of hired workers needed and the total working hours available for those employed. Thus, landless laborers and poorer peasants suffered a great loss in labour opportunities, being compelled to migrate away from the villages towards the urban areas in search of jobs (p. 184).

Another constraint to agricultural mechanization in Iran, as mentioned by Fallah (11), is the increase in machinery prices from 2 percent to 7 to 10 percent annually after 1972. This limited the purchasing power of small farmers in acquiring necessary implements, particularly those implements for power-intensive operations.

Mojtahed and Esfahani (25) have reported, however, that tractor prices hardly increased compared with the high inflation rates in the post-revolution era. The result has been an increasing use of tractors and farm machinery at relatively high rates, contributing to the rapid mechanization of Iranian agriculture. According to the information provided by Okazaki (31), the number of tractors in use was estimated at around 50,000 in 1977 in Iran, while Mojtahed and Esfahani (25) reported that this figure was 135,000 in 1985. Nonetheless, they have not reported on the

distribution patterns of these inputs across the farming regions of the country. Mojtahed and Esfahani (25) indicated that:

> The large increases in farm inputs noted above have largely been made possible by heavy subsidization of their prices and by ample supply of low-interest agricultural credit (p. 852).

As a result, "the input price subsidies that were supported to maintain production incentives partly induced labor-displacing mechanization" (25, p. 859). Given the growing rates of the labor force and the slow growth in other sectors of Iran's economy, the rural areas are likely to face greater difficulties in terms of unemployment, underemployment, and income distribution in the future. Although the Islamic government of Iran has shifted its agricultural policies from large-scale farming in favor of small farmers and cultivators, nonetheless, the rapid mechanization of agriculture has accelerated to some extent the labor migration from rural areas to the urban centers of economic activity.

Major Problems of Agricultural Extension in the Developing Countries and Iran

The role of agricultural extension as an institution for improving the farming practices and consequently raising the standards of living through farmers education has been recognized for many years in the developing countries, as well as in Iran. However, certain constraints have limited

the success of this important institution to the extent that extension services in many countries have experienced serious handicaps in carrying out their responsibilities, that is, educating farmers.

Raoufi (35) has mentioned the extension organization, institutions of higher education in agriculture, training of extension workers, extension teaching methods, and communication in extension as the areas in which Iran and other developing countries face problems in agricultural extension work.

Von Blanckenburg (46) has identified three major constraints of extension work in the developing countries. These are: 1) administrative and management structures, 2) staff density and qualification, 3) budgetary constraints and their impact on extension equipment. Findings from other studies, as quoted by Von Blanckenburg, reveal the following points:

1. Lack of clearly defined extension objectives, policies and job descriptions for extension personnel;
2. Lack of an annual extension plan, of evaluation and extension manuals;
3. Lack of information on appropriate staff training;
4. Lack of economic and farm management research for dissemination to farmers;
5. Economic planners not sufficiently aware of the role and importance of extension;
6. Lack of communication in agricultural knowledge system (research, extension, farmers);

7. Extension supervisors not sufficiently trained for the job;

8. Lack of supporting services and of their coordination with extension (p. 63).

Swanson (43) has related agricultural extension objectives with agricultural and food policy for a country and its major impacts on the agricultural development process. He maintains that:

> If a nation wants to develop a productive agricultural sector, it is very important that agricultural policy be supportive of and consistent with agricultural development goals. Furthermore, there should be congruency and continuity between these agricultural development goals and agricultural extension objectives. If agricultural policy is not consistent with agricultural development goals and vice versa, then it will be very difficult for agricultural extension to operate effectively (p. 14).

Zamanipour (50) conducted a detailed study of recommendations for agricultural extension in Iran between 1950-1975. He has concluded that:

> An inconsistency was found between the agricultural development objectives and agricultural extension operational policies expressed in the third and fifth national development plans. In both the third and fifth development plans, there were recommendations that the extension agents should not be spread evenly over the country. Instead, they should be concentrated in those regions where production programs were concentrated and where the opportunities for increased agricultural production were deemed to be the greatest. This policy was obviously in opposition to the agricultural development objectives in the mentioned plans which emphasized the goal of equality of income distribution among the farmers (p. 130).

Malone (22) has stated that the development and maintenance of successful extension services require the

involvement of people (human resources), such as researchers, administrators, technicians, field staff, and significant others in the community. Unfortunately, many developing countries lack sufficient number of professional people who can develop educational programs in reaching small farmers, and ultimately only a small portion of well-to-do, progressive farmers have benefited from extension services programs. Shaner (39) has noted that:

> Those analyzing the plight of small farmers (i.e., farmers with limited resources) in the less developed countries often cite the ineffectiveness of the extension service. This ineffectiveness has been attributed to poorly equipped and motivated extension staff and to research unsuitable for small farmer's needs. Both reasons could be due in part to inadequate government coordination and support for extension and research aimed at such farmers (p.45).

The most limiting factors in the functioning of the extension service in Iran may be the lack of a strong linkage between the research institutions and the extension service, shortage of extension staff at the village level, and lack of profound farmer training programs throughout the country. In a study conducted on two provinces in Iran, Karami and McCormick (17) reported that the extension service was not successful in its educational efforts, for the following reasons:

1) The extension service does not have enough resources, facilities or funds to do a good job.
2) The extension programmes are not based on the needs of people and local situations.
3) The extension service has deviated from its objectives (increasing farmers' income through educational programmes).
4) Research institutions have not provided the

> agents with information which can be used to meet the needs of farmers (p. 147).

Domont has stated, as quoted by Zamanipour (50), that in 1975 there were only 1,000 extension agents (who worked at their desks in their offices rather than in the field), and there was one agent for each 3,000 farm families. Zamanipour further states that:

> It seems that the government of Iran did not have a well-defined policy for training an adequate number of extension agents to serve the farmers who were scattered in more than fifty thousand villages throughout the country (p. 131).

Salmanzadeh (38) has indicated that the agricultural extension service in Iran has been very limited. Its total annual field staff numbers have always been well below 1,000 and it has only reached ten per cent of all Iranian villages (p. 261).

According to Mirza-Aghazadeh (24), the extension service in Iran continues to be severely handicapped by shortages of funds and of trained personnel. He maintains that there is still an inadequate number of subject-matter specialists dealing with extension problems of specific crops or animals to back up the work of the field agents.

Suggestions for the Improvement of Extension Services in the Developing Countries

Although extension services in different developing countries have similar constraints and obstacles as to their success, it must not be forgotten that the same remedies and solutions suggested may not work for all or some of them at

the same time. However, a general outline of suggestions for the improvement of these institutions in the developing countries is brought here that may be applied or experienced with certain modifications based on each given situation (20, 34).

- Revitalization of the extension services role in most developing countries by introduction of legislation establishing the extension service as a permanent institution;

- Reorganization of government operations and transfer of full administrative control of field-level extension agents to the Ministry/ Department of Agriculture;

- Establishment of policies for extension education programs by a combination of the sponsor (e.g. ministry of agriculture) and the clientele (e.g. small farmers);

- Use of a combination of "top-down" and " bottom-up" program development in the extension education system;

- Linking extension service to a vigorous and highly applied research program;

- Instructing all extension personnel to devote all their time exclusively to professional agricultural extension work;

- Strengthening the organization of extension service through the use of technical subject matter specialists;

- Organizing a systematic program of in-service training and visitation;

- Appropriating more funds for extension work;

- Providing social, and economical incentives for extension personnel to keep them in the service;

- Program improvement by extension administrators and agents through discovering new opportunities of greater agricultural productivity and economic growth (p. 32, 156).

Summary of Review of Literature

Today, agriculture has become more important to the existence and national sovereignty of the developing countries more than ever before. On one hand, a rapidly growing population has created severe food shortages in many poorer developing countries; and, on the other hand, a vital source of foreign exchange acquisition has been eliminated as agriculture has faced setbacks and stagnation in its growth. For the developing countries to increase agricultural production, either the productivity of the land already under cultivation must be increased or the area of cultivation be expanded. Either way, performing intensified farming operations requires introducing mechanical elements into the traditional ways of producing food crops.

The extent and level of incorporating mechanical elements into any agricultural environment depends on the socio-economical conditions of a country which includes an economy's land and labor endowments, by the non-agricultural sectors demand for labor, and by conditions of demand for final agricultural products. Today, in the developing countries a great portion of the population depends on agriculture for its living and its source of income. This fact coupled with a growing labor force have created a situation in which many developing countries can not afford a fully mechanized agriculture from a social cost stand point. The resulting unemployment from mechanization would

further exacerbate the problems facing already socially and economically depressed rural areas in these countries.

Other means could be employed to increase the agricultural production in these countries. The use of inputs such as fertilizers and improved seeds can contribute to the achievement of greater productivity in agriculture on small farms. Furthermore, suitable mechanical elements which reflect on the social and economical realities of these countries could be used to increase labor productivity on the farm. The concept of "technologies for productive employment" or the "appropriate technology" refers to the situation where the drudgery of power-intensive operations could be reduced by using suitable mechanical elements, while at the same time, labor displacement has been avoided or minimized too. Therefore, the characteristics of such technology are:

- It has wide adaptability and is easy to apply, i.e., low technical skills required to build, apply, and repair.
- It is easily accessible for small farmers.
- It has low risks for small farmers to adopt, especially those with low management skills and economic power.
- It is suitable to farm size, land topography, crops planted, and type of operation intended for.
- It is not labor displacing where population density is high.
- Its generation and production depend on local resources and not imported material.

Unfortunately, the results of large mechanization programs in some developing countries like Iran have been discouraging, since agricultural laborers have been forced to migrate to urban areas only to take menial jobs with low pays. Also, mechanizing agriculture has not resulted in significant increases in agricultural production.

The developing countries have also experienced difficulty in managing and utilizing their extension services. The extension services in these countries have not been able to bring about the desired change in production practices due to various reasons. The most important problem has been identified as inadequate government coordination and support for extension work and research aimed at small farmers. Other problems cited are associated with this problem and include lack of adequate staff, lack of sufficient educational programs for farmers, contradiction between extension policies and agricultural development objectives, shortage of funds to expand extension programs, and low social status and recognition associated with extension work.

Extension services in the developing countries can greatly contribute to the process of agricultural development and growth in agricultural production in these countries. Indeed, extension services can identify the needs and problems faced by farmers, and transmit them to the research centers for possible solutions. However, to be successful, extension services in the developing countries

must expand the scope of their activities in order to reach the majority of farmers who have low access to information and resources. Also, governments should allocate more funds and pay more serious attention to meet the human and material resource needs of the extension services in their countries. A successful extension organization can deliver its responsibility of educating farmers effectively, and contribute to the general welfare of the people of its respective country, particularly the disadvantaged rural population.

CHAPTER III

DESIGN AND CONDUCT OF THE STUDY

The purpose of this chapter is to describe the methodology used to achieve the purpose of this study. The procedure used was determined by the purpose and the objectives which were discussed in chapter one.

The following tasks were determined to achieve reliable guidelines for collecting and analyzing the data (10):

1. To determine a general description of the population for the study.

2. To develop an instrument for data collection which would provide useful information for further research and possible improvements.

3. To develop the most effective, yet short and concise procedure for collecting the data.

4. To select methods most significant for analysis of the data.

Population of the Study

The population of the study consisted of all of the participants in the fifth National Meeting on Agriculture Extension held on the campus of the Technology University of Isfahan, Iran in the spring of 1989. The meeting was

sponsored by the Agriculture Extension Agency of the Ministry of Agriculture with the cooperation and assistance from provincial agriculture departments and university centers. The participants consisted of extension administrators, specialists, and extension workers as well as university faculties who are interested in agriculture extension work.

Development of the Instrument

A thorough review of related literature was undertaken to develop the instrument for the study. An instrument was developed based on the previous works in the area of mechanized agriculture and agriculture mechanics by Driskill (1983), Raoufi (1980), and the general format was adopted from Mirza-Aghazadeh-Atari (1980).

The instrument was submitted to the faculties of the Agriculture Education and Agriculture Engineering Departments at the Oklahoma State University for review and possible corrections, additions, and deletions.

Furthermore, a pilot test was conducted with a population, consisting of selected graduate students from Iran who are majoring in different agriculture-related fields in various capacities. These students, some of whom had worked in the Extension Service in Iran and/or are majoring in Agriculture Extension and Education currently in the U.S., were asked to answer the instrument and make comments and suggestions in regard to the contents, particularly the

translation of the instrument from English to Farsi, the Iranian language. Certain modifications in the format of the instrument were made based on the recommendations received from the sample group of the pilot test. The sample group expressed no difficulty in terms of understanding the translation of the instrument. Hence, the instrument was finalized for sending to Iran.

Collection of the Data

The instrument was completed by the summer of 1988. In light of difficulty for the author to travel to Iran, a copy of the instrument was mailed to his father, Mr. Hossein Razavi, in the fall of 1988 who in turn with the help and cooperation of the organizers of the meeting and the faculty of the College of Agriculture at the Isfahan University of Technology xeroxed and distributed the instrument among the participants in the meeting. The meeting was held on the first week of the spring of 1989. The completed instruments were collected during the course of the meeting while still in progress and mailed to the researcher via the mail by the end of the spring of 1989.

Analysis of the Data

A Likert Type scale was used in the instrument to collect the data. A combination of the ranges of one to five and zero to four were chosen for the scale for sections one, two, and three of the instrument in order to secure the

responses of the participants in the study, zero and/or three indicating a null answer in response to the question and four and/or five indicating a very positive response. One in the second scale indicated a very negative response. Descriptive statistics were used to calculate mean and frequency distribution for each item of the instrument.

Treatment of Data

In order to achieve the study's objectives, the questionnaire was designed to measure the training needs of extension workers in mechanized agriculture comprised of the area of farm power and machinery and farming systems. The questionnaire was divided into three parts. Part one provided the researcher with the background and general information about the respondents. Part two measured the respondents' perceptions in regard to four issues related to agriculture mechanization in Iran, i.e., present level and problems of mechanization, the role of mechanization in boosting agricultural productivity, and finally the selection of appropriate technology for agriculture mechanization. Part three measured the respondents' perceptions as to the present level of knowledge, training, and skills possessed by extension workers, extent of knowledge, training, and skills needed by extension workers, and extent of available and needed educational resources in the area of mechanized agriculture by the extension workers in Iran.

The respondents' perceptions were measured with the help of a five point rating scale for part two and a four point rating scale for part three of the questionnaire. Also, a four point rating scale was used for questions eight through twelve of the first part of the questionnaire.

The ranges of absolute values established for each scale were determined as follows:

Response Category	Scale	Range Limits
Very Much	4	3.50 - 4.00
Much	3	2.50 - 3.49
Some	2	1.50 - 2.49
Little	1	0.50 - 1.49
None	0	0.00 - 0.50
Very Agree	5	4.50 - 5.00
Agree	4	3.50 - 4.49
Neutral	3	2.50 - 3.49
Disagree	2	1.50 - 2.49
Very Disagree	1	1.00 - 1.49

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this study was to identify and analyze the training needs of extension workers in the area of mechanized agriculture in Iran. In order to accomplish this purpose, the following objectives were formulated:

1. To determine the degree of cooperation between agricultural colleges and the agriculture extension agency in Iran as perceived by the respondents of the study.

2. To identify the best time table and best location for training extension workers in the area of mechanized agriculture in Iran as perceived by the respondents of the study.

3. To identify the training needs of extension workers in the area of farm power and machinery and farming systems as perceived by the respondents of the study.

4. To determine the views of the respondents about issues related to mechanization, in terms of its present level and problems in Iran, its role and degree of contribution in boosting agricultural productivity, and the appropriateness of its technology.

Findings

Population

A total of 86 questionnaires out of 110 distributed were collected from the meeting of which 85 were useable for tabulation and analysis. Figure 4 shows the percentage of the respondents' job titles. The data revealed that the largest portion (38.6 and 33.7 percent) of the respondents were extension specialists and extension administrators. Some of the administrators included the head of the Agriculture Extension Service, Deputy head of the Agriculture Extension Service, and a number of provincial Agriculture Extension Service directors. The next highest (16.9 percent) group consisted of the respondents who marked the "Other" item in the first question. Table I furnishes the description of this group's job titles. A quick look at this group would indicate the importance associated with their positions as related to agriculture extension in Iran, especially for extension program development, implementation and training of extension workers. University faculties comprised the next highest group (9.6 percent), while the extension worker group was comprised of only 1.2 percent.

