THE IMPACT OF TECHNOLOGY APPLICATION ON EMPLOYMENT

IN THE RAINFED FARMING AREAS OF IRBID GOVERNORATE IN JORDAN

BY

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A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS

FACULTY OF GRADUATE STUDIES, UNIVERSITY OF JORDAN

UNIVERSITY OF JORDAN

FACULTY OF AGRICULTURE

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

OCTOBER 1989

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Thesis presented: October 1989.

تقرير لجنه مناقشه الرساله المقدمه من السيد عماد كامل محمد الكرابليه للحصول على درجه الماجستير في الاقتصاد الزراعي / كليه الزراعه/الجامعه الاردنيه وعنوان رسالته :-

The Impact of Technology Application on Employment in the Rainfed Farming Areas of Irbid Governorate in Jordan .

اجتمعت اللجنه المكونه بقرار من مجلس كليه الدراسات العليا رقم (١/٨/٩) تاريخ ٢٧ / صفر، ١٤١٠ هـ . الموافق ١٩٨٩/٩/٢٧ من السادة :-

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الاستاذ الدكتور محمود الدويري	عضوا
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وذلك في الساعه الحاديه عشر من صباح يوم الثلاثاء تاريخ ١٠/ربيع الاول ١٤١٠ هـ . الموافق ١٩٨٩/١٠/١٠ . لمناقشه الرساله المقدمه من السيد عماد كامل محمد الكرابليه طالب الدراسات العليا بقسم الاقتصاد الزراعي والارشاد للحصول على درجه الماجستير وعنوان الرساله :-

The Impact of Technology Application on Employment in the Rainfed Farming Areas of Irbid Governorate in Jordan .

وقد قام أعضاء اللجنه بمناقشه الطالب في محتوى الرساله بالاضافه الى مختلف العلوم المتعلقه بموضوعها ، وبعد انتهاء المناقشه قررت اللجنه بالاجماع بنجاح الطالب وتوصي بمنحه درجه الماجستير في الاقتصاد الزراعي .

أعضاء اللجنه

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الدكتور محمد رفيق حمدان

إهداء

إلى الأرض الأم التي أنجبتنا ...
إلى أرواح شهدائنا الأبرار الذين رووا
بدمائهم ثرى الوطن غربي النهر في
انتفاضتهم المباركة
إلى والدي ووالدتي وإخوتي جميعاً .
إلى أستاذي الفاضل محمود سالم
إلى أساتذتي الكرام الذين لم يألوا جهداً
معي في رسالتي هذه .

أهدي لهم جميعاً جهدي المتواضع
وكل الشكر والتقدير وعظيم الامتنان

حماد كامل كرايلية

ACKNOWLEDGMENT

I wish to express my deep gratitude and thanks to Dr. Mahmoud Salem, my major advisor, for his guidance, support, and helpful comments in conducting the study and in preparing the thesis. Gratitude is also extended to committee members, Dr. Sueilman Arabbiat, Dr. Mahmoud Duwayri, Dr. Ali Yousef Khalifa and Dr. Mohammad Hamdan for their support and the suggestions they made when reviewing the manuscript.

I am very thankful for the financial support during my program provided by the International Center for Agricultural Research in Dry Areas (ICARDA), Aleppo, Syria.

I am also indebted to Dr. Dennis Tully for his continuous help and support and very useful suggestions he made when discussing the thesis-proposal. Thanks and appreciation are extended to Dr. Thomas Nordblom and Mrs. Andree Rassam at ICARDA, Aleppo in Syria for their helpful suggestions they made in the thesis-proposal discussion. The thanks also extended to Dr. Mohammad, S. Habbab, Dr. Akram Begaeen and Dr. Mahmoud Shafei.

Special gratitudes and thanks are extended to all my friends, especially Nidal Nimer for computer services and their help, Ahmad Abdel-Azez, Qutaiba, Fuad, Adnan, Ziad Shbol, Amjad Obeid Allah, Abdel Majeed, Hussein, K., Ra'ed Iziat, and N. Fanik for their help, support and

encouragement. A very special thank is extended to Dr. Saleh Hamarneh for his support.

I am especially grateful to my parents for their love, support and encouragement. Grateful appreciation is extended to my brother Jamal and sisters for their love, support and encouragement. Without my family's help, this thesis would not have been a reality.

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ABSTRACT

The objective of the study is to examine the impact of technology application on employment in the rainfed areas of Irbid. Farmers in Irbid Governorate were interviewed concerning their contribution of household labor force in farming operations compared to hired and migrant labor force. The socio-economic factors which affect labor input and explain the adoption of technology in the rainfed farming in Irbid have been examined and analyzed. Also, the calendar for agricultural labor and operations has been developed . Moreover, the cost of production and requirements per one dunum of field crops for different labor groups have been estimated.

The data used to explain the impact of technology aplication on employment in the rainfed farming in Irbid were obtained by personal interviews conducted in the 1988/1989 season. A random sample of 120 farmers was selected from seven villages located in three different agro-climatological zones. Primary data and secondary data were used in the analysis. Cereal and legumes in three climatic zones were considered in the analysis. On the average, farmers in the survey were about 57 years of age, have a large household (11.5 person), have been farming most of their lives and most of them can read and write (60%). Only

about 20% of the farmers finished secondary school. They farm an average size of nearly 279 dunums. The average planted areas of wheat and lentil in the sample were 126 and 32 dunums respectively. 87% and 55% of farmers in the sample planted wheat and lentil respectively. About 60% of farmers were full-time farmers. The income generated from the agricultural activities was about 47% of the total household income. More than 80% of the wheat farmers planted wheat after the rainfall. This means that 80% of the wheat farmers are risk-avert.

Multiple regression model was developed and used in the analysis to determine factors affecting household labor, hired labor, male and female labor input, and the adoption of technology. The results of the study indicated that cropped area, household size, number of students, site of the village and age and heath of farmers, experience in farming were statistically significant factors affecting labor input and technology adoption.

It can be concluded that the agricultural production in the rainfed areas in Irbid Governorate is dependent on hired labor. The contribution of men, women and children is summarized in the following points:

1. Household labor input is less than 40% of total hours input in agricultural production.
2. Female contribution is less than 20% of total hours input in agricultural production.

3. The average input of women from household was about 35% of total hours input by household labor and less than 15% of total hours input on farm.
4. Local hired laborers are mainly the ones using machines and their contribution is about 23.6% of total hours.
5. The local hired labor input is more in cereals than in legumes, but migrant hired labor is more in legumes than in cereals.
6. The migrant hired labor force is mainly engaged in operations that need unskilled labor and physical work.

Also the results indicated that 33% and 45% of hours for seeding was done in November and December respectively, whereas about 87% of hours for mechanical harvesting was done in June and about 71% of hours was spent in July for post-harvesting operation.

The requirements of one dunum of different crops for labor was calculated according to the methods of production in the farm. One dunum of wheat requires 2.16 men equivalent hours by using modern methods, whereas 11.68 men equivalent hours by using traditional method. Also the cost and return for one dunum for different crops has been calculated according to method of production by using enterprise budgets. The result indicates as increase the level of technology by using new method leads to reduce the cost of production for cereals and increase return for legumes.

الملخص

يهدف هذا البحث لدراسة اثر تطبيق التكنولوجيا على العمالة الزراعية في المناطق البعلية في محافظة اربد، هذا وقد تم استجواب المزارعين للحصول على الاجابات بخصوص توزيع العمالة العائلية على العمليات الزراعية المختلفة وكذلك العمالة المحلية والوافدة المستاجرة. هذا وقد تم دراسة المحددات الاجتماعية - الاقتصادية التي تؤثر على مدخلات العمل والتي تفسر تبني التكنولوجيا، وكذلك دراسة توزيع العمالة الشهرية على مدار العام للعمليات الزراعية المختلفة وتقدير تكاليف الانتاج و احتياجات الدونم الواحد من العمالة للمحاصيل المختلفة.

تم الحصول على المعلومات اللازمة لهذه الدراسة بواسطة المقابلة الشخصية مع المزارعين في عام ١٩٨٨\١٩٨٩ ، وكانت مفردات العينة ١٢٠ مزارعا تم اختيارهم عشوائيا من سبع قرى تمثل معدلات سقوط الامطار المختلفة.

دلت نتائج الدراسة على ان معدل اعمار المزارعين كان ٥٧ عاما ومعدل حجم الاسرة ٥ر١١ شخصا ويمارسون العمل الزراعي طيلة حياتهم. هذا وقد دلت النتائج على ان معظم المزارعين يجيد القراءة والكتابة (٦٠%) و ٢٠% قد انهى المرحلة الدراسية الثانوية وان متوسط حجم المزرعة ٢٧٩ دونما ، وقد كانت متوسط

المساحة المزروعة للقمح ١٢٦ دونما و ٣٢ دونما للعدس ، وان ٨٧٪ من مزارعي العينة يزرعون القمح وحوالي ٥٥٪ يزرعون العدس ، وان ٦٠٪ من المزارعين هم من المتفرغين للعمل الزراعي.

اما بالنسبة للدخل المتولد من الدخل الزراعي فقد كان حوالي ٤٧٪ من الدخل العائلي وان اكثر من ٨٠٪ من المزارعين يزرعون القمح بعد هطول الامطار للمرة الاولى .

تم استخدام نموذج الانحدار المرحلي لبيان اهم العوامل التي تؤثر على مدى مساهمة الذكور والاناث في العمل الزراعي وكذلك على تبني التكنولوجيا. دلت نتائج الدراسة على ان المساحة المزروعة وحجم العائلة والطلاب في الاسرة وموقع القرية والعمر والوضع الصحي للمزارع ذو تاثير معنوي على ساعات العمل (مدخلات العمل) وعلى تبني التكنولوجيا.

ويمكن الاستنتاج ان الانتاج الزراعي في المناطق المطرية في محافظة اربد يعتمد اعتمادا كبيرا على العمل المستاجر ، اما مساهمة الرجل والمراة والاطفال في العمل الزراعي فهي تتلخص في النقاط التالية:

١) ساعات العمل العائلي تقل عن ٤٠٪ من اجمالي ساعات العمل في الانتاج الزراعي .

٢) مساهمة الاناث تقل عن ٢٠٪ من اجمالي ساعات العمل في الانتاج الزراعي .

٣) متوسط ساعات العمل للمراة في العائلة حوالي ٣٥٪ من ساعات العمل التي تقدمها العائلة واقل من ١٥٪ من اجمالي ساعات العمل في المزرعة .

٤) العمالة المستاجرة المحلية هي التي تستخدم الالات وبلغت مساهمتها حوالي ٢٣ر٦% من اجمالي ساعات العمل .

٥) تستخدم العمالة المستاجرة المحلية اكثر في الحبوب منها في البقوليات بينما تستخدم العمالة المستاجرة الوافدة اكثر في البقوليات منها في الحبوب .

٦) غالبا ما تستخدم العمالة المستاجرة الوافدة في العمليات التي لا تحتاج الى مهارة في العمل وتكون القوة البدنية مطلوبة .

وقد بينت نتائج الدراسة ان ٣٣% و ٤٥% من ساعات العمل للقيام بعملية البذار تتم في شهري تشرين الثاني وكانون اول على التوالي، وحوالي ٨٧% من ساعات العمل للحصاد الميكانيكي تتم في شهر حزيران ، بينما تبين ان ٧١% من ساعات العمل تتم في شهر اب وذلك للعمليات ما بعد الحصاد .

ولقد تم تقدير احتياجات الدونم الواحد من العمالة للمحاصيل المختلفة بناء على اسلوب الانتاج المتبع في المزرعة ، وتبين ان الدونم الواحد من القمح يحتاج الى ٢ر١٦ ساعة عمل / رجل باتباع الاسلوب الحديث في الانتاج ، بينما احتاج الدونم الواحد من القمح الى ١١ر٦٨ ساعة عمل / رجل باتباع الاسلوب التقليدي .

وكذلك تم حساب التكاليف والايرادات للدونم الواحد للمحاصيل المختلفة بناء على اسلوب الانتاج المتبع باستخدام موازنة النشاطات ، وقد بينت الدراسة انه كلما ازدادت درجة تبني التكنولوجيا باستخدام اساليب انتاج جديدة فانها تؤدي الى خفض التكاليف في محاصيل الحبوب بينما تؤدي الى زيادة العائدات في البقوليات .

CHAPTER ONE

1.1 INTRODUCTION

The doubling of world food output over the past generation is due to largely advances in agricultural technology. The agricultural technology is based on a combination of new production input: seed varieties with high yield potential, fertilizer, irrigation, mechanization, and in some cases chemical pesticide.

Unlike other productive sectors of the economy, agricultural is organized into a huge number of small families production units. Policymakers concerned with raising farm production should be appreciate the complexity of decision making this implies. For any kind of change in production to take place on a wide scale, hundred of decisionmaker have to be convinced to adopt whatever innovations will make such production changes possible. In most cases the decisions emerge from families rather than from single manager, so that many competing and sometimes conflicting factors complicate the decision process.

Furthermore, technological change is often two edged: often for the better, but those improvements are often achieved at cost. The economist's viewpoint is of course concerned about the impact of technological change on the social welfare, but particularly the concept of the social welfare is too broad. So usually the discussions of the impact of technological advance is largely centered on the

output, employment, growth rate, and income distribution. This is justified on the ground that those factors imping on social welfare.

In present discussions the main issue which has been at the center of the debate is the impact of the new technology application on employment and division of labor groups. However, the impact will be at the end of a long chain of economic decision-making involving the generation and implementation of the new technology.