Figure 5 provides the summary of the respondents responses to the question in regard to their highest degree earned. The majority (65.9 percent) had a B.S. degree, while only 17.6 percent had a M.S. degree. Those respondents having a Ph.D. comprised the next highest group

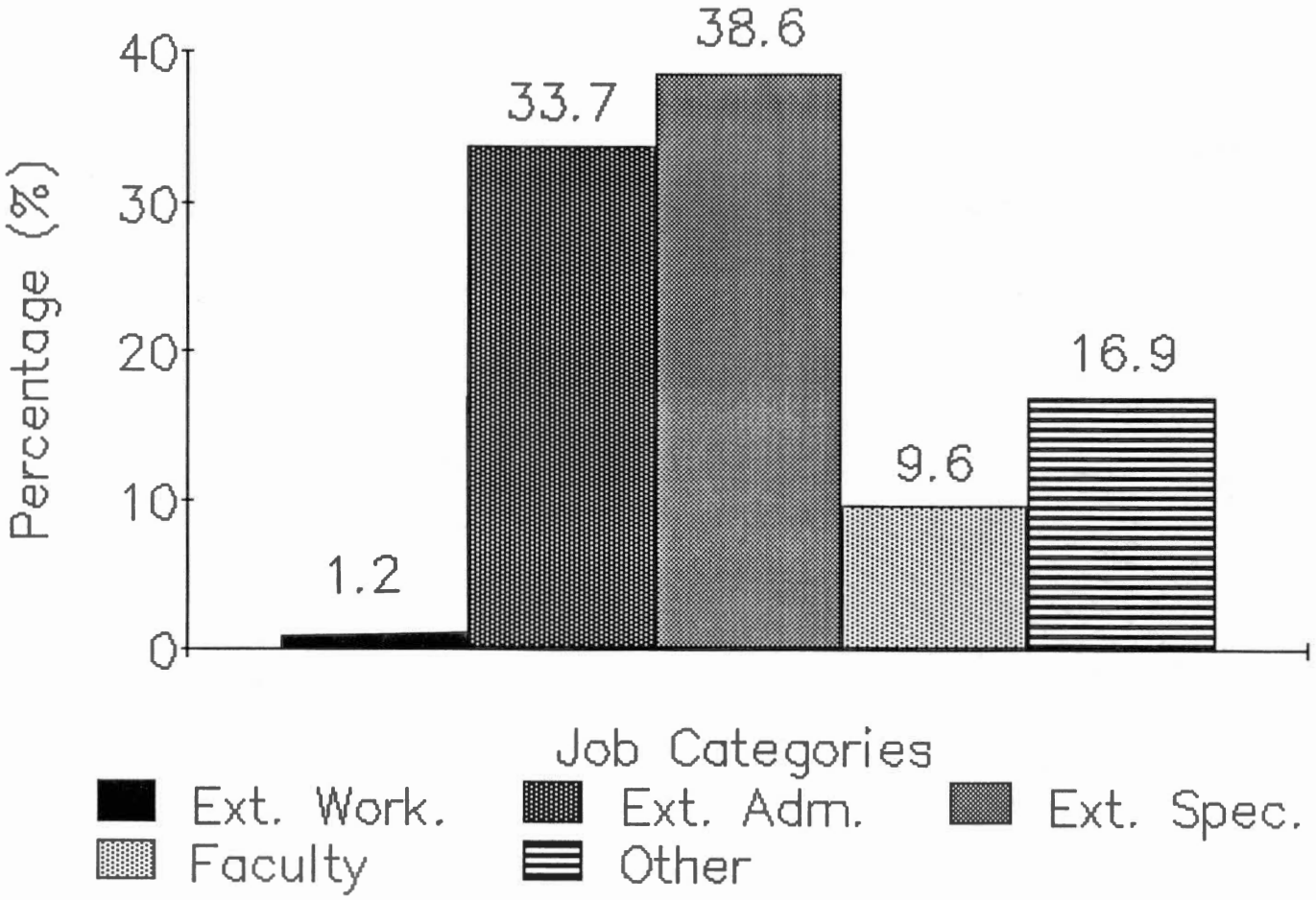


Figure 4. Study Respondents' Job Titles

TABLE I

RESPONDENTS' JOB TITLES UNDER "OTHER" ITEM
(n = 14)

Job Titles	No. of Respondents
General Director, Rural Services Centers	1
Agriculture Machinery Specialist	1
Planning Specialist, Isfahan Provincial Bank	1
Fellow Member, Agriculture Research Organization	1
Deputy Agriculture Training Center	1
Deputy Director, Department of Agriculture, Isfahan	1
Agriculture Instructor	1
Students	3
Researcher, Agriculture Research Center, Isfahan	1
Deputy in Technical Affairs, Department of Agriculture, Kurdestan	1
Director, Department of Agriculture, Kurdestan	1
Agriculture Irrigation Engineer	1

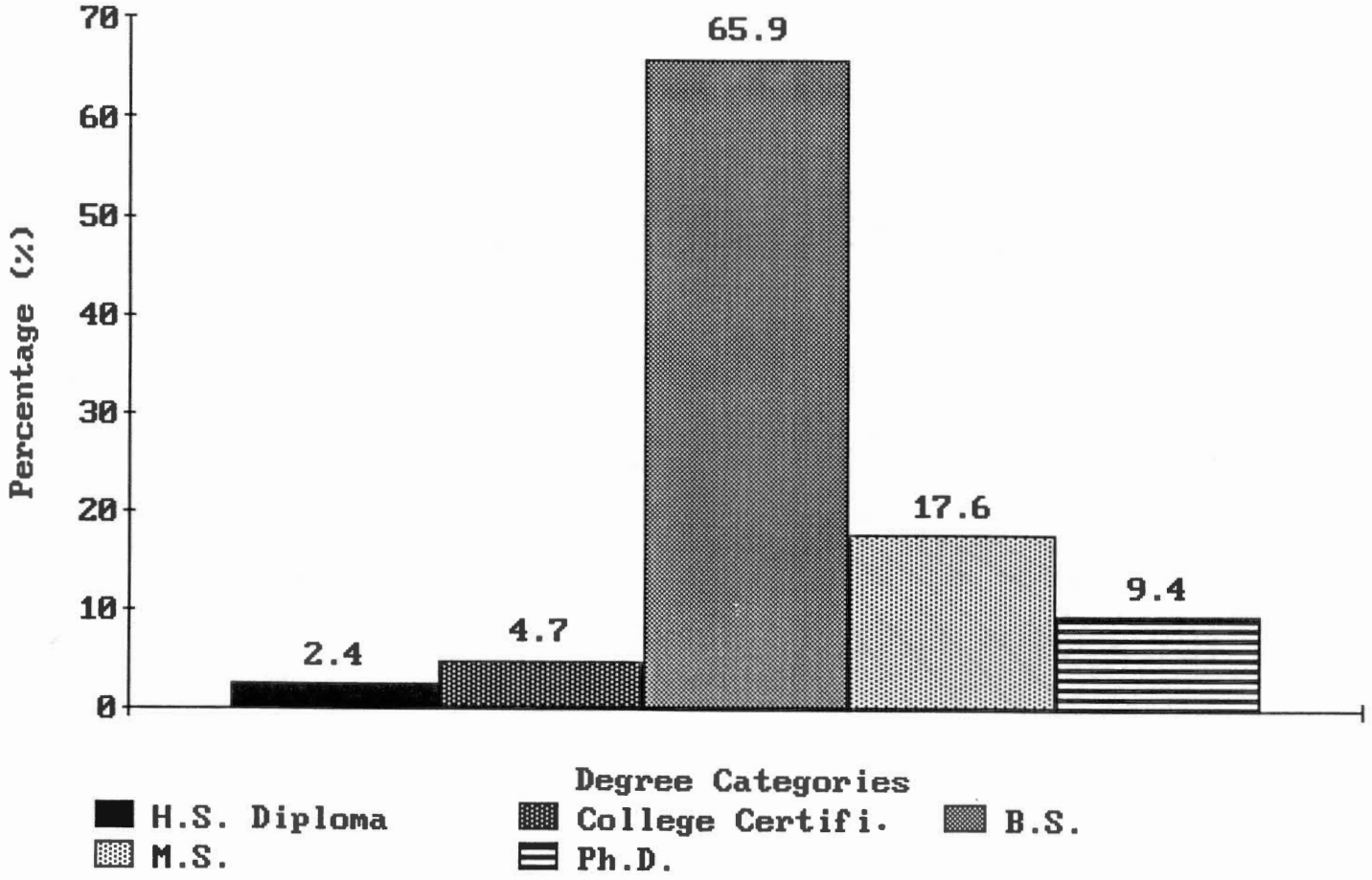


Figure 5. Study Respondents' Last Degree Earned

(9.4 percent) followed by college certificate holders (4.7 percent) and high school diploma holders (2.4 percent).

Table II shows the distribution of the respondents' major area of study. Overall, twelve different fields of study in agriculture were identified. Eighteen (21.69 percent) respondents were in agriculture education and extension, while 17 (20.48 percent) were in agronomy, 10 (12.05 percent) in general agriculture, 9 (10.84 percent) in soil science, 8 (9.64 percent) in animal science, 5 (6.02 percent) in agriculture engineering, 5 (6.02 percent) in horticulture, 3 (3.61 percent) in agriculture machinery, 3 (3.61 percent) in plant pathology, 2 (2.41 percent) in rural studies and development, and, finally, 1 (1.20 percent) in agriculture economics.

The next item was in regard to the geographical locations where the respondents were working. Figure 6 presents a map of Iran and Table III provides the distribution of the respondents based on their residency locations. Table III also indicates those provinces which did not have any representation in the population of the study. The largest group of respondents (22.89 percent) were from the Central province. It must be noted that recently this province has been divided into two separate provinces of Tehran and Central. However, since a current map of Iran was not available for this study, the respondents from these two provinces were combined into one group under the Central province. Other provinces to follow

TABLE II

RESPONDENTS' MAJOR AREA OF STUDY (n = 83)

Area	No. of Respondents	%
Ag. Extension/Education	18	21.69%
Agronomy	17	20.48%
General Agriculture	10	12.05%
Soil Science	9	10.84%
Animal Science	8	9.64%
Agriculture Engineering	5	6.02%
Horticulture	5	6.02%
Plant Pathology	3	3.61%
Agriculture Machinery	3	3.61%
Rural Development/Studies	2	2.41%
Agricultural Sciences	2	2.41%
Ag. Economics	1	1.20%

Figure 6. Map of Iran

TABLE III

DISTRIBUTION OF THE RESPONDENTS FROM VARIOUS PROVINCES (n = 83)

Province	No. of Respondents	%
Central	19	22.89%
Isfahan	13	15.66%
Khuzestan	9	10.84%
Fars	5	6.02%
Khorasan	5	6.02%
Baluchestan va Sistan	4	4.82%
Kurdestan	4	4.82%
Mazandaran	4	4.82%
Booshehr	4	4.82%
Kerman	3	3.61%
Yazd	3	3.61%
Boyer Ahmad	3	3.61%
West Azarbaijan	2	2.41%
East Azarbaijan	1	1.20%
Zanjan	1	1.20%
Semnan	1	1.20%
Ghilan	1	1.20%
Lorestan	1	1.20%
Hamadan	0	0.00%
Kermanshahan	0	0.00%
Ilam	0	0.00%
Chahar Mahal va Bakhtiari	0	0.00%
Hormozgan	0	0.00%

were Isfahan (15.66 percent), Khuzestan (10.84 percent), Fars (6.02 percent), Khorasan (6.02 percent), Baluchestan va Sistan (4.82 percent), Kurdestan (4.82 percent), Mazandaran (4.82 percent), Booshehr (4.82 percent) , Yazd (3.61 percent), Boyer Ahmad (3.61 percent), Kerman (3.61 percent), West Azarbayejan (2.41 percent), East Azarbayejan (1.20 percent), Lorestan (1.20 percent), Zanjan (1.20 percent), Semnan (1.20 percent), and Gilan (1.20 percent).

According to Figure 7, 33 (39.3 percent) of the respondents had worked between 1 to 5 years at their present job, while 25 (29.8 percent) between 6 to 10, 6 (7.1 percent) between 11 to 15, 17 (20.2 percent) between 16 to 20, and finally only 3 (3.6 percent) had worked over twenty years. Fifty eight (69.1 percent) of the respondents had worked between 1 to 10 years at their present jobs.

Table IV presents the summary of the responses given to the question asking respondents where they had received their training in extension work. 28 (35.44 percent) of the respondents had received their training in extension work at a university, mostly inside Iran. All of the respondents holding a Ph.D. degree had received their training abroad. The next highest (22.78 percent) group comprises those respondents who had received training in extension work from more than one place. Often, they had completed a formal program in a university and received additional training in extension work in the Ministry of Agriculture, at provincial agriculture departments, or from abroad. Data revealed that

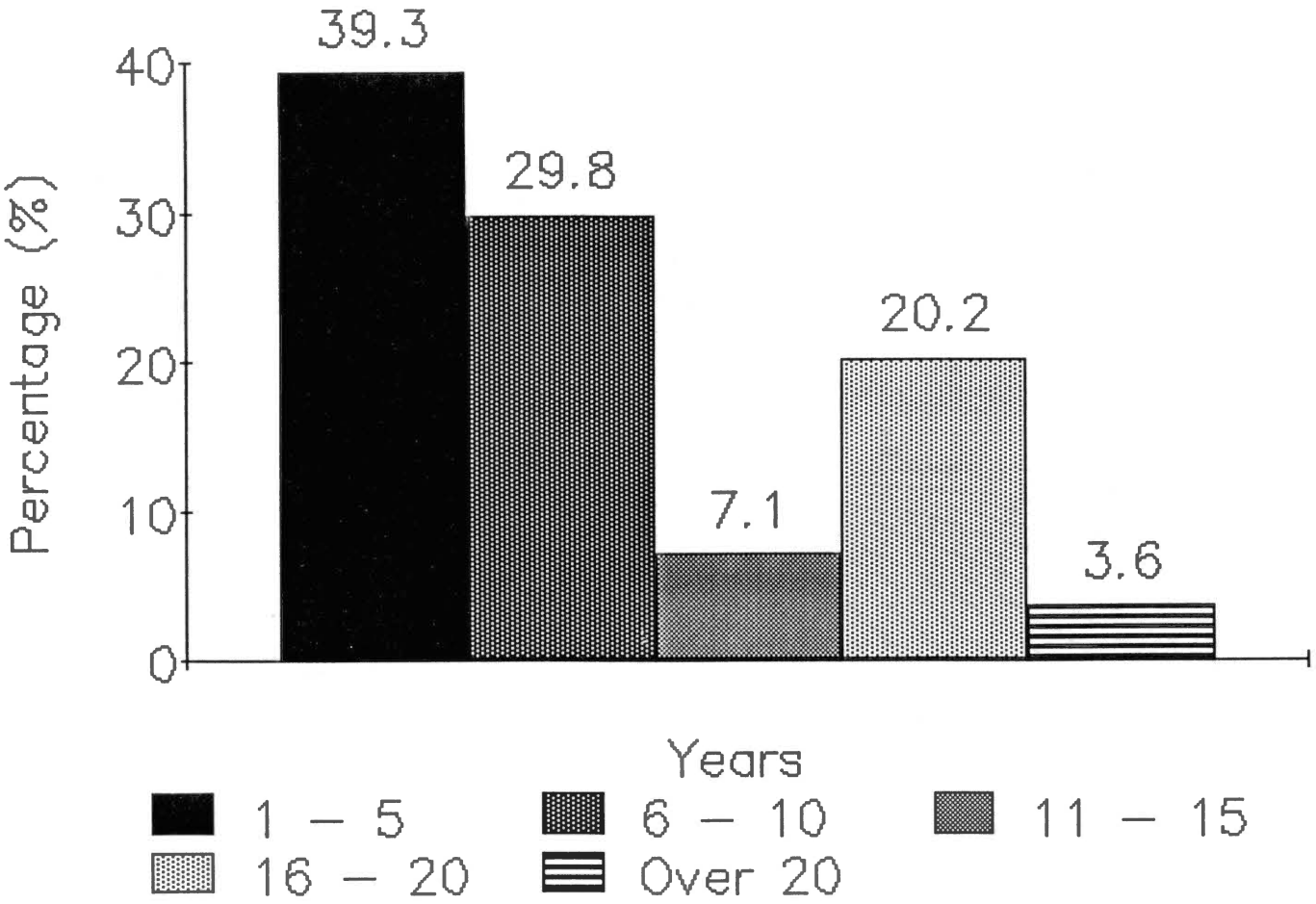


Figure 7. Study Respondents' Years of Experience at Present Job

TABLE IV

RESPONDENTS' TRAINING IN EXTENSION WORK
RECEIVED AT (n = 79)

Factors Surveyed	No. of Responses	%
Provincial Agriculture Dept.	13	16.46%
Ministry of Agriculture	12	15.19%
At a University	28	35.44%
A combination of the above	18	22.78%
Other	8	10.13%

13 (16.46 percent) and 12 (15.15 percent) of the respondents had received training at provincial agriculture departments and Ministry of Agriculture, respectively. Eight (10.13 percent) of the respondents indicated that they had received training at other than the above mentioned places. The places they indicated were mainly the agriculture cooperatives, agriculture research centers, Extension Corps, and extension seminars.

Table V provides the summary of the respondents' views in regard to what program extension workers should have completed their training. Twenty three (28.40 percent) of the respondents believed the Agricultural High School diploma as the most appropriate program for extension workers to receive their training in extension work, while 21 (25.53 percent) indicated that "Other" programs should provide the training opportunity for extension workers. Among the programs suggested by the respondents were two-year Agriculture College certificate, Agriculture High School diploma with two years of experience leading to a B.S., Agriculture High School diploma with long term training, and two-year college certificate with one year practical training. If we add the values obtained under the "Other" item for agriculture high schools to the previous values regardless of the additional conditions put by the respondents, then, 34.57 percent of them have perceived the agriculture high school diploma as the most appropriate program for extension workers to receive their training in

TABLE V

EXTENSION WORKERS SHOULD RECEIVE TRAINING IN (n = 81)

Factors Surveyed	No. of Responses	%
High school diploma with pre-service training	7	8.64%
Agricultural high school	23	28.40%
B.S. (general Ag.)	18	22.22%
B.S. (specialized Ag.)	11	13.58%
M.S. in Agriculture	1	1.23%
Other	21	25.93%

extension work while, B.S. in general agriculture was viewed by 22.22 percent and two-year agriculture college certificate 19.75 percent. B.S. in specialized agriculture was viewed by 13.58 percent followed by High school diploma with pre-service training (8.64 percent), and M.S. in agriculture (1.23 percent).

Table VI provides the summary of the responses on questions eight through twelve of the first part of the questionnaire. The perceptions of the respondents in regard to these items were measured on a Likert scale from "None" to "Very Much". It should be noted that not all of the respondents answered these questions and, therefore, there is a variance in the total N as reported in the table.

Data on these items revealed that 48.24 percent of the respondents expressed "much" familiarity with agriculture extension service in Iran with a mean of 2.86 and a standard deviation of 0.75. The standard deviation of 0.75 shows the degree of variation of responses around the mean. However, the means for their familiarity with agriculture extension services in developing countries (1.37) and developed countries (1.36) were considerably lower. The standard deviations for developing countries and developed countries were 0.96 and 0.88, respectively.

Further examination of Table VI revealed that 45.24 percent of the respondents expressed "some" familiarity, while 39.29 percent expressed "much" familiarity with agriculture mechanization in Iran. The mean was 2.63 with a

TABLE VI

SUMMARY RESPONSES TO QUESTIONS EIGHT THROUGH TWELVE

FACTORS SURVEYED	None (0) N	%	Little (1) N	%	Some (2) N	%	Much (3) N	%	VERY Much (4) N	%	MEAN	STD. Dev.	TOTAL N	Category
8. Familiarity with Ag. Ext. service in:														
A: Iran	0	0	2	2.35	25	29.41	41	48.24	17	20.00	2.86	0.75	85	Much
B: Developing countries	17	22.37	22	28.95	30	39.47	6	7.89	1	1.32	1.37	0.96	76	Little
C: Developed countries	12	17.39	26	37.68	26	37.68	4	5.80	1	1.45	1.36	0.88	69	Little
9. Familiarity with Ag. mechanization in:														
A: Iran	0	0	2	2.38	38	45.24	33	39.29	11	13.10	2.63	0.74	84	Much
B: Developing countries	10	14.29	25	35.71	26	37.14	8	11.43	1	1.43	1.50	0.92	70	Some
C: Developed countries	8	11.76	23	33.82	22	32.35	12	17.65	3	4.41	1.69	1.03	68	Some
10. Degree of cooperation between extension service and Ag. colleges in Iran:	10	11.90	59	70.24	15	17.86	0	0	0	0	1.06	0.54	84	Little
11. Extent of mechanized agriculture help in boosting agricultural productivity in Iran:	0	0	3	3.70	10	12.35	46	56.79	22	27.16	3.07	0.73	81	Much
12. Extent of extension workers training in the area of mechanized agriculture needed in Iran:	0	0	3	3.61	8	9.64	43	51.81	29	34.94	3.18	0.75	83	Much

standard deviation of 0.74, indicating an overall response of "much" familiarity with agriculture mechanization in Iran. The extent of familiarity with agriculture mechanization in developing countries and developed countries received a mean response of 1.50 with a standard deviation of 0.92 and a mean response of 1.69 with a standard deviation of 1.03, respectively.

Data on the degree of cooperation between extension service and agriculture colleges in Iran indicated that the majority (70.24 percent) of the respondents believed there was "little" cooperation existing between these two institutions. The mean was 1.06 with a standard deviation of 0.54. As in many other developing countries, this data indicates that there is a serious lack of cooperation between the extension service and the agricultural colleges which should act as the supporting arm of research for extension work in Iran.

The extent of mechanized agriculture help in boosting agricultural productivity in Iran was perceived by the respondents to be "much". The mean was 3.07 with a standard deviation of 0.73.

The last item shown in Table VI is the extent of extension workers training needed in the area of mechanized agriculture in Iran. The mean was 3.18 with a standard deviation of 0.75, indicating that extension workers needed "much" training in this area of agriculture.

Table VII presents the summary of the respondents perceptions as to the required time table for the training of extension workers in the area of mechanized agriculture. Forty six (55.42 percent) of the respondents believed a training program on yearly basis was needed while, 18 (21.69 percent) recommended a training program every 6 months, 10 (12.05 percent) every 2 years, and 9 (10.84 percent) recommended "Other" time tables. Some of the recommendations under "Other" item were on the basis of as needed and every five years.

Table VIII shows the perceptions of the respondents as to the importance of mechanization of different crops from an economical stand point in Iran. Most respondents chose to answer more than one crop. However, the data indicated that those crops which are of greater importance to the country which are known as "essential" crops in Iran, were considered to be more important in terms of mechanization. These crops were grain crops (80 percent), forage crops (61.18 percent), row crops (57.65 percent), and root crops (49.41 percent). Tree and vegetable crops were perceived as the least important (10.59 percent each).

Table IX presents the following information on the sources of farm power used more often by the farmers in Iran considering the farming operations indicated. The data suggest that 90.5 percent of the respondents believed primary tillage operations were performed by the farmers using engine power, while only 8.24 percent and 1.18 percent

TABLE VII

PERCEPTIONS ON THE TIME TABLE FOR EXTENSION WORKERS TRAINING IN MECHANIZED AGRICULTURE (n = 83)

Time Tables	No. of Responses	%
Every six months	18	21.69%
Every year	46	55.42%
Every two years	10	12.05%
Other	9	10.84%

TABLE VIII

PERCEPTIONS ON THE IMPORTANCE OF MECHANIZATION OF DIFFERENT CROPS (n = 85)

Crops	No. of Responses	%
Grain crops	68	80.00%
Tree crops	9	10.59%
Row crops	49	57.65%
Root crops	42	49.41%
Forage crops	52	61.18%
Vegetable crops	9	10.59%
Other	0	0.00%

TABLE IX

PERCEPTIONS ON THE SOURCES OF POWER USED IN IRAN
(n = 85)

	(1) Man Power		(2) Animal Power		(3) Engine Power	
Farming Operations	N	%	N	%	N	%
Primary tillage	1	1.18	7	8.24	77	90.59
Secondary tillage	3	3.53	4	4.71	73	85.88
Planting	61	71.76	6	7.06	20	23.53
Cultivation	77	90.59	0	0.00	9	10.59
Harvesting	56	65.88	4	4.71	39	45.88
Crop handling	10	11.76	39	45.88	59	69.41

believed farmers used animal power and man power, respectively. On the secondary tillage, 85.88 percent of the respondents believed farmers used engine power, while 4.71 percent and 3.53 percent believed farmers applied animal power and man power, respectively. Planting, cultivation, and harvesting were perceived to be performed more with man power than the other two sources. The respondents indicated that 71.76 percent of the farmers used man power for planting compared to 7.06 percent and 23.53 percent for animal power and engine power, respectively. 90.59 percent of the respondents believed that farmers used man power for cultivation, while 10.59 percent believed farmers applied engine power for the same operation. No responses were reported for animal power used for cultivation. 65.88 percent of the respondents indicated that farmers used man power for harvesting operation, while 4.71 percent and 45.88 percent indicated the use of animal power and engine power, respectively. And finally, engine power was used more often for crop handling as indicated by 69.41 percent of the respondents compared to animal power (45.88 percent) and man power (11.76 percent).

Data pertaining to the last question in the first part of the questionnaire is presented in Table X. The respondents were asked to identify the best place for training extension workers in the area of mechanized agriculture. Only 42.35 percent of the respondents viewed the agriculture departments at the provincial levels as the best

TABLE X

PERCEPTIONS ON THE BEST INSTITUTION FOR TRAINING EXTENSION WORKERS IN MECHANIZED AGRICULTURE
(n = 85)

Institutions	No. of Responses	%
Ministry of Agriculture (in Tehran)	9	10.59%
Ag. department at provincial level	36	42.35%
University centers at provincial level	12	14.12%
Other	28	32.94%

place, while 32.94 percent suggested a variety of places under the "other" item in the question. Table XI provides the responses and the corresponding percentages. Agriculture training centers and/or experiment stations and public and private commercial farms marked the top of the list by 32.29 percent and 25 percent of the respondents, respectively. Among other places suggested were the Agriculture Ministry and provincial agriculture departments, and universities and the Agriculture Ministry, indicating the respondents' concern for the need of a cooperative work to achieve better results. Only 14.12 percent of the respondents viewed university centers at provincial level , while 10.59 percent viewed the Ministry of Agriculture in Tehran as the best place for training extension workers.

Perceptions of the Respondents in Regard to the Training Needs of the Agriculture Extension Workers in the Area of Mechanized Agriculture

The respondents of the study were asked to determine the extent of knowledge, training, and skills possessed, as well as needed, by the extension workers in the area of farm power and machinery and farming systems. Furthermore, the respondents were asked to determine the extent of available and needed educational resources in the area of mechanized agriculture by the extension workers in Iran.

TABLE XI

PERCEIVED "OTHER" BEST INSTITUTIONS FOR TRAINING EXTENSION WORKERS IN MECHANIZED AGRICULTURE
(n = 28)

Institutions	No. of Responses
Agriculture Training Centers and/or Experiment Stations	11
Public and private commercial farms	8
Universities and Agriculture Ministry	3
Agriculture Ministry and provincial Agriculture Departments	2
Universities and provincial Agriculture Departments	2
Vocational and Technical centers	1
Karaj (Tehran) Agriculture Engineering center	1

The perceptions of the respondents for this part of the questionnaire were measured on a Likert scale from "None" to "Very Much". There were six categories of expertise based on which extension workers needs were determined. These categories were "Operation and Safety," "Maintenance and Service," "Major Repairs," "Selection and Matching to Proper Auxiliary Machines," "Tillage Systems," and "Types of Farming Operations."

Data Concerning the Extent of Knowledge, Training, and Skills Possessed by the Extension Workers

Table XII reports data on the extent of knowledge, training, and skills possessed by the extension workers under "Operation and Safety" category for eleven different machines and equipment. The data revealed that the respondents believed extension workers had "little" training for operating small stationary and mobile power units, row crop planters, combines, and land leveling equipment, while they had "some" training for operating tractors, primary and secondary tillage equipment, grain drill, hay/forage equipment, field sprayers, and small harvesting machines. Overall, the mean for land leveling equipment was the lowest (0.77) and the mean for the field sprayers was the highest (2.34) in this category. The standard deviation for land leveling equipment was greater than its mean due to the higher distribution of data towards the lower side of the scale.

TABLE XII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN OPERATION AND SAFETY

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	7	8.86%	26	32.91%	37	46.84%	9	11.39%	0	0.00%	1.61	0.80	79	Some
- Small power units	9	11.69%	35	45.45%	23	29.87%	10	12.99%	0	0.00%	1.44	0.86	77	Little
- Primary tillage equip.	8	10.26%	16	20.51%	38	48.72%	14	17.95%	2	2.56%	1.82	0.93	78	Some
- Secondary tillage equip.	7	8.97%	21	26.92%	36	46.15%	13	16.67%	1	1.28%	1.74	0.88	78	Some
- Row crop planters	9	11.69%	34	44.16%	24	31.17%	10	12.99%	0	0.00%	1.45	0.86	77	Little
- Grain drill	8	10.53%	25	32.89%	27	35.53%	15	19.74%	1	1.32%	1.68	0.95	76	Some
- Hay equipment	7	9.59%	29	39.73%	24	32.88%	13	17.81%	0	0.00%	1.59	0.89	73	Some
- Fiels sprayers	0	0.00%	9	11.69%	35	45.45%	31	40.26%	2	2.60%	2.34	0.71	77	Some
- Combines	19	25.68%	27	36.49%	23	31.08%	3	4.05%	2	2.70%	1.22	0.96	74	Little
- Land leveling equip.	35	44.30%	30	37.97%	11	13.92%	3	3.80%	0	0.00%	0.77	0.83	79	Little
- Small harvest machines	6	7.59%	32	40.51%	28	35.44%	13	16.46%	0	0.00%	1.61	0.85	79	Some

Table XIII reported data on the "Maintenance and Service" category. The respondents indicated that the extension workers had "little" training for all equipment and machinery but primary tillage equipment and field sprayers. The extension workers were found to have "some" training for the maintenance and service of these two class of equipment. Overall, land leveling equipment had the lowest mean (.55) and field sprayers had the highest mean (1.95). Once again, the standard deviation for land leveling equipment was greater than its mean, indicating a strong distribution towards the lower side of the scale. 58.97 percent of the respondents believed extension workers had no training in maintenance and servicing land leveling equipment.

Table XIV contains data collected on the "Major Repairs" category. Data revealed that the extension workers were rated as "none" in regard to training in major repair of tractors, combines and land leveling equipment while, they had "little" training for the rest. The lowest mean (0.32) was that of the land leveling equipment and the highest one was for fields sprayers. Once again, due to the skewed distribution of data towards the lower side of the scale, the standard deviation for land leveling equipment, tractors, small power units, and combines were greater than their means.