The agricultural sector occupies an important place in the Jordan economy; 7.3% of GDP came from agriculture in 1987. About 7.41% of the labor force is presently engaged in agriculture and generates income for 20% of population (DOS,1987)

Since the early 1960's there has been a growing emphasis on the rapid development and diffusion of agricultural technology in the developing countries. The rapid development and diffusion of new varieties of wheat, rice and other cereal grains, referred to as "The Green Revolution" in grain and legumes production has been in progress in some developing countries in the mid-1960's. Increased demand for food and agricultural products is due to acceleration in population growth rates in low-income developing nations, and strong increases in demand for agricultural products in developed nations due to continued growth in per capita income .

The increased demand for food and agricultural products,

recent world food scarcities and high food prices emphasize the need to increase productivity in the developing countries.

There is a great potential for increasing wheat and legumes production in the rainfed areas in Jordan through technology adoption. Low productivity in the rainfed sector is due to the use of land for field crops that are not suited for cultivation (rainfall, slope), irregular rainfall which causes low yields even in the high-potential areas, and high risks associated with erratic rainfall which induces farmers to minimize their risks by limiting inputs to seed and plowing. The agricultural production could be substantially increased through the adoption of appropriate technology that take into account the land use capability of the different areas, the introduction of soil and moisture techniques, and improved production techniques (seeds, fertilizer, herbicides and land preparation). The importance of the need to transform appropriate technology to suit local conditions must be stressed. Local participation and the farmers themselves are an important link in the adoption process.

Although suitable technology is needed in the rainfed areas in Jordan to increase agricultural productivity, the adoption process is not that simple and requires an adjustment in management in order to utilize the technology adoption efficiently. There is a wide variety of constraints to adoption of labor saving technology in Jordan.

A major constraint to the adoption of agricultural labor

saving technology by farmers in Jordan stems from the fact that often the technology being made available is not applicable for the specific agro-climatic conditions facing the farmers or farmers do not understand the technology. The availability of inputs (labor, capital etc.) can influence the adoption of technology. In the case of tractors, for example, the farm size or tenure or topography of the land could be a constraint to the adoption of new mechanized technology. Per-Penstrup (1985) mentioned five factors that are of great importance in determining the distribution of economic gains from technological changes in agriculture, and therefore the direct impact on poor. These are (a) nature of the technology; (b) the general structure of the agricultural sector and the local tenure system in particular; (c) the structure of the market of input, such as fertilizers and labor, and for credit; (d) the market for agricultural products; (e) and prevailing agricultural policy. The impact will differ among poor producers, landless laborers, and poor consumers.

Studies support the notion that "HYV" technology requires more special trained skilled labor. "The introduction of the new high yielding wheat and rice technology has resulted in an increase in the demand of labor" (Ruttan, 1974). Since technology requires increased labor input, the availability of household labor can influence the adoption and shortage of labor may be a constraint to technology adoption.

The adoption of new agricultural inputs or mechanical technology requires access to capital , which is often considered as an important factor in explaining variation in the rate of technology adoption, especially in the case of mechanical technology which requires a larger initial investment opposed to the "HYV" technology.

Some studies indicate the importance of access to capital for technology adoption and others indicate that the lack of institutional credit was an important determinant of variation in the adoption rates. However, empirical evidence is required regarding those relationships.

Agricultural prices, access to markets, and the supplies of high quality seed may have influenced the technology adoption in a number of developing countries. Risk and uncertainty seem to contribute to differential adoption rates among farmers. In general, low income farmers are considered to be risk averse because they are poor and lack of the capital to withstand wide variation in output and income.

Although there are many factors affecting the adoption of technology in the rainfed farming in Jordan. Technology practices that improve net returns have been, and will continue to be adopted. Those practices that do not improve net returns or required skilled labor likely will not be adopted. Jordanian farmers are well aware of the agronomic benefits of adoption of technology . However, they tend to adopt only those which are economical. The adoption process of technology is not only to own the machine, it is include to hire and using machine and application of fertilizer and

herbicide. If appropriate technology is adopted, there would be a positive impact of technology on output, employment, growth and income distribution without destroyed the social structure of rural peoples.

As it will be indicated in a subsequent section, the purpose of this study is to describe and analyze the impact of technology on employment by examining the factors affecting labor input and relative contribution of men, women and children in agricultural production. The data used involve detailed information collected by the author on the involvement of various persons in specific agricultural tasks for cereals and legumes in 1988/1989 season.

The outline of this thesis is as follows: Chapter one provides a brief general background of labor force in agriculture, the agricultural characteristics in Jordan and agricultural employment in rainfed farming, farmers and new technology and the problem statement. The objectives of the study are further elaborated at the end of this chapter. Chapter two gives a review of the literature and empirical studies showing factors affecting technology adoption, male and female labor input in agricultural production. Impact of technology on employment and the role of women in technological changes. Chapter three provides the methodology of the study including the study unit of the analysis, sample selection and collecting of data. Also the procedure and the mathematical model as well as the basic assumptions of the model have been discussed. Chapter four present the

analysis of the sample including demographic characteristics, the cropping system, income generating activities, factors affecting labor inputs on farm and technology adoption, and contribution of labor force in agricultural activities. Also, the calendar for agricultural operations, calendar of various labor groups, requirements of labor per one dunum of field crops and the impact of technology on the cost of production are presented in chapter four. Chapter five includes the discussion and recommendation of relevant issues and the findings of the study, as well as implication for further research.

1.2 FARMERS AND NEW TECHNOLOGY

Several early studies on the impact of new agricultural technology concluded that the poor farmers do not receive their fairs of the benefits from this technology, mostly larger farmers adopt new technology which increases yield because new technology needs access to capital which is not available for subsistence or semi-subsistence farmers. This implies that the small farmer is unaffected or even worse-off because the new technology resulted in (a) downward pressures on the prices of the small farmers outputs ; (b) upward pressure on the prices of input purchased ; (c) pressures by large farmers to increase their tenant's rents ; and (d) attempts by large farmers to increase their holdings by purchasing the smaller farms. This makes small farmers landless. Furthermore some agriculturists argued that the

green revolution resulted in reduced rural employment, that net result, they said, was a rapid increase in the inequality of the income and assets distribution and worsening of rural poverty in areas affected by green revolution (Per-Pinstrup, 1987)

There is a question about the validity of those conclusions, because it should be distinguished between the early adopters and subsequent adopters of new technology. As a matter of fact, the early adopters are usually large farmers but the small farmers would follow quickly once they see the success of the new technology, second the lower prices of the output will benefit the poor people as consumers. Third, the multiplier effect of new technology by redistribution of labor in economy. Fourth, there are many factors that determine the economic gains from new technology like the nature of technology (labor-saving or labor-intensive), structure of agricultural sector, land tenure system, the structure of the markets of inputs & outputs, institutional arrangements, and agricultural policy.

1.3 AGRICULTURAL CHARACTERISTICS OF JORDAN

The total area of Jordan is about 89.2 million dunums, but over 91 percent of this area is desert with less than 200mm of rainfall, only 9 percent receives more than 200mm of rainfall and can be considered as productive agricultural land. Also the water resources in Jordan are limited. Areas with high rainfall (800mm and more are non-existing and those

areas which receive more 500mm are rocky and steep mountains.

The agricultural sector is unable to satisfy the country's needs of various food and agricultural products. Agriculture contribution to the GDP has declined from about 20% in the early 1960's to about 7.3% in 1987 (DOS,1987).

Jordan depends on imports to meet its consumption requirements of a large number of agricultural commodities . Imports of agricultural commodities covered more than 50% of domestic needs for grains and meat. The average annual imports of agricultural commodities amounted to nearly J.D. 155.7 million in 1987. Exports of agricultural commodities were only, on average, J.D. 33.81 million. Thus , a deficit in trade balance of agricultural commodities exists of about J.D. 121.9 million (DOS, 1987). At the same time the agricultural sector has shown a remarkable progress, the net agricultural income (value added) increased from 81.9 million J.D. in 1982 to 109.2 million J.D. in 1987 at current prices (DOS,1987).

This low contribution of the agricultural sector does not reflect the importance of this sector. It is known that the agricultural sector generates income for other sectors (transport, marketing, retailer), as well as the national accounting measure the relative importance in the monetary term. This means the price is calculated as a farmgate price, which is relatively very low. Therefore the agricultural sector provides the society with more than what the price is reflected. But as a matter of fact the performance of the agricultural sector is still weak and more efforts are needed

to increase output potential, particularly in the rainfed region. Agricultural share in jordan's gross fixed investment is low and most of this investment has been channeled into irrigated sector. After experiencing several years of drought which had a negative impact on rainfed agriculture, Jordan turned its agricultural development effort from the Jordan valley to the rainfed sector. The food and agricultural situation demonstrates the necessity of reactivating efforts for the development of the rainfed sector. The future will show an ever greater need for developing the rainfed areas as a result of an increase in demand for cereals and legumes, but up to date most of efforts in the area of research and technology transfer, rainfed sector is a low priority for resource allocation. Specific project which is involved in actual production must be stressed, e.g., the Jordan Highlands Agricultural Development Project. This project utilizes a new method and a new approach in dealing with the issues of production in the rainfed areas. Total agricultural output in the East Bank of Jordan comes from utilizing only 6.71% of the land in this part of the kingdom.

This output is affected not only by the area utilized but also by a number of interrelated factors that necessitate the review of the general agricultural situation in Jordan.

1.4 AGRO-CLIMATOLOGICAL ZONES

The land area of Jordan is about 89.3 million dunums which can be divided into four climatic zones, (Table 1).

From this table it can be seen clearly that Jordan in general falls in low rainfall region, since over 91.4% falls in dry desert region which has no economic importance for Jordan except for sporadic grazing sometime in the year.

Table (1)
Agro -Climatological Zones in Jordan

Zone	Average rainfall	Area mn,du	percent
Arid desert	100 mm	71.7	81.1
Desert	100-200mm	9.6	10.3
Marginal	200-300mm	5.3	5.7
Semi-arid	300-400mm	1.7	1.8
Semi-humid	500 mm	1.0	1.1
Total		89.3	100.0

1 dunum = 0.1 hectare
Source: NPC.1976 Five Years Plan for Social and Economic Development,1976-1980.(National Planning Council. Amman,Jordan. p.172.

The map in Fig (1), shows agro-climatological zones in Jordan, where rainfall decreases considerably from west to east and from north to south. Under such conditions, every possible effort should be exerted to find new sources of water and to increase output potential from marginal and semi-arid zones. Of the total cultivable area of about 5 million dunums, or 5.7% of the total areas, 4.9million dunums, or 93% is rainfed, and 7% or about 360,000 dunums are completely irrigated. Total areas under each zone in each governorate are given in Table (2). From this table one can locate the areas with better potential for developing rainfed agriculture, the semi-arid and marginal zones with rainfall 200-500mm in Irbid, Amman, Karak governorate if this can be utilized properly can reduce the amount of wheat imported.

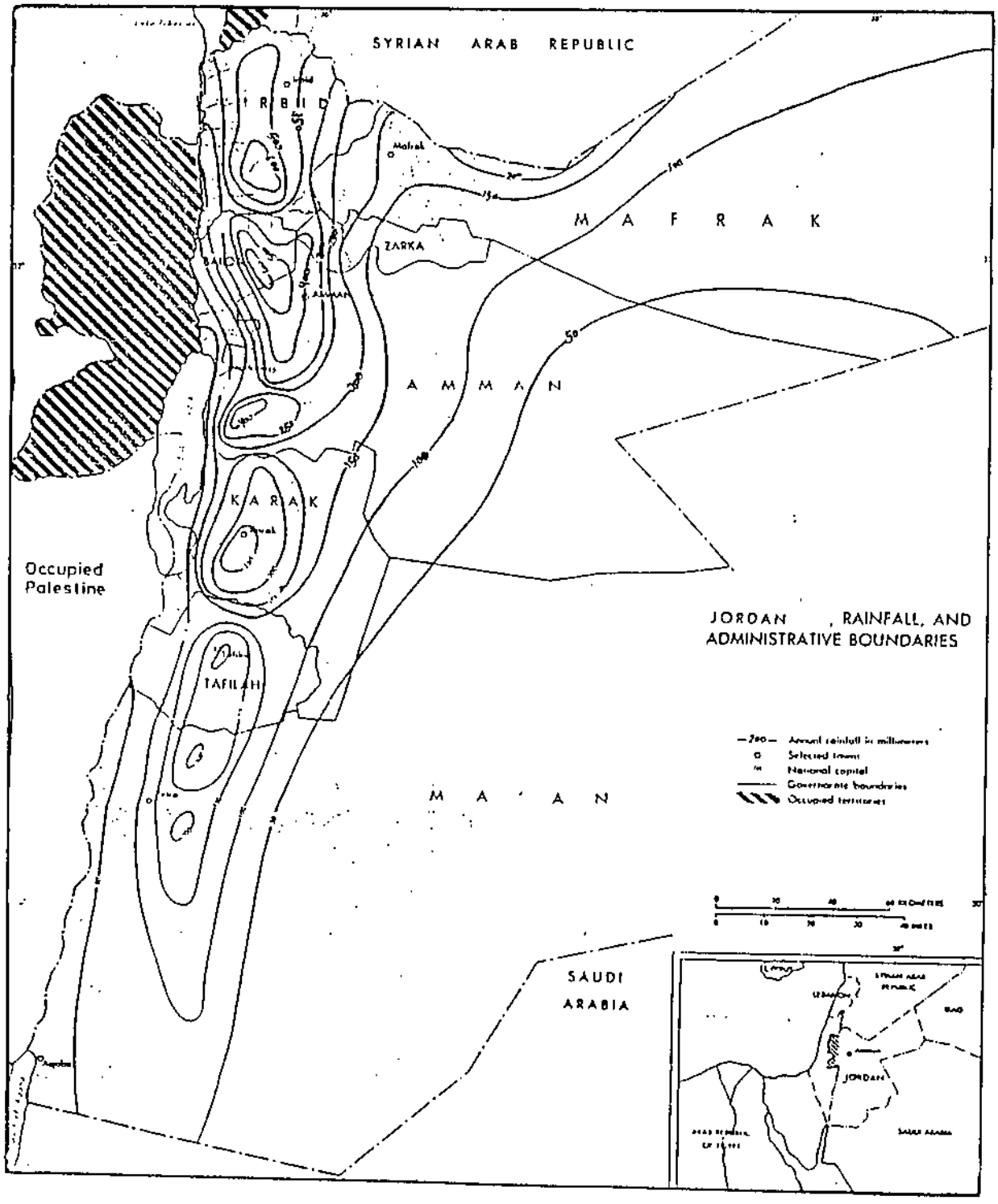


FIG (1)

Source : World Bank, 1989." Jordan Towards an Agriculture Sector Strategy", p, 121.