Table XV provides data on the "Selection and Matching to Proper Auxiliary Machines" category. The respondents

TABLE XIII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN MAINTENANCE AND SERVICE

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	11	13.92%	32	40.51%	30	37.97%	5	6.33%	1	1.27%	1.41	0.85	79	Little
- Small power units	14	18.18%	35	45.45%	25	32.47%	3	3.90%	0	0.00%	1.22	0.78	77	Little
- Primary tillage equip.	9	11.54%	22	28.21%	38	48.72%	9	11.54%	0	0.00%	1.60	0.84	78	Some
- Secondary tillage equip.	11	14.29%	27	35.06%	32	41.56%	7	9.09%	0	0.00%	1.45	0.85	77	Little
- Row crop planters	12	16.00%	38	50.67%	21	28.00%	4	5.33%	0	0.00%	1.23	0.78	75	Little
- Grain drill	16	21.05%	27	35.53%	26	34.21%	6	7.89%	1	1.32%	1.33	0.94	76	Little
- Hay equipment	10	13.89%	33	45.83%	25	34.72%	4	5.56%	0	0.00%	1.32	0.78	72	Little
- Fiels sprayers	2	2.63%	20	26.32%	35	46.05%	18	23.68%	1	1.32%	1.95	0.81	76	Some
- Combines	28	38.89%	27	37.50%	15	20.83%	2	2.78%	0	0.00%	0.88	0.83	72	Little
- Land leveling equip.	46	58.97%	24	30.77%	6	7.69%	1	1.28%	1	1.28%	0.55	0.79	78	Little
- Small harvest machines	15	18.99%	30	37.97%	28	35.44%	6	7.59%	0	0.00%	1.32	0.86	79	Little

TABLE XIV

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN MAJOR REPAIRS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	45	57.69%	29	37.18%	4	5.13%	0	0.00%	0	0.00%	0.47	0.59	78	None
- Small power units	34	44.74%	34	44.74%	6	7.89%	2	2.63%	0	0.00%	0.68	0.73	76	Little
- Primary tillage equip.	22	29.73%	30	40.54%	21	28.38%	1	1.35%	0	0.00%	1.01	0.80	74	Little
- Secondary tillage equip.	21	27.63%	35	46.05%	19	25.00%	1	1.32%	0	0.00%	1.00	0.76	76	Little
- Row crop planters	26	34.67%	41	54.67%	6	8.00%	2	2.67%	0	0.00%	0.79	0.70	75	Little
- Grain drill	27	36.00%	32	42.67%	12	16.00%	3	4.00%	1	1.33%	0.92	0.89	75	Little
- Hay equipment	25	35.21%	33	46.48%	10	14.08%	2	2.82%	1	1.41%	0.89	0.85	71	Little
- Fiels sprayers	10	13.51%	34	45.95%	21	28.38%	9	12.16%	0	0.00%	1.39	0.87	74	Little
- Combines	46	64.79%	18	25.35%	6	8.45%	0	0.00%	1	1.41%	0.48	0.77	71	None
- Land leveling equip.	60	77.92%	12	15.58%	3	3.90%	1	1.30%	1	1.30%	0.32	0.73	77	None
- Small harvest machines	29	37.18%	29	37.18%	16	20.51%	4	5.13%	0	0.00%	0.94	0.88	78	Little

TABLE XV

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN SELECTION AND MATCHING TO AUXILIARY MACHINES

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	14	17.95%	39	50.00%	16	20.51%	6	7.69%	3	3.85%	1.29	0.98	78	Little
- Small power units	21	27.27%	32	41.56%	15	19.48%	7	9.09%	2	2.60%	1.18	1.02	77	Little
- Primary tillage equip.	9	12.00%	25	33.33%	29	38.67%	10	13.33%	2	2.67%	1.61	0.95	75	Some
- Secondary tillage equip.	11	14.29%	25	32.47%	31	40.26%	8	10.39%	2	2.60%	1.55	0.95	77	Some
- Row crop planters	17	22.37%	30	39.47%	21	27.63%	8	10.53%	0	0.00%	1.26	0.92	76	Little
- Grain drill	15	20.00%	25	33.33%	22	29.33%	11	14.67%	2	2.67%	1.47	1.05	75	Little
- Hay equipment	12	16.90%	31	43.66%	18	25.35%	8	11.27%	2	2.82%	1.39	0.99	71	Little
- Fiels sprayers	3	4.11%	19	26.03%	30	41.10%	18	24.66%	3	4.11%	1.99	0.91	73	Some
- Combines	23	32.39%	21	29.58%	19	26.76%	6	8.45%	2	2.82%	1.20	1.07	71	Little
- Land leveling equip.	34	44.16%	25	32.47%	15	19.48%	2	2.60%	1	1.30%	0.84	0.91	77	Little
- Small harvest machines	11	14.29%	34	44.16%	22	28.57%	10	12.99%	0	0.00%	1.40	0.89	77	Little

believed that extension workers had "little" training for all but primary and secondary tillage equipment and field sprayers. The data reveals that they had "some" training in selecting and matching these three class of equipment. The lowest mean (0.84) was for land leveling equipment and the highest one was for field sprayers. Again, the standard deviation for land leveling equipment was greater than the mean. It must be noted that so far (for the fourth time in a row), the land leveling equipment had the lowest, and the field sprayers had the highest mean.

Table XVI reports data on the "Tillage Systems" category. The data revealed that the extension workers had "little" training for no-till farming while, they had "some" training for minimum-till farming, conventional farming, irrigated farming, and dry-land farming. Among the four, irrigated farming had the highest mean (2.36) followed by conventional farming (2.25), dry-land farming (1.91), and minimum-till farming (1.87).

Table XVII presents the following information on the "Farming Operations." The respondents believed that extension workers had "some" training for all five types of farming operations. The highest mean (2.25) was for planting followed by primary tillage (2.21), secondary tillage (2.16), and cultivation and harvesting (2.06 each).

TABLE XVI

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN TILLAGE SYSTEMS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- No-Till farming	14	18.42%	26	34.21%	24	31.58%	11	14.47%	1	1.32%	1.46	0.99	76	Little
- Minimum-till farming	6	8.00%	11	14.67%	46	61.33%	11	14.67%	1	1.33%	1.87	0.81	75	Some
- Conventional farming	2	2.63%	8	10.53%	37	48.68%	27	35.53%	2	2.63%	2.25	0.78	76	Some
- Irrigated farming	2	2.63%	3	3.95%	41	53.95%	26	34.21%	4	5.26%	2.36	0.76	76	Some
- Dry-land farming	4	5.26%	17	22.37%	38	50.00%	16	21.05%	1	1.32%	1.91	0.83	76	Some

TABLE XVII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS POSSESSED BY EXTENSION WORKERS IN TYPES OF FARMING OPERATIONS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Primary tillage	2	2.63%	8	10.53%	42	55.26%	20	26.32%	4	5.26%	2.21	0.80	76	Some
- Secondary tillage	2	2.67%	10	13.33%	41	54.67%	18	24.00%	4	5.33%	2.16	0.82	75	Some
- Planting	3	3.90%	8	10.39%	36	46.75%	27	35.06%	3	3.90%	2.25	0.84	77	Some
- Cultivation	3	3.90%	15	19.48%	35	45.45%	22	28.57%	2	2.60%	2.06	0.86	77	Some
- Harvesting	3	3.90%	12	15.58%	41	53.25%	19	24.68%	2	2.60%	2.06	0.81	77	Some

Data Concerning the Extent of Knowledge, Training, and Skills Needed by the Extension Workers

Table XVIII presents data concerning the extent of training needed by extension workers under the "Operation and Safety" category. The data reveals that they needed "some" training in operating land leveling equipment while, they needed "much" training for the rest of the machines and equipment. The lowest mean (2.74) in the "much" training needed response group was for combines, and the highest one was for field sprayers (3.12).

Table XIX contains data collected on the extent of training needed under the "Maintenance and Service" category. The data reveals that the extension workers needed "some" training for the maintenance and servicing land leveling equipment and "much" training for the rest of the machines and equipment. The lowest mean (2.62) in the "much" training needed response group was for combines, and the highest mean (3.12) was for field sprayers.

Table XX reports data on the extent of training needed by extension workers under the "Major Repairs" category. Data indicated that extension workers needed "much" training for field sprayers, represented by a mean of 2.54 with a standard deviation of 1.04 and, "some" training for the rest of the machines and equipment. The lowest mean (1.61) for this group of responses was for land leveling equipment, and the highest one (2.30) was for the grain drill.

TABLE XVIII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN OPERATION AND SAFETY

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	2	2.82%	2	2.82%	13	18.31%	31	43.66%	23	32.39%	3.00	0.93	71	Much
- Small power units	1	1.47%	2	2.94%	19	27.94%	30	44.12%	16	23.53%	2.85	0.86	68	Much
- Primary tillage equip.	1	1.41%	2	2.82%	17	23.94%	28	39.44%	23	32.39%	2.99	0.90	71	Much
- Secondary tillage equip.	1	1.45%	2	2.90%	14	20.29%	31	44.93%	21	30.43%	3.00	0.87	69	Much
- Row crop planters	2	2.82%	4	5.63%	12	16.90%	26	36.62%	27	38.03%	3.01	1.01	71	Much
- Grain drill	2	2.86%	3	4.29%	13	18.57%	22	31.43%	30	42.86%	3.07	1.02	70	Much
- Hay equipment	2	2.86%	3	4.29%	11	15.71%	30	42.86%	24	34.29%	3.01	0.96	70	Much
- Fiels sprayers	0	0.00%	3	4.41%	13	19.12%	25	36.76%	27	39.71%	3.12	0.87	68	Much
- Combines	4	5.80%	6	8.70%	14	20.29%	25	36.23%	20	28.99%	2.74	1.14	69	Much
- Land leveling equip.	7	9.86%	9	12.68%	16	22.54%	24	33.80%	15	21.13%	2.44	1.23	71	Some
- Small harvest machines	3	4.29%	1	1.43%	18	25.71%	26	37.14%	22	31.43%	2.90	1.00	70	Much

TABLE XIX

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN MAINTENANCE AND SERVICE

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	1	1.43%	5	7.14%	12	17.14%	37	52.86%	15	21.43%	2.86	0.88	70	Much
- Small power units	1	1.49%	6	8.96%	12	17.91%	36	53.73%	12	17.91%	2.78	0.89	67	Much
- Primary tillage equip.	1	1.43%	4	5.71%	14	20.00%	32	45.71%	19	27.14%	2.91	0.91	70	Much
- Secondary tillage equip.	2	2.86%	3	4.29%	12	17.14%	34	48.57%	19	27.14%	2.93	0.93	70	Much
- Row crop planters	3	4.29%	5	7.14%	9	12.86%	34	48.57%	19	27.14%	2.87	1.03	70	Much
- Grain drill	2	2.86%	4	5.71%	11	15.71%	32	45.71%	21	30.00%	2.94	0.97	70	Much
- Hay equipment	2	2.90%	5	7.25%	12	17.39%	32	46.38%	18	26.09%	2.86	0.98	69	Much
- Fiels sprayers	0	0.00%	2	2.94%	13	19.12%	28	41.18%	25	36.76%	3.12	0.81	68	Much
- Combines	5	7.35%	10	14.71%	10	14.71%	24	35.29%	19	27.94%	2.62	1.24	68	Much
- Land leveling equip.	7	10.14%	17	24.64%	11	15.94%	22	31.88%	12	17.39%	2.22	1.27	69	Some
- Small harvest machines	2	2.86%	5	7.14%	11	15.71%	33	47.14%	19	27.14%	2.89	0.98	70	Much

TABLE XX

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN MAJOR REPAIRS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	5	7.25%	18	26.09%	24	34.78%	13	18.84%	9	13.04%	2.04	1.12	69	Some
- Small power units	6	8.96%	16	23.88%	23	34.33%	15	22.39%	7	10.45%	2.01	1.11	67	Some
- Primary tillage equip.	4	5.80%	15	21.74%	26	37.68%	14	20.29%	10	14.49%	2.16	1.10	69	Some
- Secondary tillage equip.	3	4.41%	17	25.00%	17	25.00%	24	35.29%	7	10.29%	2.22	1.07	68	Some
- Row crop planters	5	7.25%	16	23.19%	16	23.19%	22	31.88%	10	14.49%	2.23	1.17	69	Some
- Grain drill	4	5.80%	13	18.84%	20	28.99%	22	31.88%	10	14.49%	2.30	1.11	69	Some
- Hay equipment	6	8.70%	14	20.29%	22	31.88%	17	24.64%	10	14.49%	2.16	1.16	69	Some
- Fiels sprayers	3	4.48%	7	10.45%	20	29.85%	25	37.31%	12	17.91%	2.54	1.04	67	Much
- Combines	10	15.15%	17	25.76%	18	27.27%	11	16.67%	10	15.15%	1.91	1.28	66	Some
- Land leveling equip.	17	24.64%	21	30.43%	12	17.39%	10	14.49%	9	13.04%	1.61	1.34	69	Some
- Small harvest machines	5	7.25%	14	20.29%	22	31.88%	22	31.88%	6	8.70%	2.14	1.07	69	Some

Table XXI contains data on the extent of training needed by extension workers under the "Selection and Matching to Proper Auxiliary Machines" category. The data reveals that extension workers needed "much" training for all the machines and equipment. The lowest mean (2.52) was for land leveling equipment and, the highest mean (3.01) was for field sprayers. It is interesting to note that the respondents to the study believed extension workers had and needed the most training for field sprayers as represented by the highest means for all categories of expertise and conversely, they had and needed the least training for land leveling equipment as represented by the lowest means for all categories of expertise.

Table XXII reports data on the extent of training needed by extension workers in "Tillage Systems". It was found that they needed "much" training in all areas of tillage systems. The highest mean (3.12) was for conventional farming followed by irrigated farming (3.10), minimum-till farming and dry-land farming (2.86 each), and no-till farming (2.60).

Table XXIII provides information pertinent on the extent of training needed by extension workers in "Farming Operations". Data revealed that they needed "much" training in all types of farming operations. The highest mean (3.16) was for both harvesting and cultivation followed by planting (3.12), secondary tillage (2.97), and primary tillage (2.91).

TABLE XXI

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN SELECTION AND MATCHING TO AUXILIARY MACHINES

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Tractors	1	1.45%	8	11.59%	11	15.94%	24	34.78%	25	36.23%	2.93	1.05	69	Much
- Small power units	1	1.52%	8	12.12%	14	21.21%	22	33.33%	21	31.82%	2.82	1.06	66	Much
- Primary tillage equip.	2	2.90%	4	5.80%	16	23.19%	25	36.23%	22	31.88%	2.88	1.01	69	Much
- Secondary tillage equip.	3	4.35%	3	4.35%	14	20.29%	27	39.13%	22	31.88%	2.90	1.04	69	Much
- Row crop planters	3	4.35%	3	4.35%	11	15.94%	28	40.58%	24	34.78%	2.97	1.04	69	Much
- Grain drill	3	4.35%	3	4.35%	11	15.94%	30	43.48%	22	31.88%	2.94	1.02	69	Much
- Hay equipment	4	5.80%	4	5.80%	14	20.29%	23	33.33%	24	34.78%	2.86	1.13	69	Much
- Fiels sprayers	1	1.49%	5	7.46%	11	16.42%	25	37.31%	25	37.31%	3.01	0.98	67	Much
- Combines	3	4.55%	7	10.61%	13	19.70%	22	33.33%	21	31.82%	2.77	1.14	66	Much
- Land leveling equip.	7	10.14%	9	13.04%	15	21.74%	17	24.64%	21	30.43%	2.52	1.31	69	Much
- Small harvest machines	3	4.35%	5	7.25%	15	21.74%	23	33.33%	23	33.33%	2.84	1.10	69	Much

TABLE XXII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN TILLAGE SYSTEMS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- No-Till farming	3	4.62%	11	16.92%	13	20.00%	20	30.77%	18	27.69%	2.60	1.19	65	Much
- Minimum-till farming	1	1.56%	5	7.81%	14	21.88%	26	40.63%	18	28.13%	2.86	0.97	64	Much
- Conventional farming	0	0.00%	3	4.62%	11	16.92%	26	40.00%	25	38.46%	3.12	0.85	65	Much
- Irrigated farming	0	0.00%	3	4.48%	14	20.90%	23	34.33%	27	40.30%	3.10	0.88	67	Much
- Dry-land farming	1	1.52%	5	7.58%	16	24.24%	24	36.36%	20	30.30%	2.86	0.98	66	Much

TABLE XXIII

PERCEPTIONS ON THE EXTENT OF KNOWLEDGE, TRAINING, AND SKILLS NEEDED BY EXTENSION WORKERS IN TYPES OF FARMING OPERATIONS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Primary tillage	0	0.00%	6	8.82%	13	19.12%	30	44.12%	19	27.94%	2.91	0.90	68	Much
- Secondary tillage	0	0.00%	6	8.82%	11	16.18%	30	44.12%	21	30.88%	2.97	0.91	68	Much
- Planting	0	0.00%	3	4.41%	10	14.71%	31	45.59%	24	35.29%	3.12	0.81	68	Much
- Cultivation	0	0.00%	4	5.88%	10	14.71%	25	36.76%	29	42.65%	3.16	0.88	68	Much
- Harvesting	0	0.00%	4	5.88%	10	14.71%	25	36.76%	29	42.65%	3.16	0.88	68	Much

Data Concerning the Extent of Available Educational Resources in the Area of Mechanized Agriculture to the Extension Workers

Table XXIV contains data on the extent of the educational resources in the area of mechanized agriculture being available to extension workers. It was found that there were "little" amount of books, slides, video tapes and films, machinery repair, operation,and maintenance and service manuals, equipment selection handbooks, and equipment calibration manuals available to extension workers. The respondents believed there were "some" extension fact sheets available to extension workers as represented by a mean of 1.80 with a standard deviation of 0.87. The highest mean (1.41) in the "little" response group was for books while, the lowest mean (0.60) was for equipment calibration manuals. The standard deviation for equipment calibration manuals and equipment selection handbooks were greater than their mean due to the skewed distribution of data on the lower side of the scale.