Table (2)

Distribution of Lands by Different Governorates and Agro-climatological zones in Jordan

Governorate	arid 200mm	marginal 200-350mm	semi arid 350-500mm	semi humid 500-800mm	Total (ha)
Irbid	2094060	137696	83908	55360	2371025
Amman	1650389	151574	26725	20492	1849180
Balqa	36928	27606	19219	23048	106801
Karak	257657	204419	6048	0	468124
Ma'an	4115866	42104	0	0	4157970
Total	8154900	563399	135900	98900	8935100

Source: FAO,1982."Regional study on Rainfed Agricultural and Agro-Climatic Inventory of Eleven Countries in the Near East Region,.p 54

1.5 AGRO-CLIMATOLOGICAL ZONES AND CROPS ROTATION

Crops rotation plays an important role in rainfed agricultural production in Jordan. Crop rotation affects the moisture which is the limiting factor in the rainfed areas. In the areas with sufficient rainfall crop rotation with respect to moisture is not limited. The crop rotation practiced vary from area to another and it can be discussed zone by zone.

I. The desert zone (100-200mm rainfall), there is no definite crop rotation, wheat and barley planted in this zone and the successful crop may be obtained every five to ten years.

II. The marginal zone (200-300). A two year crop rotation is followed wheat/barley-fallow, wheat/barley-lentil/vetch, wheat/barley-summer crop. The wheat/barley-fallow is most

dominance in this zone, the planned rotation depends mainly on the rain.

III. Semi-Arid zone (300-400). The rainfall pattern is reliable and therefore well planned crop rotation is practiced. There are three types of rotation in this area.

a- Two year rotation mainly wheat-legumes.
b- Two year rotation mainly wheat-summer crop.
c- Three year crop rotation mainly wheat-legumes-summer crop.

Type (c) of rotation predominates near the city of Irbid

IV. Semi-Humid zone (more than 400mm). The upland areas, a two year crop rotation predominates in this zone, wheat is either followed by legumes or summer crop.(Duwayri,1985)

1.6 LAND USE IN JORDAN

Like in other countries in the region, wheat is by far the most important crop. Jordan devotes most of its rainfed cultivated land for wheat production, and yet it produces only one fifth of the requirement, and most of this wheat is either consumed at the village level or stored for seeds (Hourani,1988), because most of the wheat is grown in rainfed areas, and drought is coupled with poor techniques for the poor yield.

It was estimated that 1,915,000 dunums are left in fallow in Jordan. Fallowing is a common practice in the marginal zones. Due to introduction of vegetables in rotation with wheat and legumes, fallowing in those areas is rather limited. A good agricultural land was left fallow. Table (3) shows the distribution of agricultural areas in Jordan. It is

shown that 75% of the area is arable land, generally used to plant annual crops. The share of trees amounts to 11.7% of the area, only 1% of the land was used as a permanent pasture. Furthermore, the field crop output is adversely affected by shrinking of agricultural area due to uncontrolled urban expansion at the expense of agricultural land.

Table (3)
Land Utilization in Jordan

Land Utilization	No of Holdings	Area (Dunum)	% to total area
Arable Land	41095	2768675	76.0
Permanent trees	29582	425224	11.7
Permanent pasture	170	38107	1.0
Forest land	296	9140	.3
Unutilized land	6572	278171	7.6
Other	3328	123312	3.4
Total	81043	3642629	100

Source. DOS,1983b."General Results of the agricultural Census Department of Statistics ,Amman.1983

1.7 SIZE OF HOLDINGS AND DEGREE OF FRAGMENTATION

Concerning the natural agricultural areas and land use in the East Bank, Jordan is faced with agricultural problems and constraints that affect output and it's agricultural growth.

Law of inheritance of farm land from father to sons in Jordan had led through the years to severe fragmentations of land and reduced the size of holdings severely.

Because the law of land inheritance, which can not be

altered easily, the small size of plots it may be doesn't encourage mechanization in the rainfed areas where income per area unit doesn't justify hiring mechanized labor. Also the fact that the farmer in a small village may own several plots scattered in various parts of the village is time consuming to handle with . Therefore, Jordan is faced not only with the natural constraints, but also with other serious problems that are obstacles for its agricultural development such as defect of the land tenure system. 16.41% of farms is less than 5 dunums, 64% of farms is less than 50 dunums. Only 2% is between 500 and 5000 dunums, and only 0.036% is over 5000 dunums (DOS,1983).

Land holdings in Jordan are small and fragmented: About 50% of land holdings has less than 30 dunums and 64% less than 50 dunums; 5% of holdings is divided into an average of 3.5 fragments. For a farmer who has a holding of 30 dunums, and an average of 3.5 fragments means that he owns three pieces of land in three different places. Each piece of land is about 8.6 dunums. Most of the land is owner-operated and about 16% of land holdings is rented. Urbanization of good agricultural land and speculation have further reduced Jordan's small high-potential agricultural land resource.

Table (4) shows the distribution of holdings by governorate. About 58.9% of holdings is concentrated in Irbid governorate. Land of deceased farmer is divided among sons and daughters and each one receives a narrow strip of land. If the original plot is located on a slope, the narrow strip

then can be cultivated only up and down this slope. Such tillage is seen throughout the country and it's damaging effect in the form of severe erosion is one of the most serious problems of dryland farming in Jordan.

Table (4)
Distribution of Holdings by Governorate

Governorate	No of holdings	Area(000,du)	percent
Amman	7,965	981	15.6
Irbid	29,915	1967	58.9
Balqa	546	229	10.8
Karak	589	560	11.6
Ma'an	154	167	3.0
Total	50,790	3904	100.0

Source: DOS,1983."Statistical Yearbook." No.33. Department of Statistics. Amman, Jordan

This phenomenon led to the fact that the younger people are less interested in farming as a profession, and also increased the number of part-time farmers (Arabiat,1984).

High proportion of farmers makes loss in farming, so the dependence on the rainfed agriculture only does not give them acceptable standard of living, and consequently they are forced to emigrate or to change the profession (Barham,1986).

This situation shows how difficult it is to cultivate these holdings unless they are grouped in a cooperative, or in some other way.

1.8 JORDANIAN LABOR FORCE

The agricultural sector remains relatively undeveloped in comparison with the other sectors. Increasing demand for labor by other economic sectors inside Jordan and by neighboring Arab countries resulted in migration from rural areas to the cities and further eroding the farm household and necessitating the import of non-Jordanian labor. The main characteristic of Jordanian markets is the low participation of the population in the labor force. In the best conditions this percent does not exceed 20% because of the following reasons:

1) High percentage of people engaged in educational system about 38% of population.
2) Low participation of women. Women's participation in the total labor force increased from 7.7% in 1979 to 12.5% in 1985.
3) Retired in early age, specially in public sectors
4) Continuous migration of young and qualified labor force to work abroad.
5) Increase in the volume of migrant manpower in domestic labor market. Therefore, there is dispersion in the labor market as a result of interrelated current internal and external migration.

1.9 AGRICULTURAL LABOR FORCE

The Jordanian labor force has played a major role in the economic development in Jordan. Prior to 1970s the Jordanian Government supported the outflow of jordanian manpower for

work abroad because the labor market was somewhat loose and a surplus of labor was evident. The first comprehensive development plan (1973-1975) has set as one of its major targets the reduction of the rate of unemployment, which was estimated at 8% (Hourani,1985) and creation of new job opportunities, due to dramatic rise in oil price after 1974.

In the beginning of 1984 Jordan labor market suffered from unemployment which amounted to 8% of total labor force. This unemployment was due to the increase in the output of the educational system and return of labor force from abroad. The agricultural labor market suffered from a shortage of jordanian labor force. Because of the availability of relatively cheap imported labor, many jordanian farmers have become more interested in working on share-cropper basis and land renters. It is estimated that 18,501 non-jordanian agricultural laborers were working in Jordan in 1987. A survey conducted by the Jordan Valley Authority showed that 95% were Egyptians and the rest Pakistanis. Interviewed workers reported that they worked nine months on the average before returning home . The wage ranged from 2 to 2.5 J.D. per day. Laborers usually work from 6 in the morning until noon. In addition to cash wages, employers also provided accommodations together with free meals, usually breakfast for labor hired on a day basis, and three meals for workers who are paid monthly. The interviewed workers reported that more than three quarters of the Egyptian workers (76%) were illiterate (Hourani, 1985).

1.10 EMPLOYMENT AND AGRICULTURAL TECHNOLOGY IN JORDAN

Agriculture in Jordan is heavily mechanized. Most farmers obtain their machinery through private rental services. Farm mechanization in the rainfed areas of Jordan is limited to plowing, planting and harvesting grains. This trend towards agricultural mechanization in Jordan was the result of labor shortages and rising labor costs. Many Jordanian workers have migrated from the rural areas to the oil-rich Arab states. This migration has caused shortages during periods of peak labor demand. These shortages increased the costs of labor for harvesting crops by hand, particularly lentils (Duwayri,1985).

Jordan's emigrant workers in the Arab states are about 38% of its total national work force. In 1968, about 40% of labor force was engaged in agriculture; this percentage decreased to 7.81% in 1985, (Kasawnih,1986).

There is some disagreement on the effects of mechanized production techniques on employment. Some authors state that the agricultural employment has increased due to the fact that either larger areas are cultivated or more intensive cultivation is taking place. A second group states that employment has decreased in the agricultural sector, but there is increased employment in other related sectors. A third group of authors admits that mechanization decreases the employment opportunities but considers this as a short-term disadvantage. A fourth group claims a reduction in employment, with a severe degradation of living standards for

the poorest members of society.

The use of fertilizer is new in Jordan. While farmers in irrigated area apply fertilizer to vegetables and fruit trees, the use of fertilizer in the rainfed areas is still low.

Arabiat *et al* (1982) commented on the slow adoption rate pointing out that 50% of wheat is used for home consumption, and farmers are not motivated to adopt improved technologies, such as fertilizer.

In addition agro-climatic conditions in Jordan, especially the variability of rainfall from year to year, introduce a high uncertainty and risk in agricultural production. According to the survey by Arabiat and his colleagues, the soil conditions and the risk associated with rainfall are the most important factors that make the farmer avoid fertilizer application.

In the case of tractors, for example, the farm size or labor could be a constraint to the adoption of such mechanized technology. In the case of the high yielding varieties (HYV'S) technology, the farm size or tenure does not seem to be a constraint to the adoption of "HYV" technology. "Neither farm size nor tenure has been a serious constraint to the adoption of new high-yielding grain varieties" (Ruttan,1974).

1.11 AGRICULTURAL EMPLOYMENT IN THE RAINFED AREAS

Because of traditional farming they generally practice Jordan's rainfed farmers are described as risk averse towards

agricultural innovations. Nevertheless, Jordan's urban areas and Arab countries have turned away potential farm labor, and farmers have increased their use of labor-saving equipment, primarily tractors and combines, in the cultivation of rainfed corps. A survey conducted by Arabiat *et al* (1984) revealed that 77.4% of farmers hired tractor operators. In addition, other needed equipments such as boom-sprayer, grain drill, orchard sprayer and harrows, were not available. Jordanian labor has moved form the agricultural sector to urban areas or abroad, or became involved in the daily migration from the village to the city. Because most of the farmers are part time farmers, they usually have jobs in the government and private sectors. In recent years, farmers have become less dependent on their household members for agricultural operations. The independence on household members from the older generation in farming created a significant labor shortage in the agricultural sector. To make a distinction between mechanization and importing migrant laborers from low-wage countries, mechanization appears to have been more acceptable among agricultural societies than introduction of migrant laborers, since the latter causes intercultural problems (Arabiat, 1984).

Table (5) shows the distribution of the labor force by occupation groups (DOS,1986) for the rainfed areas in the Irbid Governorate.

Table (5)
Work Permits Issued to Migrants Labor by Occupation and Sex during 1986

Occupation Group	Jordan 1986 male	female	Total	Irbid rainfed @ male	female	Total
Specialists & technicians	2292	-	3032	159	47	206
Managers	574	-	589	5	2	7
Clerks	262	-	396	6	0	6
Sales men	1559	470	1606	57	1	58
Services	31817	10731	42548	1056	65	1121
Agriculture	14526	0	14526	1137	0	1137
Industry	12262	88	13350	783	0	783
Tran.& Comm.	633	0	3633	31	0	31
Construct.	18205	0	18205	1067	0	1067
Total	97885	11090	97885	4205	331	4536

Source: DOS,1986." Statistical Yearbook." No,37 Department of Statistics. Amman, Jordan
@ Source:(Ministry of labor and social development),1988. Unpublished report.

1.12 THE PROBLEM STATEMENT

The labor situation play a dominant role in technological advances take place. The breakthrough in the utilization of tractor in Jordan was from in the mid 1960's. At the end of 1960's there was a plenty of unemployed looking for work. Therefore, the introduction of tractor has not been a response to the shortage of available labor, on the contrary, it was introduced in a situation of ample labor supply. By the end of the 1970's small areas of draft tillage persisted, mechanization coupled with emigration and industrialization policy of the 1970's, which created

employment urban areas, caused many agricultural labor to leave rural areas and to migrate to cities or to work abroad. of the remaining labor force, a large number migrated seasonally to work abroad or in the urban areas.

Agricultural work is increasingly carried out by women and the elderly aged, who are unable to find other employment opportunities particularly in subsistence farming and by migrant hired labor in commercial farming.

The economic boom in the Arab Petrol Exporting Countries following 1973 drastically changed Jordan labor situation. The demand for Jordan's labor force raised upwards both in the neighboring arab countries and urban areas. This created severe bottlenecks within Jordan. These changes have been noticeable in rainfed agriculture, which is characterized by highly seasonal labor demand as well as low labor productivity. In the agricultural field, shortage was most evident and to fill this gap an ever increasing number of mainly unskilled labor came from low wage countries. NPC (1985) Pointed out that the "low rate of farmers participation in agriculture, a rise in the ratio of non-resident farmer and an increasing dependence on non-Jordanian labor."

These factors, coupled with small holding size, because of the law of inheritance are the main causes of such severe fragmentation. Since laws can't be altered easily, it should be expected that such a problem will continue and other

measure should be introduced to solve this problem.

The problem of fragmentation of holdings has numerous setbacks as it is well known. The small size of plots does not encourage mechanization in rainfed areas, where income per area unit does not justify their incomes from non-agricultural pursuits.

As a result, labor replacing technologies are usually of interest to owner's of small and large farms. In the study by Lanzendorfer (1985) about the mechanization in Jordan it was found that the employment effect of agricultural mechanization at the farm level is rather independent of machinery ownership, and most of farmers exclusively depend on machinery use.

Tractorization and use of combines and/or threshers are predominant features of rainfed areas, but their effect on employment is also valid for irrigated agriculture. Their main effect on employment is the facilitation of the work and saving of labor. Such technologies are often available economically to small farms via custom services, by private sector or by government agents.

The question still remains about the impact of labor replacing technologies on poor and the landless labor seems to be becoming less available, which is leading to change farm patterns, e.g. the cultivated area of legumes is declining, because the peak time shortage of labor increases the cost of manual harvesting. On the other hand, the new technologies which decrease the labor requirement for

agricultural operations, might overcome one of the most important income for rural people particularly unskilled labor.

Therefore to prevent migration from rural areas to urban areas the impact of new technologies on employment should be examined in order to help the policy makers to balance of trade-offs between the positive and negative impact of technologies.

1.13 THE OBJECTIVES OF THE STUDY

The main objective of the study is to examine the impact of technology application on employment in the rainfed farming, it's importance to draw a clear picture of the division of labor between men, women, and children in agricultural production for both household and hired labor. Specific objectives of the study are:

(1) To describe the current situation in the rainfed farming in Irbid with respect to employment and technology

(2) To examine the relative contribution of men, women, and children as household, hired and migrant labor in the farming operation for cereals and legumes in Irbid.

(3) To analyze the socio-economic factors which affect the labor input in the rainfed farming in Irbid.

(4) To examine the socio-economic factors which explain the adoption of technology in the rainfed farming in Irbid.

(5) To construct enterprise budgets for agricultural practices for cereals and legumes according to different levels of technology.

(6) To initialize time calendar for different labor groups as well as agricultural operations.

(7) To determine the labor requirement per one dunum of wheat, barley and legumes according to division of labor groups.

CHAPTER TWO

REVIEW OF LITERATURE

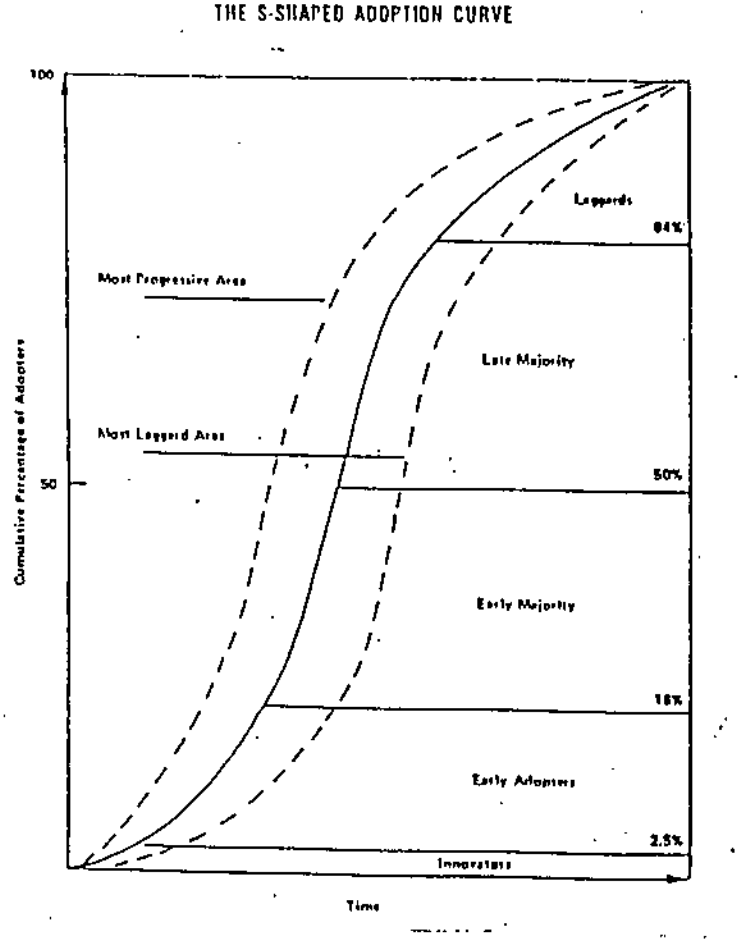
Technology plays a decisive role in the process of development. Discussion of technology "issues" at the international level has been s subject of controversy and there are different approaches and solutions to those issues. At the national level the majority of developing countries continue to make "technological choice"and the decision which affects seriously their internal division of labor "particularly relationships of production between males and females". There does not seem to be a balanced approach between the transfer from abroad and the development of national " Technology Capabilities" to take national decisions in the national interest. There are "external and internal constraints" on the transfer , choice and utilization of technologies. The new technology is based on a combination of crop varieties with high yield potential, fertilizers, irrigation in some cases, chemical pesticides, mechanization, and new ways to perform agricultural operations. One result of this combined package has been higher labor productivity. Agricultural technology increase the total production and facilitates the agricultural work.

The impact of new technology on employment in many

countries has been widely recognized and increasingly documented. However, there is a general consensus that technology adoption has had positive impact on employment in some developing countries and negative impact in some other developing countries. The final outcome of technology which is influenced by the institutional and policy environments has been favorable. The impacts of technology on employments have been positive but where they have been unfavorable and appropriate changes have not been made, the impacts of technology on employment have been negative.

2.1 LIFE CYCLE OF AGRICULTURAL TECHNOLOGY

Most agricultural technologies must embody certain common features if they are to be adopted. And if adopted, they follow a fairly predictable life cycle. To be adopted initially, a technology usually has to show potential for increasing farm profits by lowering production cost per unit. Under market conditions, cost-reducing innovations normally result in expanded output, the usual adoption rates of a technology follow an S-shaped curve (Fig. 2). At the beginning the innovation is tried by few operators, then the rate of adoption increases, and finally it tapers off as the technology becomes fully adopted or is adopted as far as existing circumstances permit. Progressive regions go through the process more quickly than poorer regions. The first adopters, in return for the risks they take, usually reap the greatest returns. As more and more farmers adopt the practice



Source : Harriss, B.; 1972. " Innovation In Indian Agriculture - The High Yielding Varieties Programme." Modern Asian Studies, January. p. 74

FIG (2)

and output expands, product prices decline, the final group of farmers to take up the practice may not realize as much profit but may have to adopt it just to keep their costs in the line with other farmers (Harriss,1972).

The process is not " equitable" to produce, not everyone who adopts the practice gets the same return. Income disparities among produces may even be wide. Consumers, however, generally benefit through added supplies at lower prices.

2.2 FACTORS AFFECTING TECHNOLOGY ADOPTION

There are several factors affecting the rate of technology adoption. The main three reasons are: (1) Farm size, credit availability, and tenure have stopped some farmers from technology adoption; (2) Uncertainty and risk, both economic and agronomic have stopped others to adopt technology; (3) Agro-climatic factors may not favor adoption in some areas. Denning (1981) examined the institutional constraints to the adoption of weed control. The results of the study indicated that the inadequate labeling of herbicide containers, complexity of chemical weed control methods by farmers, but as labor becomes relatively higher priced, shift away from labor intensive weed control techniques will likely occur.

Divinagracia (1984) found that the time-labor requirement is the significant factor that affected it's adoption consideration. Ranaweera (1985) found that if weed,infestation becomes a problem under rainfed conditions, fertilizer response was greatly diminished and yield declined

accordingly. At present, farmers are applying expensive herbicide or engaged in heavy manual labor. Roger (1969) indicated that the relative advantage of a new idea must be at least 25 to 30 percent higher than existing practice for economic factors to affect peasant's rate of adoption. Tautho (1985) pointed out that the decision by farmer to adopt new technology largely is influenced by biological and economic considerations. Goetze and Moore (1976) studied the constraints of adoption of improved wheat production in Jordan and found out that the Jordanian farmers have postponed their acceptance of technology for one or more of the following reasons: (1) they don't understand the technology and are therefore skeptical; (2) they don't perceive a positive benefit from the practice; (3) the inputs are not available; (4) they have limited or no access to capital; (5) the government of Jordan might subsidize the input at later date. Joseph (1980) used farm-level linear programming model to formulate the risk effects to the farmer's decision to adopt new technology. The model indicated that new technology is appropriate for farmers and regions, and should be adopted by farmers highly averse to risk. Perrin (1976) studied the adoption of new wheat and maize varieties and fertilizer use, the differences from farm-to-farm adoption as a result in the differences in cost of input, differential aversion to risk among farmers, and scale effect associated with farm or enterprise size, usually small farmers lag behind large farmers in adoption and which the above factors might account

for that lag. Furthermore, experimentation with new techniques involves the risk of the unknown, usually involving additional investment and small farmer may be less able to undertake such risk. This risk effect can lead to lower equilibrium levels of adoption or to lag in adoption by small farmers until the risk of unknown are reduced with experience in the area. Perrin (1976) showed that the productivity factors, agroclimatic zone and topography were the most constraints in explaining why some farmers adopt technology and others do not. Alviar (1981) studied the factors affecting technology transfer in rice production, the study identified some of the factors that may account for differences between regions in the rate of technology transfer. Those major factors were the presence of a favorable physical and economic environments such as an adequate water, better road and shorter distance of the farm to the nearest market centers. In addition, farm technicians, as a source of farm information, Ahmad (1983) studied the diffusion of a mechanical technology in Malaysia. The finding of the study was that the factors associated with the use of combine harvesters by farmers in Muda Scheme were identified as the farm size, farmer's perception of the economic benefit of the machine, neighborhood factors, membership in farmer's organization and several other factors. It was concluded that the the new technology will continue to spread among the farmers because of it's cost saving and speed of operations compared with human labor.

2.3 IMPACT OF TECHNOLOGY ON WAGE AND INCOME DISTRIBUTION

Jordanian agriculture has experienced a substantial impact of new technology. In the recent years a major focus has been the question of equity in the distribution of benefits accruing to the individual farmer from government subsidy of wheat. The adoption of new technology has two effects , long run effect and short run effect. The short run effect is an increase in the income of those farmers who adopt new inputs and techniques, the long run effect of new technology is the pattern of income distribution among farmers. The low income farmers with small holdings sell a small portion of production because they are subsistence farmers, but high income farmers with large holdings sell the most of production to government and obtain all the subsidy benefits. The small holding farmers will be worse-off because of the price competition due to the fact that the large farmers will benefit from the economics of scale by extending the fixed cost to large quantities of output, which can't be done by small holding farmers. A widespread belief that economies of scale are important in agriculture has been perceive force contributing to bimodal patterns of agricultural development, many economists, agricultural scientists, and other specialists assume that only a large and fairly capital intensive farm can be " Modern" and efficient. Raju (1976) studied the impact of new technology on farm income in Godavari District in India. The results of the study

indicated that the introduction of new agricultural technology in the district led to an increase in the economic welfare and better-off in term of their mean incomes and no group was worse-off than before. Also it was found that the equal adoption of new technology has significantly reduced income inequality. Ulluwishewa (1984) studied the labor and mechanization in paddy land in Sri Lanka. The finding of the study was that tractor hire rates and labor wage rates become crucial factors in determining farmer's decision to mechanize the land preparation; and it appears that both of those factors will accelerate mechanization. Reo (1972) found that the mechanization represents substitution of capital for labor, it may lead to a reduction in the relative share if wages in agricultural output, even when the output and employment rise. Kikuchi (1983) examined the new rice technology on migration. The results of the study indicated that the new technology has caused labor migration from unfavored to favored areas, and employment and income generated by the new technology have affected the population in unfavored area, labor migration caused by the introduction of new technology often requires new forms of labor contracts. Hayami (1977) studied the effect of technological change on income distribution in semisubsistance agriculture. The finding of the study was that the technical progress in it's production has the effect of equalizing income among urban consumers.

2.4 AGRICULTURAL TECHNOLOGY INCREASES EMPLOYMENT

There is a disagree about the impact of agricultural technology on employment, the first group of authors admits that the new technology increases employment and the second group of authors admits that the technology decreases employment, a third group admits that the new agricultural technology decreases employment in agricultural sector but increases employment in the related sectors. Inukai (1970) examined the impact of farm mechanization on output and labor input in Thailand. The conclusion of the study was that the selective mechanization may create more jobs than it eliminates. In fact, those labor-saving devices, such as diesel pumps, have provided farmers with opportunities to spread work over several seasons. Another study showed that increasing the multiple cropping in the west Pakistan has led to an increase in the rate of utilization of the existing farm labor (ILO,1966).