Data Concerning the Extent of Needed Educational Resources in the Area of Mechanized Agriculture by the Extension Workers

Table XXV contains data on the extent of needed educational resources in the area of mechanized agriculture

TABLE XXIV

PERCEPTIONS ON THE EXTENT OF AVAILABLE EDUCATIONAL RESOURCES IN THE AREA OF MECHANIZED AGRICULTURE TO EXTENSION WORKERS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Books	6	7.23%	45	54.22%	26	31.33%	4	4.82%	2	2.41%	1.41	0.79	83	Little
- Extension fact sheets	6	7.23%	22	26.51%	40	48.19%	13	15.66%	2	2.41%	1.80	0.87	83	Some
- Slides	30	36.14%	44	53.01%	8	9.64%	1	1.20%	0	0.00%	0.76	0.67	83	Little
- Videos and films	23	28.05%	45	54.88%	11	13.41%	3	3.66%	0	0.00%	0.93	0.75	82	Little
- Machinery repair manuals	16	19.28%	56	67.47%	9	10.84%	2	2.41%	0	0.00%	0.96	0.63	83	Little
- Machinery operation manuals	16	19.75%	44	54.32%	17	20.99%	2	2.47%	2	2.47%	1.14	0.84	81	Little
- Machinery maintenance manuals	13	15.85%	45	54.88%	18	21.95%	4	4.88%	2	2.44%	1.23	0.86	82	Little
- Equipment selection handbooks	35	42.68%	36	43.90%	9	10.98%	1	1.22%	1	1.22%	0.74	0.79	82	Little
- Equipment calibration manuals	41	49.40%	34	40.96%	8	9.64%	0	0.00%	0	0.00%	0.60	0.66	83	Little

TABLE XXV

PERCEPTIONS ON THE EXTENT OF NEEDED EDUCATIONAL RESOURCES IN THE AREA OF MECHANIZED AGRICULTURE BY EXTENSION WORKERS

Factors Surveyed	None (0) n	%	Little (1) n	%	Some (2) n	%	Much (3) n	%	Very Much (4) n	%	Mean	STD. DEV.	Total N	Category
- Books	0	0.00%	2	2.41%	17	20.48%	43	51.81%	21	25.30%	3.00	0.74	83	Much
- Extension fact sheets	0	0.00%	1	1.20%	8	9.64%	35	42.17%	39	46.99%	3.35	0.70	83	Much
- Slides	0	0.00%	0	0.00%	7	8.43%	46	55.42%	30	36.14%	3.28	0.61	83	Much
- Videos and films	0	0.00%	0	0.00%	9	10.84%	34	40.96%	40	48.19%	3.37	0.67	83	Much
- Machinery repair manuals	0	0.00%	1	1.20%	11	13.25%	43	51.81%	28	33.73%	3.18	0.70	83	Much
- Machinery operation manuals	0	0.00%	0	0.00%	11	13.25%	36	43.37%	36	43.37%	3.30	0.69	83	Much
- Machinery maintenance manuals	0	0.00%	0	0.00%	10	12.05%	34	40.96%	39	46.99%	3.35	0.68	83	Much
- Equipment selection handbooks	0	0.00%	0	0.00%	9	10.98%	37	45.12%	36	43.90%	3.33	0.66	82	Much
- Equipment calibration manuals	0	0.00%	0	0.00%	10	12.05%	44	53.01%	29	34.94%	3.23	0.65	83	Much

by extension workers in Iran. The data reveals that extension workers needed "much" educational resources of all types listed in the table. The highest mean (3.37) was for video tapes and films while, the lowest mean (3.00) was for books. Other necessary resources having the next highest means were extension fact sheets and equipment maintenance and service manuals (3.35 each), equipment selection handbooks (3.33), machinery operation manuals (3.30), slides (3.28), equipment calibration manuals (3.23), and machinery repair manuals (3.18). Among the three manuals- machinery repair, operation, and maintenance manuals- maintenance manuals were rated as being the most needed. In the section on needed training, extension workers were more often viewed as needing training in the category of "operation and safety" compared to the "maintenance and service" category. In the necessary educational resources section, however, the perceived need for operation manuals came next to the maintenance and service manuals. Finally, equipment selection handbooks were perceived to be needed more than equipment calibration manuals while, there were more selection handbooks available to extension workers compared to calibration manuals.

Perceptions of the Respondents of the Study in Regard to Four Related Issues of Agriculture Mechanization in Iran

As previously stated, the participants in the Fifth National Meeting on Agriculture Extension in Iran were surveyed to determine the degree of their agreement or disagreement with the statements in regard to the present level and problems of agriculture mechanization, the role of agriculture mechanization in boosting agricultural productivity, and the selection of appropriate technology for agriculture mechanization in Iran. The perceptions of the respondents for this part of the questionnaire were measured on a Likert scale from "Very disagree" to "Very agree". There were 32 statements in the second part of the questionnaire.

Data Concerning the Present Level of Mechanization in Iran

Table XXVI reports data on the perceived present level of agriculture mechanization in Iran. This segment contained 6 statements. Data revealed that the majority (52.38 percent) "disagreed" with the statement that the present level of agriculture mechanization in Iran was in a desirable state represented by a mean of 2.35 with a standard deviation of .68.

Table XXVI also contains data pertinent to the sources of engine power, such as tractors and tillers, being

TABLE XXVI

PERCEPTIONS ON THE PRESENT LEVEL OF AGRICULTURE MECHANIZATION IN IRAN

Factors Surveyed	Very (1) Disagree n	%	(2) Disagree n	%	(3) Neutral n	%	(4) Agree n	%	Very (5) Agree n	%	Mean	STD. DEV.	Total N	Category
1. Present level of mechanization in Iran is in a desirable state:	7	8.33	44	52.38	30	35.71	3	3.57	0	0.00	2.35	0.68	84	Disagree
2. Sources of engine power are adequately in reach of farmers:	3	3.61	25	30.12	36	43.37	15	18.07	4	4.82	2.90	0.90	83	Neutral
3. Various farm equipment are adequately in reach of farmers:	6	8.22	32	43.84	34	46.58	1	1.37	0	0.00	2.41	0.66	73	Disagree
4. Average unit of power(HP/hec) is adequate in meeting farmers' needs:	2	2.47	22	27.16	33	40.74	18	22.22	6	7.41	3.05	0.94	81	Neutral
5. Average unit of power(HP/hec) is relatively equally distributed between farming regions:	26	30.95	44	52.38	13	15.48	1	1.19	0	0.00	1.87	0.70	84	Disagree
6. Increase in the average unit of power(HP/hec) is necessary:	4	5.00	14	17.50	20	25.00	30	37.50	12	15.00	3.40	1.09	80	Neutral

adequately in reach of farmers in Iran. The mean was 2.90 with a standard deviation of 0.90, indicating a "neutral" response from the respondents. Apparently, there are enough tractors and/or tillers, however, if other farming operations are to be mechanized or additional land to be cultivated, then more units will be needed by the farmers.

A mean of 2.41 with a standard deviation of 0.66 indicated that the respondents were "disagree" with the statement that agriculture equipment are adequately in reach of farmers in Iran given their variety and number.

The next three statements, as shown in Table XXVI, are in regard to the perceived adequacy, distribution, and required increase in average unit of power (Hp/hec) for the mechanized farming system in Iran. The data reveals that the respondents remained "neutral" on the statements in regard to the adequacy of each unit of power (Hp/hec) for mechanized farming system in Iran and perceived required increase as represented by a mean of 3.05 and 3.40 with a standard deviation of 0.94 and 1.09, respectively. However, they were "disagree" with the statement that the unit of power (Hp/hec) was relatively equally distributed among all farming regions in Iran as represented by a mean response of 1.87 and a standard deviation of 0.70. This may be an indication that not all the farmers in different farming regions of the country have equal access to required engine powered units in order to perform their farming operations.

Data Concerning the Present Problems of Agriculture Mechanization in Iran

Table XXVII presents the following information on the problems of agriculture mechanization in Iran. The respondents were "disagree" with the statement that farmers from different regions in Iran have adequate and timely access to spare parts for their equipment as represented by a mean response of 1.68 with a standard deviation of 0.68. It must be noted that a well developed distribution system for spare parts can help farmers to avoid lengthy delays in equipment repair, especially during the working season.

Table XXVII also reports data on the statement in regard to the economical and financial ability of farmers as an important factor in the development of agriculture mechanization programs in Iran. The respondents were "agree" with the statement as represented by a mean of 3.70 and a standard deviation of 1.00. The implications from this statement could be tied to next statement which addresses the farmers' accessibility to loan services for purchasing equipment. The data reveals that the respondents remained "neutral" about the accessibility to loan services as being one of the biggest problems facing farmers in Iran. Twenty seven point seventy one percent of the respondents were "disagree" with the statement. The mean was 3.00 with a standard deviation of 0.93. This could be interpreted as although farmers' financial and economical ability was perceived as an important factor, nonetheless, their access

TABLE XXVII

PERCEPTIONS ON THE PRESENT PROBLEMS OF AGRICULTURE MECHANIZATION IN IRAN

Factors Surveyed	Very Disagree (1) n	%	(2) Disagree n	%	(3) Neutral n	%	(4) Agree n	%	Very Agree (5) n	%	Mean	STD. DEV.	Total N	Category
1. Farmers from different regions have adequate and timely access to spare parts for equipment:	34	40.48	45	53.57	4	4.76	0	0.00	1	1.19	1.68	0.68	84	Disagree
2. Farmers' economical/financial ability is an important factor for mechanization programs:	0	0.00	12	14.29	22	26.19	29	34.52	21	25.00	3.70	1.00	84	Agree
3. Access to loan services is one of the biggest problems facing farmers in Iran:	2	2.41	23	27.71	38	45.78	13	15.66	7	8.43	3.00	0.93	83	Neutral
4. Lack of training programs for application of equipment is one of the important problems:	2	2.38	4	4.76	15	17.86	38	45.24	25	29.76	3.95	0.94	84	Agree
5. Trend in mechanization does not match average farm size in Iran:	1	1.27	5	6.33	16	20.25	48	60.76	9	11.39	3.75	0.79	79	Agree
6. Equipment and spare parts are distributed equally & justly:	23	28.05	36	43.90	16	19.51	5	6.10	2	2.44	2.11	0.96	82	Disagree

to loan services poses no serious problems in adopting mechanized farming. Thus, farm mechanization programs could be undertaken with borrowed capital from lending institutions.

The next statement under investigation was in regard to the lack and/or shortage of technical training programs to teach farmers proper application of farming equipment as being one of the important problems of agriculture mechanization in Iran. The mean was 3.95 with a standard deviation of 0.94, an indication that respondents were "agree" with the statement.

Table XXVII further provides data on the statement addressing the present trend in agriculture mechanization from a farming equipment selection stand point which does not correspond to the average farm size in Iran. The majority (60.76 percent) were "agree" with the statement as represented by the mean 3.75 with a standard deviation of 0.79.

A mean response of 2.11 with a standard deviation of 0.96 indicated that the respondents were "disagree" with the statement that farm equipment and spare parts were distributed on an equal and just basis among farmers of different regions in Iran.

Data Concerning the Role of Mechanization in Boosting Agricultural Productivity

Table XXVIII reports data on four statement in regard to the role of mechanization in boosting agricultural productivity as perceived by the respondents.

The majority (51.81 percent) were "agree", while 36.14 percent were "highly agree" with a statement in regard to the application of agriculture mechanization in Iran to reduce production costs. The mean was 4.20 with a standard deviation of 0.76.

The data reveals that respondents were "agree" with the statement in regard to the substitution of traditional farming, which is labor intensive, with mechanized farming as being beneficial to farmers in Iran from an economic stand point. The mean was 4.12 with a standard deviation of 0.82.

The respondents were also "agree" with the statement that the expansion of agriculture mechanization programs in Iran would act as a facilitating means for a quantitative and qualitative increase in cultivated area, therefore, improving agricultural productivity. The mean was a high 4.21 with a standard deviation of 0.71. A low standard deviation indicated that the responses were in little variance around the mean.

A mean response of 3.81 with a standard deviation of 0.81 indicated that the farmers' problems in terms of

TABLE XXVIII

PERCEPTIONS ON THE ROLE OF MECHANIZATION IN BOOSTING AGRICULTURAL PRODUCTIVITY

Factors Surveyed	Very (1) Disagree n	%	(2) Disagree n	%	(3) Neutral n	%	(4) Agree n	%	Very (5) Agree n	%	Mean	STD. DEV.	Total N	Category
1. Application of mechanization in Iran will reduce production cost:	1	1.20	1	1.20	8	9.64	43	51.81	30	36.14	4.20	0.76	83	Agree
2. Substitution of traditional farming with mechanized farming is beneficial to farmers:	1	1.23	2	2.47	11	13.58	39	48.15	28	34.57	4.12	0.82	81	Agree
3. Expansion of mechanization can facilitate an increase in cultivated area:	0	0.00	1	1.19	11	13.10	41	48.81	31	36.90	4.21	0.71	84	Agree
4. Farmers' problems in performing their farming operations will by solved by adopting mechanization:	1	1.19	3	3.57	22	26.19	43	51.19	15	17.86	3.81	0.81	84	Agree

performing their farming operations on time will be solved by adopting mechanization.

Data Concerning Selection of Appropriate Technology

Table XXIX provides data on the respondents' perceptions in regard to the selection of appropriate technology for mechanization in Iran. The data reveals that the respondents were "agree" with the statement that the trend in the expansion of mechanization is only economical for medium and large scale farming. The mean was 3.94 with a standard deviation of 0.86. However, the respondents believed that research in the area of mechanization for the development of agriculture equipment and machinery should be based on small and medium size farms. The mean response was 4.17 with a standard deviation of .88. Another related statement was in regard to the necessity for research and development of agriculture machinery which can be used on small farms utilizing animal power. The mean was 3.62 with a standard deviation of 1.15, indicating that respondents were "agree" with the statement. Nonetheless, the respondents remained "neutral" as to whether the programs for the expansion of agriculture mechanization should be concentrated only on small and medium size farms. The mean was 3.09 with a standard deviation of 1.08. Thirty two point ninty three percent of the respondents were "disagree" with the statement, while 26.83 percent were "disagree".