In his study Robert (1979) pointed out that " The Green Revolution" technology should increase the demand for labor because of increased labor requirement involved in fertilizer application. Per-Penstrup Anderson (1985) and (1987) who pointed out the impact of Green Revolution on landless labor, indicated that the higher labor productivity and increase in labor demand were the result of the green revolution. In areas with high unemployment and high elastic labor supply, this has resulted in a considerable expansion in employment. In regions

with little unemployment and inelastic labor supply, considerable wage increases have occurred. However, in-migration of labor from other regions and availability of labor saving mechanical technology has limited such wages to increase. Johnston (1969) found that the increase in multiple cropping led to an increase in farm labor inputs greater than the increase in the farm labor force. Burke (1979) found that the share of labor in output is substantially smaller in the high-fertilizer-using areas than the low fertilizer-using areas. It has been suggested that the green revolution technology should increase labor requirement involved in fertilizer application and controlling weed growth stimulated by fertilizer application. Kikuchi (1983) found when new varieties were introduced, agricultural employment opportunities increased, labor needs not only absorbed the rapidly increasing labor force, but also attracted migrants from less productive agricultural areas. Therefore, new technology not only supported the agricultural labor force but also reduced the urban poverty. At a regional level, (Per-Penstrup,1985) pointed out that each 1% increase in agricultural income in Nveva Ecija province of Philippines generated a 1-2% increase in employment in most sectors of the local nonfarm economy.

2.5 AGRICULTURAL TECHNOLOGY DECREASES EMPLOYMENT

Singh (1975) examined the impact of farm mechanization on human and bullock labor. It was found that the use of human labor per acre decreases with mechanization. The decrease in

human employment is much pronounced in the case of land preparation, sowing and post-harvesting operations in wheat and maize crops. The bullock labor use decreases with the increase in the level of mechanization and the magnitude of this reduction was more pronounced than that of human labor for all important crops. This reduction was mainly in land preparation and post-harvesting operations. Martin (1978) studied the tobacco technology and agricultural labor and it was found that the mechanization led to a reduction of labor requirements, without much possibility of the absorption of displaced labor by other sectors. Also the impact of mechanization will be most directly felt by hired work force, especially the younger workers and women labor who perform much of the harvest labor under conventional harvest systems. Danok (1978) developed a planning process for choosing machinery implement and crop planning on a state farm in Iraq. In the optimal plan, major reduction in hired labor, temporary labor were achieved by harvesting. Better utilization of permanent labor was shown to be another way of reducing hired temporary labor. Singh (1975) indicated that the tractors power use in land preparation at farm business level results in a negative impact on human and bullock labor use on different sizes of farms. On small farms one hour use of tractors replaces 5.21 labor days. On aggregate level also one hour use of tractor power results in replacement of 3.81 labor days. Pongsrikul (1985) found that farm mechanization was only policy producing adverse influence on farm

employment. Rose and Clark (1968) found in West Pakistan that the mechanization reduces labor force. This study was based on 60 mechanized farms in Punjab and Bahawalpur. Also the labor force reduced from 2000 to only 340, out of which 100 were employed on tractors. Another result of the study was while tractor power was reduced, the permanent labor stimulated demand for causal labor. Rao (1972) found that agricultural tractor displaces human and animal labor for plowing, threshing, and transportation. Srivastava and Heady (1973) and (1977) examined the technological and relative factors share in Indian agriculture. The result of the study indicated that the Green Revolution had brought about a decline in the share of labor.

2.6 MALE AND FEMALE LABOR INPUT IN AGRICULTURAL PRODUCTION

It has been argued, in the past, that to promote economic and social development, the development of technology is essential. The question of new technologies are critical issues in the economic and social development. Any development policy might be unbalanced if in to reality is taken consideration. The fact that new technologies in the development process in rural communities are often introduced without a full understanding of the nature of work and the needs of the contributors for whom those innovations are made has resulted in an unequal division of labor between men and women (Rassam,1984).

Agrawal (1985) in a study on socio-economic implication of new technology in India found that the adoption of HYV of rice increase is accounted for by female and causal labor. In addition, the results of the study indicated that the poor families already have high workload, often higher than man. Res (1985) found that as consequence of change in harvesting practices and crop establishment methods, and introduction of mechanical thresher relatively more female than male was displaced. Rassam (1984) examined the relative contribution of men, women and children of the Syrian rural household in agricultural production, focusing primarily on women's labor and the impact of technologies on their labor. The results of the study indicated that the average contribution of women to the total production is more than men within one household. They provide more labor input in cereal and legumes crops than men, while in tree and summer crops, men's labor input is more than women's. The findings of the study showed that new technologies would have a diverse effect on women's work in general.

Rassam and Tully (1986a) analyzed the pattern of labor input in agriculture in North Western Syria. The results of the study indicated that male and female time contribution to crop production are approximately equal. Also, it has been noticed that the hired labor for mechanical operation is predominantly male, while that for manual operation is predominantly female. Other results of the study were that continuing agricultural mechanization of production will

continue to reduce female agricultural activities including both household and hired labor. ILO (1981) pointed out that the introduction of advanced sophisticated technology has created a wide difference in labor productivity between sex resulting in wage difference. Rassam (1985) in the study farm labor by age and sex in North Western Syria found that the men's and women's contribution to agricultural labor are almost equally divided, women's contribution is 60% of the total hours spent in all production. While it was 43% for men and 7% for children. Women provide 62% of all labor for legumes crops and 42% for cereals compared to 27% and 54% provided by men respectively. Legumes crops involve more non-mechanized operations in which women's contributions exceeded those of men.

2.7 THE ROLE OF WOMEN IN TECHNOLOGICAL CHANGES

The earlier work on the Green Revolution paid little attention to the role of women in technological change and implication of their role for technology adoption and utilization and distribution of benefits.

The role of women in the rural communities vary somewhat from one area to another. The labor input in agricultural tasks might be determined through many factors such as the type of crops grown, the local traditions and culture, religions and beliefs, in addition to another socio-economic factors (Rassam,1984).

There are many reasons why the role of women should be explicit analyzed. First, women play a major role in providing the additional labor required to obtain the benefits from technological change. Failure to consider genderrelated differences in labor availability and demand may result in low adoption rates and lower yield impact than expected.

In rural communities where agriculture is mainly a subsistence activity, women are found to have a heavy share of the agricultural work and in some cases female input is greater than male.(ILO,1981),(Al-wehaidi,1985),(Rassam,1984) and (Rassam and Tully, 1986b).

Although technological improvement in agriculture are often directed to farmers. However focusing on the head of household ignores not only the complexity of the household decision making process, but more importantly the extent of the participation of all household members in rural economic activities.

Al-wehaidi (1985) studied the role of Palestinian women in the occupied territories. The result of the study indicated that the palestinian women constitute 75% of work force in local agriculture, because men are seeking employments in factories and in the construction sector and public services. Also it was found that a small portion of hired women come from Palestinian refugee camps near the villages. Those women seek seasonal work to help their husbands to acquire household income. Falcon (1987) pointed out that women in most rural areas account for higher

proportion of agricultural labor than men, requiring them to carry their household and childbearing responsibilities along with full time field work. In addition new technologies introduced into traditional farming systems and into traditional social structure have often actually increased women's work and reduced their material well-being.

A comparative study of Nepal and Indonesia (Devaki,1978) pointed out the same conclusion. The daily workload of rural population by age and sex shows consistently that in rural areas of both countries women work longer hours than men in all age groups. In Zambia, the average hours of daily work were estimated to be 16 hours of women compared to 10 of men, while in the Latin America, it was found that the wives in the agricultural tenant conditions work 14 to 16 hours compared to 8 to 10 hours of men (Devaki,1978).

Youssef (1977) studied the women and agricultural production in Muslim Societies. The results of the study indicated that women's agricultural work serves as a buffer. Having no specific role or skill for their own to contribute, they have to adapt themselves to whatever employment opportunities appear seasonally. They are dependent on the intensity of demand for male labor, where seasonal employment level is high for men. Therefore, she is "allowed" to grab behind and accommodate her availability to the particular level of demand exists for male labor. In Africa, where women account for large share of the labor force in agriculture, the failure to teach modern farming methods to women results in

adverse effect on agricultural productivity and rural incomes (ILO,1981).

FAO (1987) indicated that the technical change in agriculture tend to add disproportionately to the labor demands on women. For example, the use of a plough or of fertilizer requires additional weeding of field if the gains to be fully realized. When such technical improvements are applied to men's crops, one result has been that time available to women for their own productive activities and their other household and food-related tasks have been reduced. Billings (1971) examined the effect of technology on farm employment in India. The study found that the participation rate of women workers was very high, being about 46% among cultivators and 53% in agricultural labor. Falcon (1987) indicated that the rural women tend to be the last to benefit from new technological packages, even though they account for the majority of the farm labor. Richards (1983) found that in Egypt 30% of the field crop labor is attributed to women in Delta. Also, social constraints on women participation in agricultural labor combined with spreading male education and emigration contribute to the current crisis of " labor shortage". Sa-Nyvanwong (1980) showed that all farmers who used fertilizer, pesticide, had never labor problems because they used their household members as the laborers. Res (1985) found in a study in Lloilo province in Philippines that farm wage labor was only done by women of poor households, while women in higher-income have better

opportunities for pig raising. (ILO,1966) pointed out that mechanization in agriculture is seen mainly in men's work, while women's work in both on and off-farm including household tasks has remained predominantly manual.

Finally, several papers from developing countries have pointed out that mechanization in agriculture is seen mainly in men's task, while women's work in both on-and-off the farm (including household) task has remained predominantly manual. This generalization seems to apply multiple agricultural tasks (such as weeding, harvesting and carrying operations).

From this one can conclude that in the most of cases the agricultural technology is not benefit of rural women.

CHAPTER THREE

METHODOLOGY

3.1 SOURCE OF DATA AND SAMPLING PROCEDURE

3.1.1 SOURCE OF DATA

Irbid governorate was selected as a target area for this study because it is considered to be representative for all regions located in the semi-humid area. Although the cereal and legumes production is represented all over the country, this study will emphasize only on the most important governorate with respect to cereal and legumes, namely Irbid governorate. Table (6) shows the planted area and production of field crops in Irbid compared to Jordan. Figure (3) shows that 22 percent of total area of wheat is in Irbid and produces 34.6 percent of total production of wheat in Jordan. With respect to lentils 68 percent of planted area is in Irbid that produces 79 percent of Jordan production of lentils. This means that this is the prime land for cereal and legumes production in Jordan with good soil, sufficient rainfall, and topography suited for mechanization. This area extends from the Syrian borders in the north, from the East Mafrak and Zarqa governorates, from the south Balqa governorate, from the West the Jordan River (Fig. 1). The Ghor region and Ajlon District were removed from the frame. Due to the fact that the Ghor region is irrigated which out of concern and Ajlon district have mountain and sloppy land were cereals and legumes are planted in a scattered plots

Planted Areas and Production of Fields Crops in Irbid Compared to Jordan

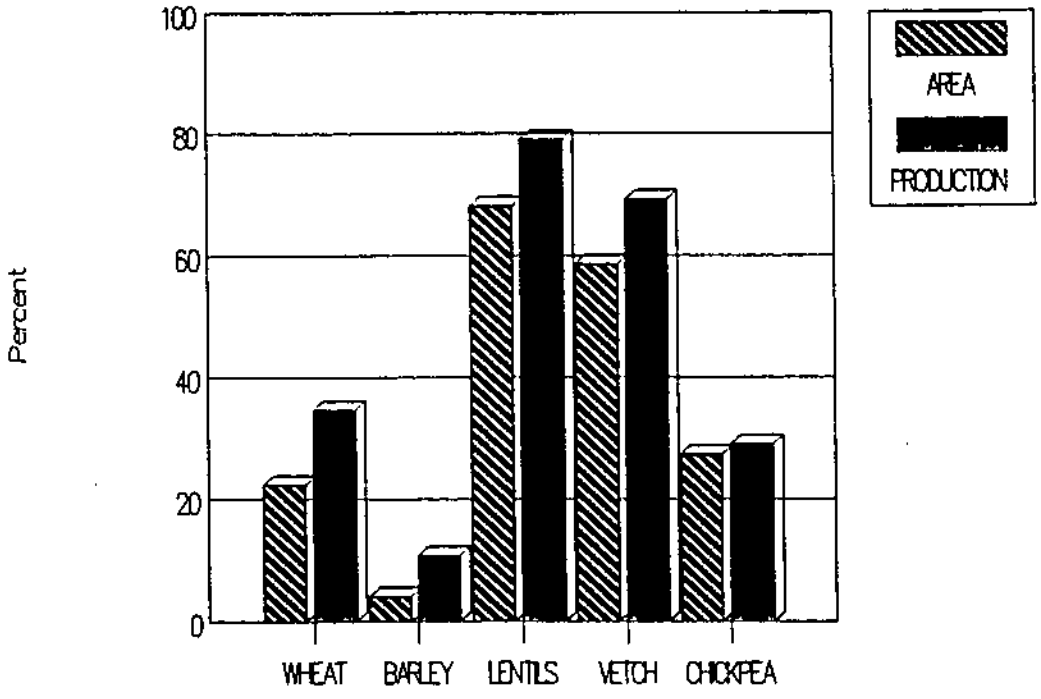


Fig (3)

whereas olives and fruits trees are dominant in this district.

Therefore the sample in the survey area was limited to villages receiving from 200 to 500mm annual rainfall.

Table (6)
Area and Production of Field Crops in Irbid Governorate and the East Bank of Jordan

Field Crop	Irbid			Jordan	
	Area	Production	Yield	Area	Production
Wheat	189276	27688.7	146.9	843193	79805
Barley	21133	3569.4	168.9	511468	33047
lentil	34826	4144.8	119.8	51187	5244
Vetch	8753	925.2	107.1	14940	1325
Chickpea	4500	363.4	83.8	16386	1250

Source: DOS.1987b." Annual Agricultural Statistics". Department of Statistics, August, Amman-Jordan

3.1.2 SAMPLE SELECTION

The data used to examine the impact of new technology on employment in the rainfed farming in Irbid were obtained by personal interviews conducted in 1988/1989. Seven villages in the rainfed areas in Irbid where cereals and legumes are planted were selected for the purpose of this study. There are mainly four climatic zones in Irbid represented in the selected villages. These are:

Zone 1. 200-300mm, Cereals, Legumes.

Zone 2. 300-400mm, Cereals, Legumes, Summer Crops.

Zone 3. 400-500mm, Cereals, Legumes, Summer Crops, and Olives.

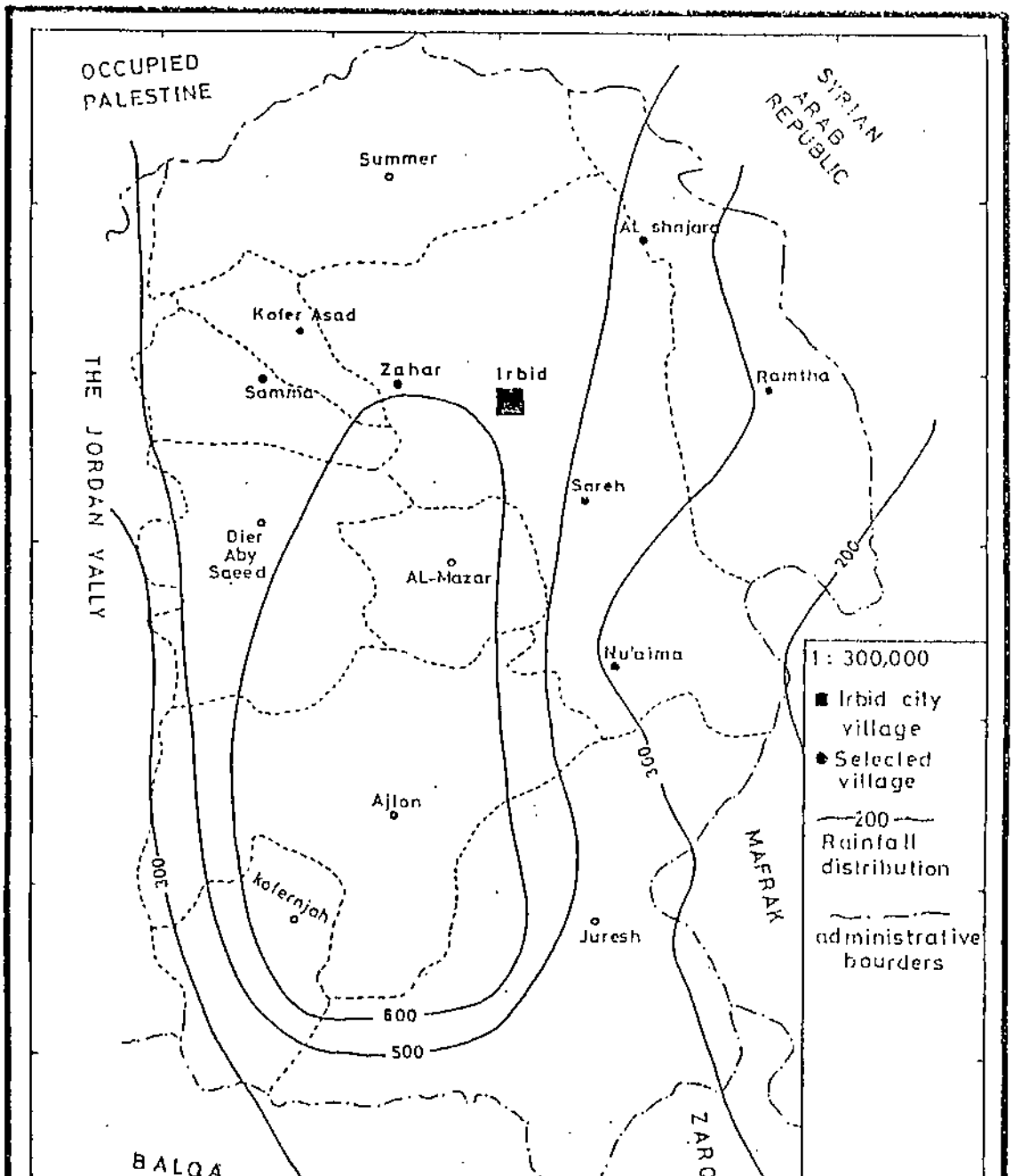
Zone 4. 500-600mm, Cereals, Legumes, Summer Crops, and Olives.

Because the land topography is completely different, steep mountains and old traditional farming are still applied. Therefore, the study will be restricted to the above mentioned first three zones.

The total population of Irbid governorate is 704,100 inhabitants. A list of all villages in Irbid was provided by the Department of Statistics as a frame to consist 184 villages. This frame contained also the members of households. Land use in each village, number of holdings, and area planted for different field crops in 1986.

A stratified random sample was selected after some visits to different villages in Irbid governorate. Four villages were selected from zone (1) and zone (2), two villages in each zone, and three villages were selected from zone (3). The villages chosen in a given zone were selected in terms of similarity in the cropping system, soils and climate. In other words, the selection of villages was based on a certain uniformity within each zone.

The different agro-climatic zones and location of seven villages are shown in Figure (4). The villages selected in zone (1) are Nu'aima and Ramtha located about 17 km south, 15 km northeast of Irbid respectively. The main crops of those two villages are wheat, barley and legumes, and the average rainfall is between 200-300mm per year. The villages in zone (2) are Sareh and Al-Shajara located 8 km south, 13 km



Map of Irbid Governorate and Site of Selected Villages

Fig (4)

northeast of Irbid respectively. The main crops of those two villages are wheat, barley, lentils, vetch and summer crops, and the average rainfall is between 300-400mm per year. The villages selected in Zone (3) are Zahar, Samma and Kufer Asad located 7-15 km EastNorth of Irbid. The main crops in those villages are wheat, barley, legumes (lentils, vetch and chickpea), summer crops and fruit trees.

3.1.3 THE SAMPLE SIZE

A survey based on a Structured questionnaire that statisfies the objectives of the study was conducted in seven villages from three different zones. The sample was randomly selected and the total sample size is 120 farmers. The population size is unknown, therefore, the sample size was determined according to the following equation (Dominick,1982), (Stevenson,1978)

$$n = \frac{p\,(1-p)\,Z^2}{(p^* - p)^2}$$

Where n = sample size

p = the probability that the sample represents the population

(1 - p) = the probability that the sample does not represent the population.

p^* = the probability of successes in the sample (and an unbiased estimator of p)

Z = Z-test, the critical value or confidence coefficient (for Z = 1.64, the confidence interval = 90%)

$(p^*-p)^2$ = the error term of the estimate,

Therefore $n = .5(1-.5)*(1.64)^2 /(.075)^2 = 120$

A list of farmers was provided by the mayor of each selected village. Thirty four farmers were randomly selected for each zone, seventeen farmers in each village , except Ramtha, where eighteen farmers only were selected. This sample size is assumed to be sufficient, because the total variations are not great within each zone. Therefore, a systematic random sample was used in selecting the sample from the list of farmers. In each village the sample interval was taken to be the total number of farmers divided by the sample size. A random number was chosen to begin the first element and so on. The total sample is 120 farmers. Four farmers were dropped from the sample because their questionnaires were incomplete. However, they were automatically replaced by other farmers.

3.1.4 THE STUDY SAMPLE

Data were collected from the farmers and sometimes from the farmers and farmer's wife. Also sons of the farmers took

part in the interview sessions. Data from farmers were collected once a time corresponding to different tasks of agricultural activities carried out in 1988/89.

The household labor has been disaggregated by age and sex. In addition the hired labor has been distinguished by local hired labor and migrant labor. The local hired labor has been divided into two groups, namely local hired labor from the village and local hired labor from outside the village. The number of workers and the number of days as well as the number of hours which was spent in each operation have been calculated for cereals and legumes. The number of hours has been used to measure the contribution of the various labor groups in agricultural production activities.

3.1.5 THE STUDY UNIT

The study unit in the analysis is the household, defined as a group of people who normally eat and reside together and provide labor force in farms, and share income and resources. The household might include one or more families. The family is considered as a married couple with or without children. Thus, a given household might represent a nuclear or extended family,the residency of the household number in the village is important. However, a household which does not reside in the village but provides labor in the peak season to the household and shares the income, has been included as a part of the household composition. In the sample studied

two types of families were found.

While the household unit is the main basis of the analysis, the individual unit is used to provide general information on the demographic characteristics of the sample, for example, household size, age distribution, marital status, level of education and migration. Information based on the farm unit such as land tenure, crops grown, land per crop. Farm machinery, institutional linkages,animal rearing, income generating activities derived from crops, livestock, off-farm agricultural activities and non-agricultural activities are also provided. The second part of the analysis provided data on the contribution of men, women and children as a number of hours spent in agricultural activities of cereals and legumes as well as the number of hours spent in each task for each crop.

The third part of the analysis deals with the yield, revenue, cost of production and gross margin for each crop by using different levels of technology to perform agricultural tasks, particularly for wheat with corresponding zones. Therefore, a stratified random sample took into consideration the following parameters:

1- Size of farm (different classes)

2- Different levels of technology

3- Field crops (cereal and legumes)

3.1.6 DATA COLLECTION

Before starting with data collection, several steps were taken. First, during the fall season in 1987, informal visits with the thesis advisor have been made to different villages in different agro-climatic zones. General questions were asked about the cropping system, division of labor in different tasks of agricultural activities for each crop, tenure system and other economic activities. Other visits were made to the directorate of agriculture in Irbid governorate to get their advice and help concerning the agro-climatic zones and the cropping system in the different villages.

Third, visits were made after selecting the village in order to explain the study to village leaders and to get a list of village farmers from the mayor of the village. A structured questionnaire was prepared. Pre-test interviews of the questionnaire's quality were conducted after some modifications. A structured questionnaire that satisfies the objectives of the study was prepared, then the empirical field work began in January 1988.

The interview sessions concentrated on three main aspects: 1) The demographic structure including household composition, age, sex, educational level, enrollment at school, migration.

2) The crops planted in the last season and all specific tasks carried out such as tillage operation, seeding,

fertilizer application, herbicide application, rodent control, hand weeding, harvesting, cleaning and bagging.

3) The cropped dunums and other information was collected about who performed the tasks, disaggregated by sex, age and source of labor, the methods used, the approximate date of accomplishment (month and week), duration in total number of days, total number of hours spend to perform particular tasks. Wages also were disaggregated by men, women, and children, with respect to hired labor the actual wages by farmers were recorded with respect to household labor, the opportunity cost was taken into account to estimate the farmers' wages and their families.

Questions on the percentage of income derived from crops, livestock, and off-farm agricultural activities and non-agricultural activities were asked. Because the absolute income is difficult to gather, the proportion of income derived from different sources was more appropriate to collect, the number of livestock, number of people working outside and the ones who had off-farm agricultural activities.

Some questions related to the farmers attitudes toward new technology proposed were asked.

A question dealing with the enterprise budgets for agricultural practices of different cereals and legumes field crops by using different levels of technology to perform agricultural practices was asked.

The following parameters were taken into account to

determine the level of technology :

1. Tillage operation, (mechanical, animal tillage).
2. Seeding, (drill, broadcasting).
3. Fertilization, if applied by the farmer, (drill, broadcasting).
4. Herbicide, if applied by the farmer, (mechanical, manual, hand weeding)
5. Mechanical harvesting (combine, mower).
6. Manual harvesting,(picking straw, thresing, winnowing).

Although the sample size is small for making generalization, the researcher feels that the findings can be attributed to any village in those zones which have the same cropping patterns, similarity in soil and climate, similarity in a number of characteristics. In this study, the ratio of farmer to holding was about equal one, which means that there are very few landless farmers. This result would not apply to village with high proportion of landless farmers.

3.2 PROCEDURE AND MATHEMATICAL MODEL

1. To achieve the first objective to describe the current situation in the rainfed farming in Irbid with respect to employment and technology, secondary and primary data were used in this analysis. The data used to examine the impact of new technology were obtained by personal interviews conducted in 1988/1989. Seven villages in rainfed areas in Irbid where cereal and legumes are planted in different climatic zones

were selected randomly.

2. To achieve the second objective, the household labor has been disaggregated by age and sex. In addition, the hired labor has been distinguished by local hired labor and migrant labor, the local hired labor has been divided into two groups, namely local hired labor from the village and local hired labor from outside the village. The number of workers and number of days as well as number of hours which was spent in each operation has been calculated for cereal and legumes. The number of hours has been used to measure the contribution of the various labor groups in agricultural production activities.

3. To achieve the third objective to examine the socio-economic factors which explain the labor input in cereals and legumes in rainfed farming in Irbid, a multiple regression model was used.