TABLE XXIX

PERCEPTIONS ON THE SELECTION OF APPROPRIATE TECHNOLOGY FOR AGRICULTURE MECHANIZATION

	Factors Surveyed	Very Disagree (1) n	%	(2) Disagree n	%	(3) Neutral n	%	(4) Agree n	%	Very Agree (5) n	%	Mean	STD DEV	Total N	Category
1	Trend in mechanization is only economical for medium/large scale farming	1	1 19	6	7 14	10	11 90	47	55 95	20	23 81	3 94	0 86	84	Agree
2	Research on development of equipment should be for small and medium size farms	1	1 22	4	4 88	8	9 76	36	43 90	33	40 24	4 17	0 88	82	Agree
3	Research on machinery for small farms utilizing animal power is necessary in Iran	6	7 69	7	8 97	15	19 23	33	42 31	17	21 79	3 62	1 15	78	Agree
4	Mechanization expansion programs should concentrate on small and medium size farms	3	3 66	27	32 93	21	25 61	22	26 83	9	10 98	3 09	1 08	82	Neutral
5	Establishment of socio-economical justice/equality between farmers groups play an important role in mechanization expansion programs	0	0 00	1	1 19	21	25 00	46	54 76	16	19 05	3 92	0 69	84	Agree
6	Improvement in farmers' life should be considered in trends towards mechanization expansion	0	0 00	0	0 00	1	1 19	49	58 33	34	40 48	4 39	0 51	84	Agree
7	Expansion in mechanization gives more time to farmers for social and cultural development/growth	0	0 00	0	0 00	13	15 48	45	53 57	26	30 95	4 15	0 66	84	Agree
8	Emphasis must be placed on local material/human resources in Iran for mechanization expansion	0	0 00	3	3 57	6	7 14	47	55 95	28	33 33	4 19	0 72	84	Agree
9	Material/human resources are avaiable in Iran to manufacture equipment for small/medium farms	1	1 22	17	20 73	25	30 49	30	36 59	9	10 98	3 35	0 97	82	Neutral
10	Unemployment of labor due to mechanization should not affect changes in production methods	2	2 47	9	11 11	15	18 52	40	49 38	15	18 52	3 70	0 97	81	Agree
11	Capacity to attract released labor due to mechanization exists in other economic sectors in Iran	10	12 05	29	34 94	28	33 73	13	15 66	3	3 61	2 64	1 00	83	Neutral
12	Unemployment due to mechanization is not socially desirable in Iran	3	3 61	27	32 53	23	27 71	27	32 53	3	3 61	3 00	0 97	83	Neutral
13	The released labor force due to mechanization can be employed in other agriculture sectors	1	1 20	3	3 61	4	4 82	58	69 88	17	20 48	4 05	0 71	83	Agree
14	Priority must be with improvement of socio-economic position of low and medium income farmers in selecting appropriate technology	2	2 38	0	0 00	9	10 71	51	60 71	22	26 19	4 08	0 76	84	Agree
15	Attention must be paid to delivery of training programs to low/medium income farmers	0	0 00	2	2 38	6	7 14	40	47 62	36	42 86	4 31	0 71	84	Agree
16	Farmers can choose the kind of appropriate technology based on their own experiences	4	4 88	22	26 83	31	37 80	19	23 17	6	7 32	3 01	0 99	82	Neutral

A mean response of 3.92 with a standard deviation of 0.69 indicated that the respondents were "agree" with the statement that as a tool for developing rural areas in Iran, the expansion of agriculture mechanization programs can play an important role in establishing socio-economical justice and equality between different farmers social groups.

The highest mean response in this part of the questionnaire was recorded for the statement in regard to whether qualitative improvement in the farmers' life from a material and spiritual stand point should be considered in the trends towards the expansion of agriculture mechanization in Iran. The mean was a high 4.39 with a low standard deviation of 0.51. Overall, the respondents were "agree", while 40.48 percent expressed to be "highly agree" with the statement. On a related subject was the statement in regard to the social and cultural development and growth of farmers. A mean response of 4.15 with a standard deviation of 0.66 indicated that the respondents were "agree" with the statement that an expansion in the agriculture mechanization programs would reduce farmers work load and, therefore, give them more time for their social and cultural development and growth. It is clear that any development program for rural areas in Iran must consider the above mentioned needs of the farmers in terms of their social and personal growth and their families progress in the society. Often, development planners fail to consider these human factors and the results of their works have been

more devastating for the developing countries in general, and the farmers in particular.

The respondents were "agree" with the statement that in formulating the programs for the expansion of agriculture mechanization, the emphasis must be placed on the local material and human resources inside Iran. The mean was a high 4.19 with a standard deviation of 0.72. However, in a related statement, the respondents were "neutral" in regard to the adequate availability of the material and human resources inside Iran for manufacturing agriculture machinery suited for small and medium size farms. The mean was 3.35 with a standard deviation of 0.97.

A mean of 3.70 with a standard deviation of 0.97 indicated that the respondents were "agree" with the statement that the unemployment of the labor force as a consequence of the substitution of traditional farming with mechanized agriculture should not overshadow the changing trends in the production methods in Iran. However, the respondents remained "neutral" in regard to the statement that at the present time, the capacity to attract the released labor force from agriculture due to mechanization, exists in other economic sectors of the country. Thirty four point ninty four percent of the respondents were "disagree" with the statement, while only 15.66 percent were "agree". The mean was 2.64 with a standard deviation of 1.00. In another related statement, the respondents remained also "neutral" as to whether the increase in

unemployment of agriculture labor force due to the expansion of agriculture mechanization is not desireable from a social stand point in Iran. The mean response was 3.00 with a standard deviation of 0.97. The distribution of the responses were the same for both sides of the "neutral" point. On the other hand, the majority (69.88 percent) were "agree" with the statement that by formulating correct planning for the expansion of agriculture mechanization, the released labor force could be employed in other sectors of agriculture industry in Iran. The mean response was 4.05 with a standard deviation of 0.71.

Table XXIX also reports data in regard to the statement that in selecting the appropriate technology for the expansion of agriculture mechanization in Iran, the priority should be with the improvement of the socio-economic position of low and medium income farmers in the country. The mean response of 4.08 with a standard deviation of 0.76 indicated that the respondents were "agree" with the statement. Also, the respondents were "agree" with the statement that special attention must be paid to the delivery of technical training programs to low and medium income farmers as part of formulating programs for the expansion of agriculture mechanization in Iran. The mean response was a high 4.31 with a standard deviation of 0.71. Forty two point eighty six percent of the respondents were "very agree", while only 2.38 percent were "disagree" with the statement.

Finally, Table XXIX provided information on the statement that farmers in Iran can choose the kind of appropriate technology for their farming operations based on their own experiences. A mean response of 3.01 with a standard deviation of 0.99 indicated that respondents were "neutral" and their opinions were evenly divided on this matter.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter is to present a summary of the findings of this study, and to present conclusions and recommendations based upon the observations made from the conduct of the study.

Summary of the Study

Purpose of the Study

The main purpose of this study was to identify and analyze the training needs of extension workers in the area of mechanized agriculture as perceived by the extension personnel who were in attendance at the Fifth National Meeting on Agriculture Extension held in Isfahan, Iran.

Objectives of the Study

The objectives of the study were:

1. To determine the degree of cooperation between agricultural colleges and agriculture extension agency in Iran as perceived by the respondents of the study.

2. To identify the best time table and best location for training extension workers in the area of mechanized

agriculture in Iran as perceived by the respondents of the study.

3. To identify the training needs of extension workers in the area of farm power and machinery and farming systems as perceived by the respondents of the study.

4. To determine the views of the respondents about issues related to mechanization, in terms of its present level and problems in Iran, its role and degree of contribution in boosting agricultural productivity, and the appropriateness of its technology.

Design and Conduct of the Study

The instrument for collecting data was completed by the end of summer of 1988, and was mailed to Iran before the January of 1989. Questionnaires were distributed among the participants in the Fifth National Meeting on the Agriculture Extension held on the first week of spring of 1989 at the Isfahan University of Technology, Isfahan, Iran.

A total of 86 questionnaires out of 110 distributed were collected while the meeting was in progress, of which 85 were usable for tabulation and data analysis.

Findings of the Study

Data on the background information revealed that the majority of the respondents (72.3 percent) were extension specialists and administrators. Nine point six percent of

the respondents were university faculties, while 16.9 percent of them had other agriculture related positions.

The majority (65.9 percent) of the respondents had a B.S. degree, while 17.6 percent of them had a M.S. degree. Ph.D. holders comprised 9.4 percent of the study population. Overall, twelve areas of specialty in agriculture were determined for the respondents, of whom 21.69 percent were in agriculture extension and education and 20.48 percent in agronomy. Other significant areas of specialty were general agriculture (12.05 percent), soil science (10.84 percent), and animal science (9.64 percent).

From 23 provinces in the country, 18 provinces had some representation in the population of the study. Almost half of the respondents (49.39 percent) were from the Central (22.89 percent), Isfahan (15.66 percent), and Khuzestan (10.84 percent) provinces.

Overall, 39.3 percent of the respondents had worked between one to five years at their present job, while 29.8 percent had worked between six to ten years. The next highest group was comprised of those who had worked between sixteen to twenty years (20.2 percent).

The respondents of the study had received their training in extension work mostly at a university (35.44 percent) or a combination of a university and the Ministry of Agriculture or provincial departments of agriculture (22.78 percent). On the other hand, 80.55 percent of

the respondents identified three major programs in which extension workers should have completed their training. These were agricultural high school diploma (34.57 percent), B.S. in general agriculture (22.22 percent), and two-year agriculture college certificate (19.75 percent).

The respondents had "much" familiarity with agriculture extension service in Iran, while they expressed "little" familiarity with the agriculture extension services in the developing and developed countries. Also, they expressed "much" familiarity with agriculture mechanization in Iran and "some" familiarity with agriculture mechanization in the developing and developed countries.

The degree of cooperation between extension service and agricultural colleges in Iran was determined to be "little" by the respondents of the study.

The respondents perceived that mechanization would help "much" in boosting agricultural productivity in Iran.

The respondents believed that extension workers needed "much" training in the area of mechanized agriculture in Iran.

The majority (55.42 percent) of the respondents believed that extension workers needed training in the area of mechanized agriculture on an annual basis, while 21.69 percent of them recommended biannual training programs.

Among various crops surveyed in the study, grain (80 percent), forage (61.18 percent), and row crops

(57.65 percent) were determined to be of greatest importance in terms of mechanization by a majority of the respondents. Root crops were the next highest category of crops perceived to be of importance in terms of mechanization by 49.41 percent of the respondents.

The results of this study reveal that the majority of the respondents believed that farmers in Iran use engine power for power-intensive operations more often than they used animal and man power. Farmers in Iran use engine power more often for primary tillage, secondary tillage, and crop handling (transportation) operations as perceived by 90.59 percent, 85.88 percent, and 69.41 percent of the respondents, respectively. On the other hand, planting, cultivation, and harvesting operations are performed by the farmers in Iran using man power as perceived by 71.76 percent, 90.59 percent, and 65.88 percent of the respondents, respectively.

Finally, 42.35 percent of the respondents believed that provincial departments of agriculture are the best place for training extension workers in the area of mechanized agriculture. Other places of significance were agriculture training centers and/or experiment stations, public and private commercial farms, and university centers.

Summary Findings on the Training Needs of Extension Workers in the Area of Mechanized Agriculture

Table XXX provides a summary comparison of means and corresponding categories pertinent to four areas of competencies for various farm machinery and equipment. Table XXX provides the respondents' perceptions as to the present training possessed and needed training by extension workers in "Operation and Safety", "Maintenance and Service", "Major repairs", and "Selection and Matching to Auxiliary Machines."

Operation and Safety

The respondents believed that extension workers had "some" training in 'operation and safety' for tractors, primary tillage and secondary tillage equipment, grain drills, hay equipment, field sprayers, and small harvesting machines, while they had "little" training for small mobile and stationary power units, row crop planters, land leveling equipment, and combines.

On the other hand, the respondents felt that extension workers needed "much" training for all classes of machinery and equipment except for land leveling equipment which was perceived as "some" training needed by extension workers.

TABLE XXX

SUMMARY COMPARISONS OF RESPONSES AS TO EXTENSION WORKERS PRESENT SKILLS AND TRAINING NEEDS IN OPERATION AND SAFETY, MAINTENANCE AND SERVICE, MAJOR REPAIRS, AND SELECTION AND MATCHING

	1 Operation/ Safety				2 Maintenance/ Service			
	Present Skills		Needed Training		Present Skills		Needed Training	
Factors Surveyed	Mean	Category	Mean	Category	Mean	Category	Mean	Category
- Tractors	1.61	Some	3.00	Much	1.41	Little	2.86	Much
- Small power units	1.44	Little	2.85	Much	1.22	Little	2.78	Much
- Primary tillage equip.	1.82	Some	2.99	Much	1.60	Some	2.91	Much
- Secondary tillage equip.	1.74	Some	3.00	Much	1.45	Little	2.93	Much
- Row crop planters	1.45	Little	3.01	Much	1.23	Little	2.87	Much
- Grain drill	1.68	Some	3.07	Much	1.33	Little	2.94	Much
- Hay equipment	1.59	Some	3.01	Much	1.32	Little	2.86	Much
- Field sprayers	2.34	Some	3.12	Much	1.95	Some	3.12	Much
- Combines	1.22	Little	2.74	Much	0.88	Little	2.62	Much
- Land leveling equip.	0.77	Little	2.44	Some	0.55	Little	2.22	Some
- Small harvest machines	1.61	Some	2.90	Much	1.32	Little	2.89	Much

	3 Major Repairs				4 Selection/ Matching			
	Present Skills		Needed Training		Present Skills		Needed Training	
Factors Surveyed	Mean	Category	Mean	Category	Mean	Category	Mean	Category
- Tractors	0.47	None	2.04	Some	1.29	Little	2.93	Much
- Small power units	0.68	Little	2.01	Some	1.18	Little	2.82	Much
- Primary tillage equip.	1.01	Little	2.16	Some	1.61	Some	2.88	Much
- Secondary tillage equip.	1.00	Little	2.22	Some	1.55	Some	2.90	Much
- Row crop planters	0.79	Little	2.23	Some	1.26	Little	2.97	Much
- Grain drill	0.92	Little	2.30	Some	1.47	Little	2.94	Much
- Hay equipment	0.89	Little	2.16	Some	1.39	Little	2.86	Much
- Field sprayers	1.39	Little	2.54	Much	1.99	Some	3.01	Much
- Combines	0.48	None	1.91	Some	1.20	Little	2.77	Much
- Land leveling equip.	0.32	None	1.61	Some	0.84	Little	2.52	Much
- Small harvest machines	0.94	Little	2.14	Some	1.40	Little	2.84	Much

Maintenance and Service

The respondents felt that extension workers had "little" training in 'maintenance and service' category for all machines but primary tillage equipment and field sprayers which were perceived as "some" training possessed by extension workers. The respondents, on the other hand, felt that extension workers needed "much" training for all classes of equipment and machinery except land leveling equipment which was perceived as "some" training needed.

Major Repairs

The extension workers were perceived to have no training in 'major repairs' for tractors, combines, and land leveling equipment, while they had "little" training for the rest of the machines and equipment. The respondents felt that extension workers needed "some" training for all classes of machines and equipment except for field sprayers which was perceived as "much" training needed.

Selection and Matching to Auxiliary Machines

The respondents believed that extension workers had "little" training in 'selection and matching' for all machines and equipment except for primary and secondary tillage equipment and field sprayers which extension workers were perceived as having "some" training. On the other hand, the respondents felt that extension workers needed

"much" training in 'selection and matching' for all classes of equipment and machinery.

Further examination of Table XXX reveals that among all classes of equipment and machinery, the field sprayers received the highest mean scores in all four categories of competencies and two subcategories of 'Present Training' and 'Needed Training,' while land leveling equipment received the lowest mean scores for all four categories of competencies and two subcategories mentioned earlier.

Also, Table XXXI provides the rank order of all classes of machinery and equipment under the 'Needed Training' subcategory for all four areas of competency. The table revealed that field sprayers and grain drills were ranked first and second (grain drills was ranked third under selection and matching), while small mobile and stationary power units, combines, and land leveling equipment were at the lower rank positions for all four areas of competency.

The average mean score for each area of competency was calculated and it was found that in terms of priority, extension workers needed more training in "operation and safety", "selection and matching", "maintenance and service", and "major repairs", respectively.