A multiple regression model can be written in a general form as follows:(Dominick,1982)

$$Y_t = B_0 + B_1X_1 + B_2X_2 + \ldots\ldots\ldots + B_k X_{tk} + U_t \quad \ldots\ldots(1)$$

Where Y denotes the dependent variable , the X's denote the explanatory variables , and U is a disturbance term . The subscript t refers to the t^{th} observation ; the second subscript used in describing the explanatory variable identifies the variable in equation. The number of the explanatory variables is K-1, so that for K = 2 equation (1) reduces to a simple regression equation. An alternative way

of writing equation (1) is

$$Y_t = B_1 X_{t1} + B_2 X_{t2} + \ldots\ldots\ldots + B_k X_{tk} + U_t \quad \ldots\ldots\ldots \quad (2)$$

where $X_{t1} = 1$ for all $t = 1,2,3, \ldots\ldots, n$. Writing X_{t1} for 1 as the multiplication factor of B_1 makes the regression equation look symmetric without bringing about any real change. Similarly, a second multiple regression was used to test the socio-economic factors which explain labor input and technology, such as age, education, cropped areas. The number of dunums cropped was thought to be an important factor in labor input and technology adoption. Those with larger cropped areas favor technology adoption. Therefore, labor efficiency is improved during the critical planting and harvesting periods. Also some personal characteristics of the farmers were thought to be important factors. Age, education, experience in farm management,and health status were expected to influence labor input and technology adoption . Demographic characteristics of farmer's household, such as number of males, number of females, household size , number of students in the household , and number of absent household members were also thought to be important factors affecting technology adoption. Also it was thought that household income and source of that income play a role in determining labor input on farm.

The number of work days off-farm and institutional factors such as farmers memberships in agricultural societies

and farmers attitudes toward risk, and site of villages were thought to be other factors which explain labor input on farm. The farmers attitudes toward risk can be obtained by calculating optimism risk index .

The optimism risk index can be calculated and represented in equation (3) (Demir,1976)

$$I = (Y_b / Y_n) / (P_b / P_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where I = optimism risk index of farmers

Y_b = yield ,Kg per dunum in bad years

Y_n = yield , Kg per dunum in normal years

P_b = probability of bad years

P_n = probability of normal years

The relationships between the farmer labor input and the socio-economic factors were tested statistically. For this purpose the following multiple regression model was specified and used:

$$Y_t = B_0X_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10} + B_{11}X_{11} + B_{12}X_{12} + B_{13}X_{13} + B_{14}X_{14} + B_{15}X_{15} + B_{16}X_{16} + B_{17}X_{17} + B_{18}X_{18} + B_{19}X_{19}.$$

Where : B_0X_{0t} = the intercept term

Y_t = the farmer labor input by hours on farm during the crop season 1988/1989.

X_1 = the farmer's years of age ,

X_2 = the farmer's years of education ,

X_3 = the farmer's years of experience in farming ,

X_4 = the number of dunums operated by farmers,

X_5 = the number of household members ,

X_6 = the number of males in household ,

X_7 = surplus of females in household ,(number of female minus number of male in household)

X_8 = the number of students in household ,

X_9 = the number of absent household members (outside the village)

X_{10} = off-farm work by farmer , number of days per year,

X_{11} = percentage of household income generated from on-farm activities

X_{12} = farmer optimism risk index

X_{13} = a dummy variable which has a value of one (1) if the farmer was a member in agricultural societies; and a value of zero (0) if not.

X_{14} = a dummy variable which has a value of one (1) if the farmer's health was good or excellent, and a value of zero (0) if it was fair or poor

X_{15} = a dummy variable which has a value of one (1) if the farmer started seeding after rainfall,(0) otherwise.

X_{17} = a dummy variable which has a value of (1) if the farmer was in the zone 200-300mm, and zero (0) otherwise

X_{18} = a dummy variable which has a value of (1) if the farmer was in the zone 300-400mm, and zero (0) otherwise

X_{19} = a dummy variable which has a value of (1) if the farmer was in the zone 400-500mm, and zero (0) otherwise.

4. To test the factors which affect technology adoption process by the farmer a second multiple regression model was used. The following variables were taken in the analysis as dependent variables.

   1. Fertilizer application , kg per dunum
   2. Herbicide application, a value of one (1), if the farmer adopts herbicide application, and zero (0) otherwise.
   3. Technology adoption (fertilizer & herbicide application), a value of one (1) if the farmer adopts both fertilizer and herbicide technology, and zero (0) if not.

   For this purpose the previous explanatory variables for multiple linear regression were used.

5. To achieve the fifth objective, the farmers were asked about the cost of inputs, cost of performing different agricultural activities per dunum, yield and return per dunum for wheat, barley, lentil, vetch, chickpea, and begia has been recorded, the gross margin for those field crops has been calculated according to different levels of technology for different zones.

3.3 PROCEDURES FOR SELECTING VARIABLES

A variety of regression models from the same set of variables could be constructed. For instance, one can build seven different equations from three independent variables, three with two independent variables and one with all three. As the number of variables increases , so does the number of

potential model (ten independent variables yield 1,023 models).

Although, there is a procedure for selecting the most important and significant independent variables that had a positive or negative effect on the dependent variable this procedure called Foreword Selecting. For instance, the first variable considered for entry in to the equation is one with largest positive or negative correlation with the dependent variable. The F-test for the hypothesis that the coefficient of the entered variable is calculated to determine wither this variable is entered. The F value is compared to an established criteria (it is equal 1.96 for this model). Also specify the probability associated with F statistic, called probability of F-to-enter, and it equal (.05).

The backward selection starts with all variables in the equation and sequentially removed them if that variable does not remain in the criteria for F-test and probability of F-to-remove. Therefore, the stepwise selection of independent variables is a really combination of backward and foreword procedures and is probably the most common used method. The first variable is selected in the same manner as in foreword selection, if the variable fails to meat entry requirement the procedure terminates with no independent variables in the equation. If passe the criterion, the second variable is selected based on the highest partial correlated, If it pass entry criteria, it also enters the equation (Norusis, 1986).

The coefficient of determination R^2 (proportion of the total variation in dependent variable explained by multiple regression of dependent variable to independent variables). And the t-test for the statistical significance of the parameters, F-test was done (To test the overall significance of the regression model) to meet the statistical criteria for the regression results. Also to prevent the violation of the basic assumptions of multiple linear regression model. Multicollinearity and Heteroscedasticity were checked by correlated matrix and scatter plot for residuals respectively.

Therefore, there were no multicollinearity or heteroscedasticity found in the of regression results.

CHAPTER FOUR

RESULTS AND DISCUSSION

The seven villages are located in three zones, Nu'aima and Ramtha are in zone 1 Husun and Al-Shajara in zone 2. While Samma, Kufer Asad and Zahar in zone 3. The total number of farmers is 120, divided as 34,35 and 51 in zones 1,2,and zone 3 respectively.

The purpose of this part is to present brief overview of the characteristics of the sample. data were gathered in order to provide information on age, marital status, level of education and migration. In addition, information based on household unit such as household composition, crops grown and the average land per crop, income generating activities derived from crops, livestock, agricultural activities off-farm, and non-agricultural activities was collected.

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

4.1.1 AGE AND SEX STRUCTURE

The interviewed farmers were on the average old (57 years old) and have a large households (11.5 persons). The percentage of male to female was approximately equal in the sample, the household has an average number of 5.72 and 5.78 male and female respectively. The youngest males with less than 15 years old form about 33.5% of the male in the sample, and the youngest female were about 31%. The older population with 60 years old and over was about 4% of the sample. The

age and sex distribution for the total sample is shown in (Fig. 5). The age composition does not show the broad base of the population pyramid for the sample. This is because of the elderly of the farmers, and it is naturally expected that off-spring age group of those farmers will be in 15-30 years old, which forms 44% of the sample. Comparing the population pyramid of the sample and the population pyramid of Jordan. Figure (6) shows that there is difference between the sample and the population. The broad base in the population pyramid of Jordan reflecting high fertility rate, a long with low infant and child mortality have created a youthful population.

The Distribution of Jordan's population by sex and age was stable since 1952 (Hourani, 1985). The ratio of female to total population was 48 percent, and male ratio was 52 percent. The population characteristics in Jordan were affected by social, political and economic factors which led to high growth rate of the population. In 1987 the growth rate was 3.9% (3.4% natural increase and 0.5% net migration) where the population increases from 2.2 million in 1980 to 2.9 million in 1987.

Figure (6) shows the population under 15 years old of age is 49% of the total population, and this ratio was 45.5 in 1961. The increases were due to high birth rate accompanied by declining death rate as a result of the expansion of heath, sanitary and social services. Also

Percent Distribution Of Population In Sample By Sex And Age Group

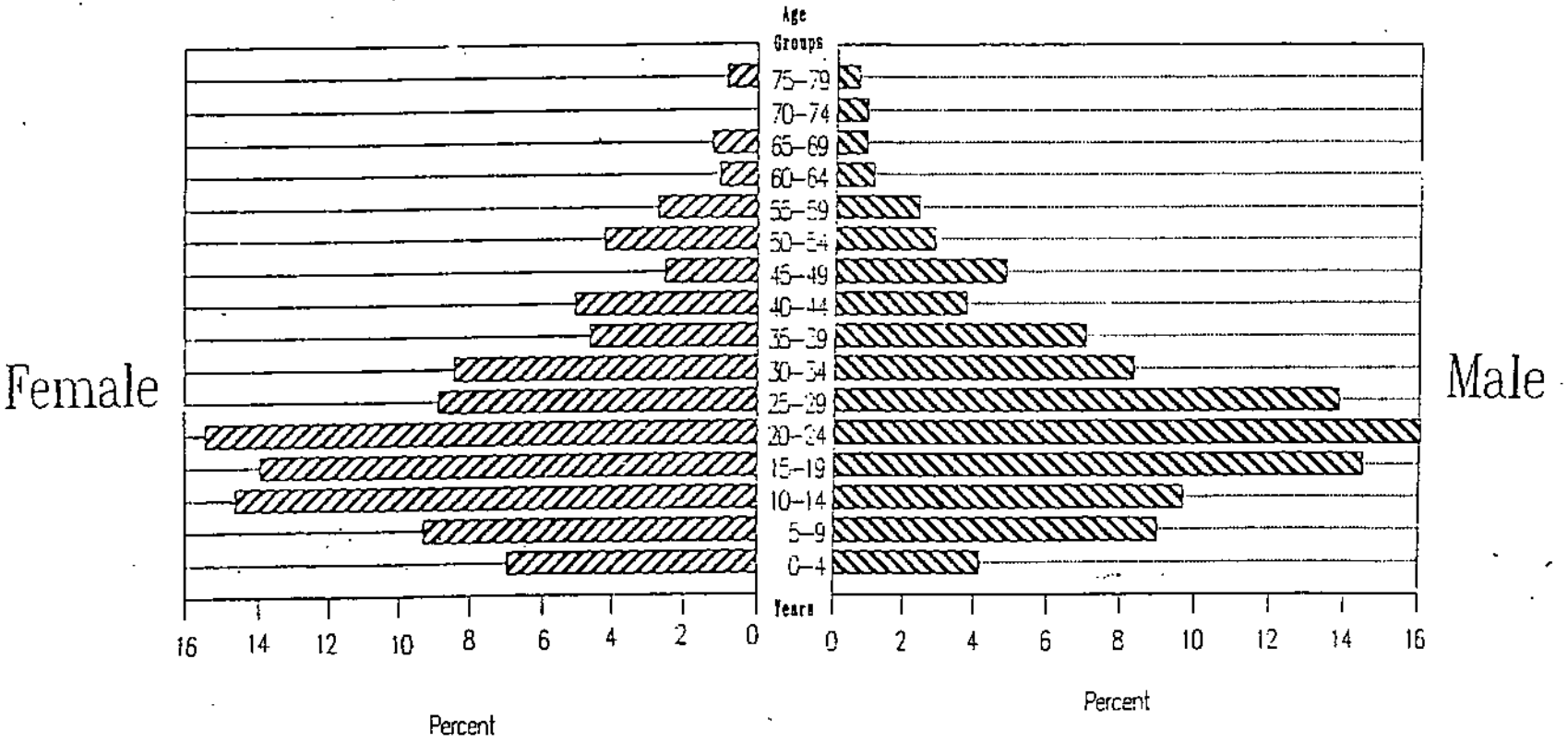


FIG (5)

Source : Villages Surveyed in Study

POPULATION PYRAMID FOR JORDAN

1987

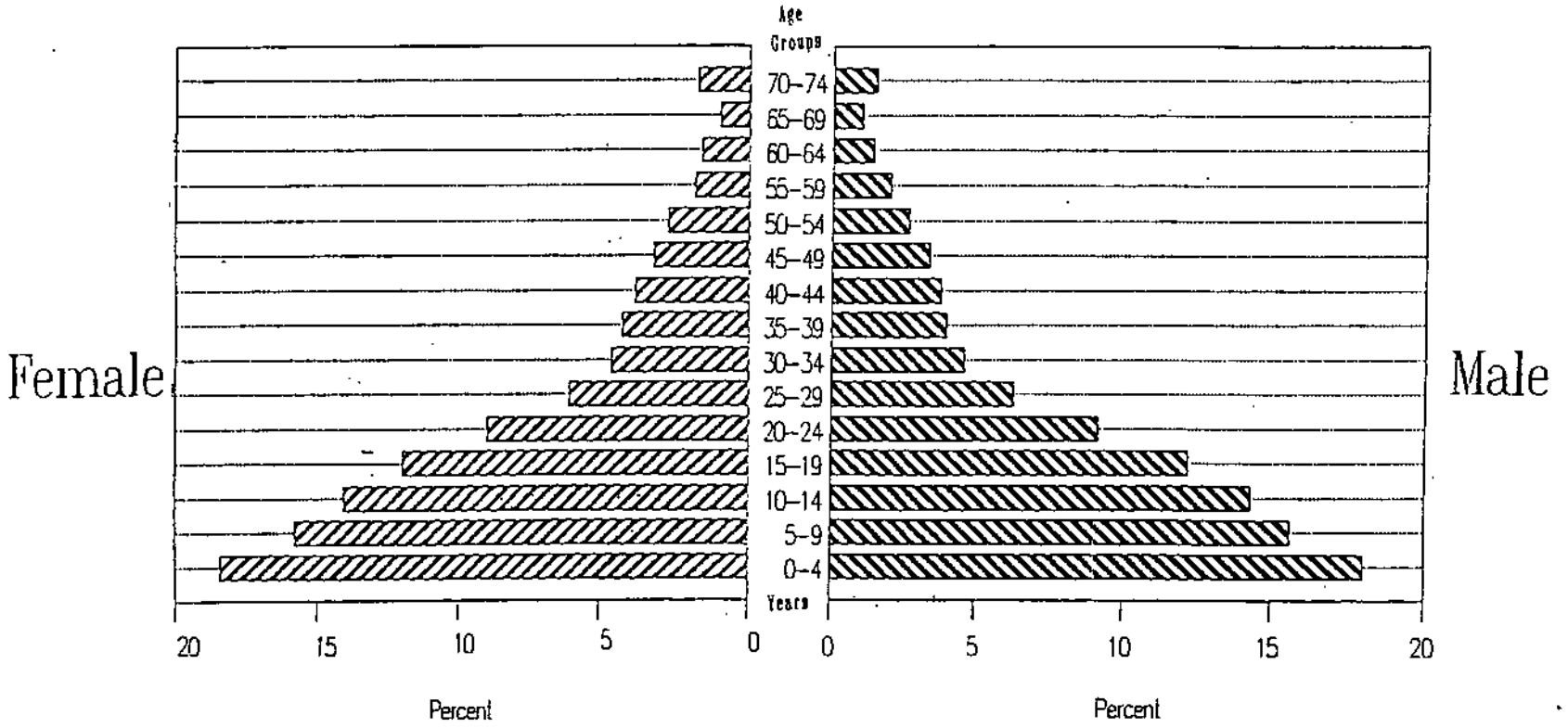


FIG (6)