Table XXXII presents the summary comparison of means and corresponding categories for "Tillage Systems" and "Farming Operations". The respondents believed that extension workers had "little" training in 'No-till farming', while they had "some" training in 'Minimum-till

TABLE XXXI

SUMMARY COMPARISON OF NEEDED TRAINING IN ALL AREAS OF COMPETENCY FOR VARIOUS EQUIPMENT AND MACHINERY BASED ON THEIR RANK ORDER

1. OPERATION & SAFETY	Mean	Category	2. MAINTENANCE & SERVICE	Mean	Category
1. Field Sprayers	3.12	Much	1. Field Sprayers	3.12	Much
2. Grain Drills	3.07	Much	2. Grain Drills	2.94	Much
3. Hay Equipment	3.01	Much	3. Secondary Tillage Equip.	2.93	Much
4. Row Crop Planters	3.01	Much	4. Primary Tillage Equip.	2.91	Much
5. Secondary Tillage Equip.	3.00	Much	5. Small Harvest Machines	2.89	Much
6. Tractors	3.00	Much	6. Row Crop Planters	2.87	Much
7. Primary Tillage Equip.	2.99	Much	7. Tractors	2.86	Much
8. Small Harvest Machines	2.90	Much	8. Hay Equipment	2.86	Much
9. Small Power Units	2.85	Much	9. Small Power Units	2.78	Much
10. Combines	2.74	Much	10. Combines	2.62	Much
11. Land Leveling Equip.	2.44	Some	11. Land Leveling Equip.	2.22	Some

3. MAJOR REPAIRS	Mean	Category	4. SELECTION & MATCHING	Mean	Category
1. Field Sprayers	2.54	Much	1. Field Sprayers	3.01	Much
2. Grain Drills	2.30	Some	2. Row Crop Planters	2.97	Much
3. Row Crop Planters	2.23	Some	3. Grain Drills	2.94	Much
4. Secondary Tillage Equip.	2.22	Some	4. Tractors	2.93	Much
5. Primary Tillage Equip.	2.16	Some	5. Secondary Tillage Equip.	2.90	Much
6. Hay Equipment	2.16	Some	6. Primary Tillage Equip.	2.88	Much
7. Small Harvest Machines	2.14	Some	7. Hay Equipment	2.86	Much
8. Tractors	2.04	Some	8. Small Harvest Machines	2.84	Much
9. Small Power Units	2.01	Some	9. Small Power Units	2.82	Much
10. Combines	1.91	Some	10. Combines	2.77	Much
11. Land Leveling Equip.	1.61	Some	11. Land Leveling Equip.	2.52	Much

TABLE XXXII

SUMMARY COMPARISON OF RESPONSES AS TO EXTENSION WORKERS PRESENT SKILLS AND NEEDED TRAINING IN TILLAGE SYSTEMS AND FARMING OPERATIONS

Factors Surveyed	Present Skills		Needed Training	
	Mean	Category	Mean	Category
5. Tillage Systems:				
- No-Till farming	1.46	Little	2.60	Much
- Minimum-till farming	1.87	Some	2.86	Much
- Conventional farming	2.25	Some	3.12	Much
- Irrigated farming	2.36	Some	3.10	Much
- Dry-land farming	1.91	Some	2.86	Much
6. Farming Operations:				
- Primary tillage	2.21	Some	2.91	Much
- Secondary tillage	2.16	Some	2.97	Much
- Planting	2.25	Some	3.12	Much
- Cultivation	2.06	Some	3.16	Much
- Harvesting	2.06	Some	3.16	Much

farming', 'Conventional farming', 'Irrigated Farming', and 'Dry-land Farming'. On the other hand, the respondents felt that extension workers needed "much" training in all five areas of tillage systems.

The respondents believed that extension workers had "some" training in all areas of farming operations, i.e., primary and secondary tillage, planting, cultivation, and harvesting. They also felt that extension workers needed "much" training in all five areas of farming operations.

Table XXXIII presents the summary comparison of means and corresponding categories for educational resources in the area of mechanized agriculture. The respondents indicated that there were "little" amount of books, slides, video tapes and films, machinery repair, operation, and maintenance and service manuals, equipment selection handbooks, and equipment calibration manuals available to extension workers, while there was "some" extension fact sheets available. On the other hand, they felt the extension workers needed "much" educational resources of all types listed in the table. Among all the educational resources, video tapes and films were needed the most, while books were needed the least. Also, maintenance manuals were rated to be needed the most among all other equipment and machinery manuals.

TABLE XXXIII

SUMMARY COMPARISON OF RESPONSES AS TO AVAIABLE AND NEEDED EDUCATIONAL RESOURCES IN THE AREA OF MECHANIZED AGRICULTURE BY EXTENSION WORKERS

	Available Resources		Needed Resources	
Factors Surveyed	Mean	Category	Mean	Category
- Books	1.41	Little	3.00	Much
- Extension fact sheets	1.80	Some	3.35	Much
- Slides	0.76	Little	3.28	Much
- Videos and films	0.93	Little	3.37	Much
- Machinery repair manuals	0.96	Little	3.18	Much
- Machinery operation manuals	1.14	Little	3.30	Much
- Machinery maintenance manuals	1.23	Little	3.35	Much
- Equipment selection handbooks	0.74	Little	3.33	Much
- Equipment calibration manuals	0.60	Little	3.23	Much

Summary Findings on Related Issues of Agriculture Mechanization in Iran

Present Level of Mechanization in Iran

The respondents of the study expressed the degree of their agreement or disagreement in regard to six statements under this segment of the questionnaire. The average response (52.38 percent) was "disagree" with the statement that the present level of agriculture mechanization in Iran is in a desirable state.

The average response was "neutral" in regard to the statement that sources of engine power, such as tractors, were adequately in reach of farmers, while it was "disagree" with the same statement in regard to the farm machinery and equipment.

Overall, the average response was "neutral" about the statement in regard to the adequacy and perceived required increase of each unit of power (Hp/hec) for mechanized farming in Iran, while it was "disagree" with the statement that the unit of power (Hp/hec) was relatively equally distributed among all farming regions in Iran.

Present Problems of Mechanization in Iran

The average response was "disagree" with the statement that farmers from different regions in Iran had adequate and timely access to spare parts for their equipment.

The average response was "agree" with the statement that the economical and financial ability of farmers was an important factor in the development of agriculture mechanization programs in Iran. However, it was "neutral" as to the statement that access to the loan services was one of the biggest problems facing farmers in Iran.

The average response was "agree" with the statement that the lack and/or shortage of training programs to teach farmers proper application of farming equipment was one of the important problems of agriculture mechanization in Iran.

The average response was "agree" with the statement that the present trend in mechanization from a farming equipment selection stand point does not correspond to the average farm size in Iran.

The average response was "disagree" with the statement that farm equipment and spare parts were distributed on an equal and just basis among the farmers of different regions in Iran.

The Role of Mechanization in Boosting Agricultural Productivity in Iran

The average response was "agree" with the statement that the application of mechanization in Iran would reduce production costs. It also was "agree" with the statement that from an economical stand point, the substitution of traditional farming, which is labor intensive, with mechanized farming is beneficial to the farmers.

The average response was also "agree" with the statement that the expansion of mechanization programs in Iran would act as a facilitating means for a qualitative and quantitative increase in cultivated area, therefore, improving agricultural productivity.

The average response was " agree" with the statement that the farmers' problems in terms of performing their farming operations on time would be solved by adopting mechanization.

Selection of Appropriate Technology for Mechanization

Overall, the average response was "agree" with eleven statements and chose to remain "neutral" on the five remaining statements under this category of responses.

The average response was "agree" with the statement that the trend in the expansion of mechanization is only economical for medium and large scale farming in Iran. However, it was "agree" with the statements that research on the development of farm equipment and machinery should be based on small and medium size farms and that research on farm equipment which could be used on small farms utilizing animal power is necessary in Iran.

The average response was "neutral" as to whether the programs for the expansion of mechanization should be concentrated only on small and medium size farms.

Overall, the average response was "agree" with the three general statements in regard to the social and cultural aspects of mechanization expansion programs in Iran. The average response was "agree" with the statement that as a tool for developing rural areas in Iran, the expansion in mechanization programs could play an important role in establishing socio-economical justice and equality between different farmers social classifications.

The average response was "agree" with the statement that qualitative improvement in the farmers' life from a material and spiritual stand point should be considered in the trends towards the expansion of mechanization in Iran. Also, it was "agree" with the statement that an expansion in mechanization programs would reduce farmers work load and, therefore, give them more time for their social and cultural growth and development.

The average response was "agree" with the statement that in formulating the programs for the expansion of mechanization, the emphasis must be placed on the local material and human resources inside Iran. However, it was "neutral" as to the adequate availability of the material and human resources inside Iran for manufacturing machinery suited for small and medium size farms.

The average response was "agree" with two statements and "neutral" on two other statements in regard to the effects of mechanization on the rural labor force employment situation. The average response was "agree" with the

statement that the unemployment of labor force as a consequence of the substitution of traditional farming methods with mechanized farming should not overshadow the changing trends in the production methods in Iran. However, it was "neutral" as to the statement that at the present time, the capacity to attract the released labor force from agriculture due to mechanization exists in other economic sectors of the country.

The average response was "neutral" as to whether the increase in unemployment of agriculture labor force due to the expansion of mechanization was not desirable from a social stand point in Iran.

The average response was "agree" with the statement that by formulating correct planning for the expansion of mechanization, the released labor force could be employed in other sectors of agriculture industry in Iran.

The average response was "agree" with the statement that in selecting the appropriate technology for the expansion of mechanization in Iran, the priority should be placed with the improvement of the socio-economic position of low and medium income farmers in the country. Also, it was "agree" with the statement that special attention must be paid to the delivery of technical training programs to low and medium income farmers as part of formulating programs for the expansion of mechanization in Iran.

Finally, the average response was "neutral" as to the statement that farmers in Iran could choose the kind of

appropriate technology for their farming operations based on their own experiences.

Conclusions

The following conclusions are based upon the findings of this study. It must be emphasized that these conclusions can not be generalized in any way to the state of agricultural mechanization and extension workers' training needs in this area in Iran due to the sampling procedures used for the conduct of the study. The conclusions are solely based on the findings of this study which was conducted to determine the perceptions of the participants in the Fifth National Meeting on Agricultural Extension in regard to the training needs of extension workers in the area of mechanized agriculture in Iran. However, since a wide range of expertise and administrative level is represented by the population of this study, and also, extensive review of literature supports the findings presented here, this study could be used as a reference source by the extension administrators and specialists for obtaining valuable information for new research in the area of extension workers training needs assessment in mechanized agriculture, and for decision making and policy formulation for extension work in Iran.

1. As in many other developing countries, it is percieved that the proper linkages between agricultural research and extension which facilitate knowledge transfer

to rural areas do not exist in Iran. University centers usually are better equipped with human and material resources to meet the training needs of extension personnel. It is concluded that cooperative efforts, such as the National Meeting on Agricultural Extension in Iran, could be used to create better understanding of the need for establishing the missing linkages between these two important institutions in agriculture in Iran.

2. Based on the findings of this study, it is concluded that the respondents believed that agricultural high schools and two-year agricultural colleges can play an instrumental role in meeting the human resource development needs of agricultural extension service in Iran. These two institutions can provide the pre-service training, while provincial departments of agriculture can provide in-service training in the area of mechanized agriculture for extension workers on an annual basis.

3. It is concluded the respondents percieved agricultural extension workers in Iran need more training in the area of farm power and machinery and farming systems. The training programs designed to meet this need should cover the four areas of competency, i.e., operation and safety, maintenance and service, selection and matching to auxiliary equipment, and major repairs. Particular emphasis should be placed on the first three areas of competency. Also, extension workers in Iran need more training in the areas of tillage systems and farming operations.

4. It is further concluded that special attention needs to be directed towards developing training programs for field sprayers and grain drills under all four areas of competency.

5. It is concluded, based on the findings of this study, that educational materials of all kind in the area of mechanized agriculture are of great need by extension workers in Iran.

6. It is concluded the respondents percieved the state of mechanized agriculture in Iran is not in a satisfactory state at the present time. Although adequate sources of power, such as tractors, are relatively in reach of farmers, nonetheless, the distribution patterns are not the same across all farming regions in the country. As the literature has suggested, domestic production and imports of tractors increased by more than 2.5 times between 1977-85 period. This increase in the number of tractors, however, has not resulted in a significant increase in agricultural production in Iran. Farm machinery and equipment, on the other hand, are not adequately in reach of the farmers. An increase in the unit of power (HP/Hec) is not an immediate concern at this time.

7. It is concluded that a good portion of the problems of mechanization in Iran are of a behavioral nature rather than technical shortcomings. As percieved by the respondents, farmers in Iran have difficulty in having adequate and timely access to spare parts and equipment in

terms of just and equal distributional patterns. Also, lack of training programs in the area of mechanized agriculture and the economic and financial inability of farmers to adopt mechanization are two other important problems. However, farmers in Iran do not experience great difficulty in terms of access to loan services. The literature also supports this point that the government had provided low-interest loans on a wide scale for mechanization schemes for a good part of the past decade. Also, trends in mechanization programs do not correspond with the average farm size in Iran. This factor may have serious implications for the future of agriculture in Iran in terms of the long-run socio-economical effects of mechanization on the rural areas.

8. Well-devised agricultural mechanization schemes can play an effective role in improving agricultural productivity in Iran. Based on perceptions of the respondents and the literature (4, 13), better utilization and efficient application of farming equipment and machinery can reduce production costs, such as labor cost, and contribute to an expansion in the cultivated area and ultimately help farmers overcome problems associated with the shortage of seasonal labor.

9. Since agricultural mechanization as a process has various keys to its success, it is concluded here, based on the findings of this study, that social considerations, as well as economic issues of mechanization and its technical

aspects, play an important role in achieving the goals of higher agricultural productivity in Iran.

10. Based on perceptions of the respondents, a successful mechanization program should be based on the primary objectives of upgrading the social and economical status of low-access farmers, improvement of the quality of life for the farmers in terms of relieving them from the hard work on the field, and giving greater opportunities for social and cultural growth and development within the society and their surrounding communities.

11. Questions of whom receives the benefits and to what extent these benefits are distributed among various farmers groups must be considered in planning agricultural mechanization programs. The type of technology selected for the expansion of agricultural mechanization in Iran should be based on the social and economical realities of the country and the factor endowments of land and labor (4). Given the growing population rates, the inability of other sectors of the economy to attract farm laborers, and the number of small- and medium-sized farms in Iran, the primary focus of research should be, based on perceptions of the respondents, on the development of equipment suited for small- and medium-sized farms as well as the equipment which is powered by animal traction. In selecting the type of appropriate technology for mechanization, low- and medium-income farmers should receive special attention in terms of the delivery of technical training programs. However, this

does not mean that the doors of success should be closed to those who can manage larger farming operations in Iran.

12. It is concluded, based on the perceptions of the respondents, that in selecting the type of technology for mechanization, emphasis should be placed on local material and human resources. However, it is noted that these resources are in short supply in Iran and problems could arise in the future expansion of mechanization programs throughout the country.

13. Change brings with it certain risks, but risks can be minimized. A change in production methods in agriculture may result in the unemployment of rural labor force. However, with adequate advance planning, the released labor force can be used in other sectors of the economy or within the agriculture sector itself (4). Also, a gradual change in the patterns of the use of new small- and medium-sized equipment and the improvement of older models of machinery, as suggested by FAO (13), can be a key to successful implementation of mechanization programs in Iran. Future growth within the agriculture sector can provide employment opportunity for displaced labors resulting from mechanization, such as in agri-businesses, etc.

14. It is concluded that four types of crops- grain crops; forage crops; row crops; root crops- play an important role in the economy of rural areas in Iran. Hence mechanization of these crops are perceived to be highly important.

15. Finally, it is concluded that farmers in Iran use new sources of power (engine) for their power-intensive operations. The implications for the extension service in Iran are to meet the educational needs of farmers in this area and to become aware of changes in the patterns of farm machinery and equipment use as they happen.

Recommendations

The following recommendations are made by the researcher based on the findings and conclusions of this study:

1. It has been established for a long time that research and extension are the mutual partners in the agricultural advancement of any country. Through cooperative efforts, researchers discover the problems facing farmers, while the extension service delivers researchers' findings to the farmers in a manner that the farmers can understand. Colleges of Agriculture in Iran do not have official ties to the extension service, yet these institutions can play a positive role in agricultural research project development, given the opportunity. Therefore, it is strongly recommended that a serious effort be undertaken by the Ministry of Agriculture and the Ministry of Higher Education in order to explore possibilities for establishing a cooperative linkage between the extension service and agricultural colleges in Iran. This effort would benefit all parties involved in the

knowledge transfer process, particularly the farmers who need to have training in modern methods of production in their farming practices.

2. It is recommended that agricultural high schools and two-year agricultural colleges should develop appropriate curriculum in mechanized agriculture for students who will join the extension service, and the Ministry of Agriculture through its provincial departments of agriculture provide opportunities for extension workers to receive in-service training in the area of farm power and machinery and farming systems on an annual basis. In terms of priority and importance of areas of competency, training needs of extension workers should be met on the following basis:

1. Operation and safety,
2. Maintenance and service,
3. Selection and matching to auxiliary equipment,
4. Major repairs.

Since it has been determined that extension workers need training in all areas of competency for field sprayers and grain drills, special attention must be paid to meet their needs in this regard.

3. A similar study needs to be conducted in order to determine the perceptions of the extension workers as to their training needs in the area of farming power and machinery and farming systems. This study should apply proper sampling methods so that generalizations can be made to the entire country based on the findings of the study.

Also, similar studies should be conducted for other four areas within mechanized agriculture- rural electrification, farm buildings and construction, material handling, and soil and water. In order to generate a reliable data base, it is suggested that a series of studies to be undertaken on country, regional, and provincial levels in order to find similarities or discrepancies in the patterns of mechanization and extension workers training needs relevant to those patterns.

4. The extension service in Iran should facilitate adequate means for developing and providing all kinds of educational materials in the area of mechanized agriculture, particularly video tapes and films, extension fact sheets, and various equipment and machinery manuals.

5. The extension service in Iran should develop educational programs to help small farmers organize cooperative entities or enterprises for use of their joint resources in adopting farm mechanization schemes. This would help low-income farmers to expand their operations, reduce their production costs, while they improve their economic status in the long run.

6. It is recommended that the Ministry of Agriculture as a governing body initiate an effort for establishing a research center, if it already does not exist, for the study of issues related to mechanization with the following purposes in mind:

A. To undertake the broad responsibility for the study and assessment of the trends and suitable directions in the agricultural mechanization process in Iran, and to plan and implement proper and necessary measures for developing and expanding programs accordingly.

B. To recruit qualified individuals such as agricultural economists, general economists, rural sociologists, anthropologists, rural development specialists, as well as agricultural engineers as part of its professional staff for achieving the above mentioned purpose.

C. To establish cooperative efforts between the center and all universities in Iran in order to secure the expertise of university faculties for conducting research in regard to socio-economic and technical aspects of agricultural mechanization. It is of great importance that agricultural colleges make necessary provisions for the development and training of necessary professional human resources in the field of agricultural engineering in order to upgrade the capability for local design and production of farm equipment for small- and medium-sized farms in Iran.

D. To study possibilities for devising mechanization programs for those crops which are considered to play a greater role in terms of helping farmers economically and financially; These are mainly grain crops, forage crops, row crops, and root crops.

E. To establish cooperative and mutual research activities with other neighboring countries and developing

and developed countries which have similar problems to those of Iran and experiences in the area of agricultural mechanization.

F. To act as a liaison between the government and the private sector in terms of providing directions and guidance, and facilitating the private sector's involvement in undertaking financial investments in suitable technology development and inventions for mechanization in Iran.

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APPENDIX

THE INSTRUMENT

PART ONE: Background Information

Please check the most appropriate blank:

1. What is your present job title?
   ---- Extension worker
   ---- Extension administrator and/or specialist
   ---- University faculty
   ---- Other(specify)

2. What is the last degree you earned?
   ---- High School diploma
   ---- Two year college certificate
   ---- B.S.
   ---- M.S.
   ---- Ph.D.
   ---- Other(specify)

3. Major area of study: _____

4. Name of the city where you are presently working at?
   City _____ Province _____

5. How many years have you been working at your present job?
   1-5 ___ , 6-10 ___ , 11-15 ___ , 16-20 ___ , over 20 ___

6. At which one of the following did you receive your training in extension work?
   ---- Agriculture department at provincial level
   ---- Ministry of Agriculture
   ---- At a university
   ---- Other(specify)

7. In your opinion extension workers should have completed their training with a:
   High school diploma with pre-service training ____ ,
   Agricultural high school diploma___ , B.S.(general agriculture)___, B.S.(specialized agriculture) ___ ,
   M.S. in agriculture ___ , Other (specify) _____

	None	Little	Some	Much	Very much
8. How familiar are you with the work of the agriculture extension service in :					
A. Iran	____	_____	____	____	_____
B. Developing countries	____	_____	____	____	_____
C. Developed countries	____	_____	____	____	_____

	None	Little	Some	Much	Very much
9. How familiar are you with the level of mechanized agriculture in:					
A. Iran	____	_____	____	____	_____
B. Developing countries	____	_____	____	____	_____
C. Developed countries	____	_____	____	____	_____
10. What degree of cooperation, in your opinion, exists between extension services and agricultural colleges at present time?	____	_____	____	____	_____
11. To what extent, in your opinion, mechanized agriculture would help in boosting agricultural productivity in Iran?	____	_____	____	____	_____
12. To what extent, in your opinion, extension workers training in the area of mechanized agriculture is needed in Iran?	____	_____	____	____	_____

13. What time table do you think would be required for extension workers to receive training in the area of mechanized agriculture?

___ Every six months
___ Every year
___ Every two years
___ Other (specify)

14. In your opinion, from an economical stand point, mechanization of which one of the following crops is more important in Iran?

___ Grain crops (wheat, barley, etc.)
___ Tree crops (pistachio, almond, etc.)
___ Row crops (cotton, soybean, etc.)
___ Root crops (sugar beet, potatoes, etc.)
___ Forage crops (alfalfa, corn, etc.)
___ Vegetable crops (lettuce, tomatoes, etc.)
___ Other (specify)

15. In your opinion, which one of the sources of farm power is used more often by the farmers considering the following farming operations practiced in Iran?

	(1) Man power	(2) Animal power	(3) Engine power (tractor,etc.)
- Primary tillage	____	_____	_____
- Secondary tillage	____	_____	_____
- Planting	____	_____	_____
- Cultivation	____	_____	_____
- Harvesting	____	_____	_____
- Crop handling	____	_____	_____

16. In your opinion, which one of the following institutions is the best place for training extension workers in the area of mechanized agriculture?
___ Ministry of Agriculture (in Tehran)
___ Agriculture department at provincial level
___ University centers at provincial level
___ Other (specify)

PART TWO:

This part of the questionnaire is taking into account your view points in regard to four issues related to *Agriculture Mechanization (AM)* in Iran. These are: present level and problems of *AM* in Iran, and the role of *AM* in boosting agricultural productivity, and finally the selection of appropriate technology for *AM* in Iran. Please indicate your opinion for each statement by checking the most appropriate blank.

VD= Very Disagree, D= Disagree, N= Neutral,
A= Agree, VA= Very Agree

"Present Level of Agriculture Mechanization in Iran"

	VD	D	N	A	VA
1. Present level of agriculture mechanization in Iran is in a desirable state:	---	---	---	---	---
2. The sources of engine power, such as tractors and tillers, are adequately in reach of farmers in Iran:	---	---	---	---	---
3. Considering variety and number, agriculture equipment for performing different farming operations are adequately in reach of farmers in Iran:	---	---	---	---	---

	VD	D	N	A	VA
4. The average unit of power (HP/hec) provided through the use of engine powered machines is adequate in meeting the farming needs of farmers in Iran:	---	---	---	---	---
5. Presently, the average unit of power (HP/hec) is relatively equally distributed between the farming regions of Iran:	---	---	---	---	---
6. An increase in the average unit of power (HP/hec) on the farms in Iran is a basic necessity:	---	---	---	---	---

"Problems of Agriculture Mechanization in Iran"

7. From a distribution stand point, farmers from different farming regions of Iran have adequate and timely access to spare parts for their agriculture equipment:	---	---	---	---	---
8. The economical and financial ability of farmers is an important factor in the development of agriculture mechanization programs in Iran:	---	---	---	---	---
9. Access to loan services for the purchase of farming equipment is one of the biggest problems facing farmers in Iran:	---	---	---	---	---
10. The lack and/or shortage of technical training programs to teach farmers proper application of farming equipment is one of the important problems of agriculture mechanization in Iran:	---	---	---	---	---
11. The present trend in agriculture mechanization from a farming equipment selection stand point does not match the average farm size in Iran:	---	---	---	---	---
12. The farming equipment and spare parts are distributed equally and justly between farmers of different regions in Iran:	---	---	---	---	---

"The Role of Mechanization in Boosting Agricultural Productivity"

13. The application of agriculture mechanization in Iran will reduce the production cost:	---	---	---	---	---

	VD	D	N	A	VA
14. From an economic stand point, the substitution of traditional farming which is labor intensive with mechanized farming is beneficial to farmers in Iran:	---	---	---	---	---
15. The expansion of agriculture mechanization program in Iran can facilitate a quantitative and qualitative increase in cultivated area, therefore, improving agricultural productivity.	---	---	---	---	---
16. Farmers' problems of performing their farming operations on time will be solved by adopting mechanization:	---	---	---	---	---

"Selection of Appropriate Technology for Mechanization"

17. The trend in the expansion of agricultural mechanization is only economical for medium and large scale farming:	---	---	---	---	---
18. Research in the area of agricultural mechanization for the development of equipment and machinery in Iran should be based on small and medium size farms:	---	---	---	---	---
19. Research and development of agricultural machinery which can be used in small farms and utilize animal power is necessary in Iran:	---	---	---	---	---
20. The programs for the expansion of agricultural mechanization in Iran should be concentrated on small and medium size farms:	---	---	---	---	---
21. In the mechanization expansion programs as one of the tools for development in rural areas in Iran, the establishment of socio-economical justice and equality between different farmers classifications play an important role:	---	---	---	---	---
22. Qualitative improvement in the farmers' life from a material and spiritual stand point should be considered in the trends towards the expansion of mechanization in Iran:	---	---	---	---	---

	VD	D	N	A	VA
23. An expansion in mechanization programs in Iran will provide the farmers more time for their social and cultural development and growth:	---	---	---	---	---
24. In formulating the programs for the expansion of mechanization, the emphasis should be placed on the local material and human resources inside Iran:	---	---	---	---	---
25. To manufacture machinery for small and medium size farms, the material and human resources are adequately available inside Iran:	---	---	---	---	---
26. The unemployment of farm laborers as a consequence of the substitution of mechanization with traditional farming should not overshadow the changing trends in the production methods in Iran:	---	---	---	---	---
27. Presently, the capacity to attract the released labor force from agriculture due to mechanization exists in other economic sectors in Iran:	---	---	---	---	---
28. The expansion in mechanization and the consequences of the increase in unemployment of farm laborers is not desirable in Iran from a social stand point:	---	---	---	---	---
29. By formulating correct planning for the expansion in mechanization, the released labor force could be employed in other sectors of agriculture industry in Iran:	---	---	---	---	---
30. In selecting the appropriate technology for the expansion of mechanization in Iran, the priority should be with the improvement of the socio-economical position of low and medium income farmers in the country:	---	---	---	---	---
31. In formulating the programs for the expansion in mechanization in Iran, special attention must be paid to the delivery of technical training programs to low and medium income farmers:	---	---	---	---	---

	VD	D	N	A	VA
32. Farmers in Iran can choose the kind of appropriate technology for their farming operations based on their own experiences:	---	---	---	---	---

PART THREE:

Instructions: This part of the questionnaire is divided to four sections of (A), (B), (C), and (D). Sections (A) and (B) contain six subsections which consider extension workers' present level of training, knowledge and skills as well as their needed training, knowledge, and skills in the area of mechanized agriculture. Sections (C) and (D) contain one subsection each which consider present level and needed educational materials by the extension workers for the enhancement of their skills in the area of mechanized agriculture. Please indicate your opinion by circling the most appropriate answer shown in numbers from 0 to 4.

A): In your opinion, to what extent do the extension workers have knowledge, training, and skills in these subject areas?

0= None, 1= Little, 2= Some, 3= Much,

4= Very Much

	1 Operation & Safety	2 Maintenance & Service	3 Major Repairs	4 Selection and Matching to Proper Auxiliary Machines
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Tractors	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Small stationary or mobile power units	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Primary tillage equip.(moldboard plow, chisel plow, rotary tillers)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Secondary tillage equip.(disk harrow, field cultivator)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Row crop planters	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Grain drill	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Hay/forage harvesting and handling equip.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Field sprayers	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Combines	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Land leveling equip.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Small harvesting machines	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

	0 1 2 3 4
5. Tillage Systems:	
- No-Till farming	0 1 2 3 4
- Minimum-till farming	0 1 2 3 4
- Conventional farming	0 1 2 3 4
- Irrigated farming	0 1 2 3 4
- Dry-land farming	0 1 2 3 4
6. Types of Farming Operation:	
- Primary tillage	0 1 2 3 4
- Secondary tillage	0 1 2 3 4
- Planting	0 1 2 3 4
- Cultivation	0 1 2 3 4
- Harvesting	0 1 2 3 4

B): In your opinion, to what extent do the extension workers need more knowledge, training, and skills in these subject areas?

0= None, 1= Little, 2= Some, 3= Much,

4= Very Much

	1 Operation & Safety	2 Maintenance & Service	3 Major Repairs	4 Selection and Matching to Proper Auxiliary Machines
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Tractors	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Small stationary or mobile power units	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Primary tillage equip.(moldboard plow, chisel plow, rotary tillers)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Secondary tillage equip.(disk harrow, field cultivator)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Row crop planters	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Grain drill	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Hay/forage harvesting and handling equip.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Field sprayers	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Combines	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Land leveling equip.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
- Small harvesting machines	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

	0 1 2 3 4
5. Tillage Systems:	
- No-Till farming	0 1 2 3 4
- Minimum-till farming	0 1 2 3 4
- Conventional farming	0 1 2 3 4
- Irrigated farming	0 1 2 3 4
- Dry-land farming	0 1 2 3 4
6. Types of Farming Operation:	
- Primary tillage	0 1 2 3 4
- Secondary tillage	0 1 2 3 4
- Planting	0 1 2 3 4
- Cultivation	0 1 2 3 4
- Harvesting	0 1 2 3 4

C): In your opinion, to what extent following educational resources in the area of mechanized agriculture are available to extension workers?

0= None, 1= Little, 2= Some, 3= Much,

4= Very Much

1- Educational Resources:	0	1	2	3	4
- Books	0	1	2	3	4
- Extension fact sheets	0	1	2	3	4
- Slides	0	1	2	3	4
- Videos and films	0	1	2	3	4
- Machinery repair manuals	0	1	2	3	4
- Machinery operation manuals	0	1	2	3	4
- Machinery maintenance & service manuals	0	1	2	3	4
- Equipment selection guidelines and handbooks	0	1	2	3	4
- Equipment calibration manuals	0	1	2	3	4

D): In your opinion, to what extent following educational resources in the area of mechanized agriculture are needed by extension workers?

0= None, 1= Little, 2= Some, 3= Much,

4= Very Much

1- Educational Resources:	0	1	2	3	4
- Books	0	1	2	3	4
- Extension fact sheets	0	1	2	3	4
- Slides	0	1	2	3	4
- Videos and films	0	1	2	3	4
- Machinery repair manuals	0	1	2	3	4
- Machinery operation manuals	0	1	2	3	4
- Machinery maintenance & service manuals	0	1	2	3	4
- Equipment selection guidelines and handbooks	0	1	2	3	4
- Equipment calibration manuals	0	1	2	3	4

VITA

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Candidate for the Degree of

Doctor of Education

Thesis: AN ASSESSMENT OF AGRICULTURE EXTENSION WORKERS' TRAINING NEEDS IN THE AREA OF MECHANIZED AGRICULTURE IN IRAN AS PERCEIVED BY THE PARTICIPANTS IN THE FIFTH NATIONAL MEETING ON AGRICULTURE EXTENSION HELD IN ISFAHAN, IRAN

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