Source : DOS, 1987, Statistical Yearbook", Ho
Depatment of Statistics. Amman, Jordan.

control of epidemic diseases (Hourani, 1985). Consequently, Jordan has a very high child dependency ratio. There is slightly less than one adult of working age to support every child under 15 years. In a typical developed country there are 2-3 working age adults for every dependent child. The proportion of the population in the working age group 15-64 was 50.7 percent in 1967, and 46 percent in 1987. This decrease has had an adverse effect on the labor force participation rate which is already low.

To examine the potential labor force in the selected villages, the age division was made. The children less than eight years old did not participate in any agricultural activity. Thus, those who were less than eight years old and form 14.5 percent of the population were eliminated from the labor force. The age group 8 to 14 years old does participate in the labor force and its hours input was considered one third of worker labor input in the adult labor-equivalent. Obviously, their participation is low compared to that of the man workers. They form 12 percent of the total sample. Finally, the most important age group is 15 year old and over, which is forming 73.5 percent in the rural areas. A 15 years old boy or girl is considered to be a full worker. For the conversion to manpower unit in agricultural activities, input hours by women was considered to be one half of male worker. Youssef (1977) studied the women and agricultural production in Islamic societies. The findings of the study indicated a vary significant overlap between women's economic

and household roles, which make it is impossible to distinguish.

The distribution of three groups by age and sex is shown in Figure (6). For the total sample there is no noticeable difference between the zone in age composition, but there is a difference in age of farmers, the average age of farmers is 57 years old. However, 53,63,55 are the average years old for the farmers in zones 1,2,3, respectively. also the average years of experience in farming is 32. Also there is difference in experience of farming between zones, where it is 30,39,29 for zones 1,2, and zone 3, respectively.

There is a high correlation between age and experience in farming (r= .73), at the same time there is a negative correlation between age of farmer and education, the r = -.50. Stover (1986) pointed out that " The remain high growth rate and fertility as it is now, will create a new additional load to Jordan in health, educational, agricultural, job opportunities, housing, water and food sector."

4.1.2 HOUSEHOLD COMPOSITION, MARITAL STATUS, AND MIGRATION

The household is defined as a dwelling unit in which one person or a group of persons reside, share work and income, and normally eat together. The average household size for the total sample is 11.5 persons with a range of 2 to 32 people per household. Also there is a slightly difference of household size between zones. The extended household is more

frequent in zone 3. the average of male in the household was 5.72 and the average female in the household was 5.78. The average age at the first marriage for males was 22.8 years compared to 19.1 years old for females. The age difference at the first marriage was not too large between zones, but the age of marriage for females was low compared to the average age at marriage for Jordanian women. Stover (1986) pointed out that the women's age marriage for Jordan is 22 years.

Different types of migration can occur in rural areas and the most frequent type is a daily migration toward cities for education, working in public or privet sector. Permanent migration to big cities is a common phenomenon in the sample. About 88% of the household members live in the villages where 12% of household members is outside the village. This means that every household has one members had a permanent migration to cities. It was found that the range of migration from 0 to 4 members. Also, it was found that 70% of members of household live in the same house, which means that three members of the household do not live with the household. Two of three live in the same village and the other migrates to cities. The migration is pronounced in zone 2 more than in zone 1 and zone 3. This may be due to the closeness of those villages to Irbid city.

4.1.3 THE LEVEL OF EDUCATION

The 1979 census reported 33 percent illiteracy rate for the Jordanian population over the age 15 year. This high rate

is mostly due to illiteracy among older segments of population. Illiteracy is over 55 percent for those over 45, but only about 7% for those aged 15-19 years. Female illiteracy is more than twice high as male illiteracy Illiteracy will decline rapidly in the future because of high enrollment rate for today's young people. About 90 percent of all children are in elementary and preparatory schools. (Stover, 1986).

The level of education was divided according to the years of study. There is nine categories 1) Illiterate, 2) literate (can read and write without certificate), 3) Primary schools certificate (those who obtained their certificate or engaged now in that certificate 4) Elementary school certificate 5) secondary school certificate 6) College certificate (two years after secondary school 7) University certificate 8) Graduate studies certificate 9) Ages of members less than to enrollment to school. Table (7) shows the distribution of educational level with respect to age group from the total sample .

In the sample 11.2% was illiterate and 1% was literate (can read and write without certificate). 8% of the sample is smaller in age to enrollment to school. 25% hold primary certificates, 20% hold elementary certificates, 10% of the sample hold university certificate. The average number of students in the household is four. From Table (7) it can shown that illiteracy ratio is positively correlated with age, and there is a negative correlation between educational

attainments and age. The highest ratio of those who obtain educational qualification is found among the youngest population. Table (8) shows the distribution of jobs by sex of the sample study. 9% and 27% for male and female respectively do not engage any kind of work or looking for jobs due to younger age for male , and for female due to household tendency and a willing to keep their older daughters at home in order to keep them in domestic duties and even to take care of the younger brothers and sisters. Only 7% of the sample size was engaged in farming activities and 7% of male in the sample has military services and 15% of male in the sample was in the army forces or retired from the army. 28.2% and 27.9% of sample for males and females respectively are students, and 4% of sample population are unemployed and looking for jobs.

4.2.0 THE CROPPING SYSTEM

The winter crops grown in the villages are wheat, barley, lentil and vetch. Chickpea is a spring and winter crop planted at the beginning of January until March. Chickpea is more pronounced in zone 3. Watermelon is considered the main summer crop. Fruit trees like olives are planted in the villages.

The average total area per farmer is 279 dunums (dunum= 0.1 hectare) with range from 4 to 2200 dunums, the average dunums owned for the farmer in zone 1 is 452 . 155 and 54

Table (7)

Distribution of Educational Level with Respect to Age Groups as a Percentage in the Sample

Age Group Years	Illit-rate	litt-rate	Prim-nary	Elem-ntry	Seco-dary	Coll-age	Univ-ersity	Grad-uate	not enrollment to Schools
0-4									69.7
5-9	1.9		24.3						30.3
10-14	2.9		30	22.9					
15-19	2.9		4.3	30.3	29.8	4.3	2.4		
20-24	1.9		3.5	11.2	38.7	56.7	28.6	9.1	
25-29			5.2	14.4	14.9	23.9	31	27.3	
30-34	2.9		11.3	11.2	4.4	6.5	15.5	36.4	
35-39	3.8		6.5	5.3	7.7	4.3	9.5		
40-44	12.5	10	5.7	2.7	1.7	2.2	4.8	9.1	
45-49	10.6	10	3.9	1.6	1.1		7.1	18.2	
50-54	21.2	40	0.9	0.5	1.7		1.2		
55-59	13.5	20	3.5						
60-64	7.7	10	0.4						
65-69	8.7		0.4						
70-74	2.9	10							
>= 75	6.7								
Total	100	100	100	100	100	100	100	100	100
Percent	11.18	1.08	24.73	20.22	19.46	4.95	9.03	1.18	8.17

Source : Villages Surveyed in Study

Table (8)
Distribution of Jobs By Sex As a Percentage of the Total Sample Size

Jobs	Male	Female
No Work	8.9	26.9
Farmers	6.7	0.2
Military Services	6.7	0.0
Army and Retired	15.0	0.4
Public Sector	15.4	4.6
Students	28.2	27.9
Privet Sectors	9.8	0.6
Household (female)	0.0	38.7
Unemployed	3.3	0.6
Total	100	100

Source: Villages Surveyed in the Study.

dunums for the farmer are zone 2, and zone 3 respectively. This indicates that zone 1 is characterized by large holdings and zone 3 suffer from severe fragmentation problems. The average dunums cropped is 313,190,27 for zone 1, zone 2 and zone 3 respectively. The average area for wheat is 126 dunums , the average area of lentil is 32 dunums . Table (9) shows the number of plot and number of owner in different zones with respect to class. The farmer may own several plots in different places of village with different size. The average number of plot per farmer is 3.9, this means the land of farmer scattered in different four places around the village. Table (9) it can be shown that 73% of plots in zone 3 is 20 dunums and less, and 52% of plots in zone 1 is more than 50 dunums.

Table (10) shows the average area, total production, yield and wheat use in the sample by zone. Table (11) shows the average area, total production, yield and lentil use in the sample by zone. From those two tables it can be shown that zone 3 is the most productive of wheat and lentil in terms of Kg/d due to high rainfall received and fertile soil.

4.2.1 CROPS ROTATION

About 87 percent of farmers planted wheat in the sample and 55 percent planted lentil. Only 10 percent of farmers planted barley. Table (12) Shows the distribution of farmers planted cereal and legumes with respect to zones. From the table it is shown that the legumes are mainly planted in zone 2 and zone 3. This is due to high rainfall received in

Table (9)
Number of Holders and plots Distribution
in Different Zones in the sample

Dunums	Zone 1		Zone 2		Zone 3	
	Plot	Holder	Plot	Holder	Plot	Holder
0-9	0	0	21	8	70	37
10-19	21	13	49	19	86	43
20-29	28	20	28	15	35	22
30-39	18	14	18	12	16	11
40-49	14	11	20	13	5	4
50-100	48	20	40	13	0	0
>= 100	43	12	14	4	0	0

Source: Villages Surveyed in the Study.

Table (10)
The Average of Area, Yield, Production use of Wheat
in the Sample by Zone

Items	Total	Zone 1	Zone 2	Zone 3
Area Planted (Dunum)	126	337	133	18
T. Grain production (Kg)	13646	31125	16210	3411
T. Straw production (sa)	12	0	0	23
Sold to Government (Kg)	10907	24905	13633	2271
Sold to Market (Kg)	955	3639	172	152
Home Consumption (Kg)	728	774	855	644
Stock for Seed (kg)	548	630	787	351
Grain Yield (Kg/D)	155	104	161	176
Straw Yield (sac/D)	1.07	0	0	2.29

Source : Village surveyed in the Study.

Table (11)
The Average of Area, Yield, Production use of Lentil
in the Sample by Zone

Items	Total	Zone 1	Zone 2	Zone 3
Area Planted (Dunum)	32	21	66	9
T. Grain production (Kg)	4188	1658	7448	1418
T. Straw production (sa)	38	20	66	12
Sold to Government (Kg)	2453	564	6123	672
Sold to Market (Kg)	559	592	609	478
Home Consumption (Kg)	156	300	133	140
Stock for Seed (kg)	124	138	569	145
Grain Yield (Kg/D)	124	98	114	142
Straw Yield (sac/D)	1.20	0.97	1.08	1.41

Source: village Surveyed in the Study.

Table (12)
Number of Farmer Planted Cereal and Legumes in the Sample by Zone.

Crop	Zone.1	Zone.2	Zone.3	Total
Wheat	24	32	49	105
Barley	8	1	3	12
Lentil	8	30	28	66
Vetch	4	0	10	14
Chickpea	2	1	10	13
Begia	0	0	8	8

Source : villages surveyed in the Study

those two zones. The number of interviewed farmer for each village and crops was presented in Appendix (A), table (1).

Crop rotation practiced in the sample varies from one area to another according to the following agricultural zones.

(a) Zone 1 : A two year crop rotation is followed wheat/barley - fallow, the wheat/fallow occupies about 75% of the area in this zone.

(b) Zone 2 : The rainfall pattern is reliable and therefore crop rotation in this zone is as follow:

1. Three year crop rotation mainly wheat-legume-summer crops predominantly in this zone, about 72% of farmers applied this rotation.
2. Three year crop rotation of wheat-legume-fallow, about 26% of farmers applied this rotation.

(c) Zone 3: This zone receives about 500mm annual rainfall and three year crop rotation is predominantly in this zone.

(1) Three year crop rotation of wheat-legume-summer crops, about 76% of farmers applied this rotation

(2) Three year crop rotation of wheat-legume-fallow, about 24% of farmers applied this rotation.

4.3.0 INCOME GENERATING ACTIVITIES

It is important to have a total overview of income generating activities in the sample. Income is derived from four activities: 1) Crops, 2) livestock, 3) agricultural activities off-farm, 4) non-agricultural activities. The average distribution of income from different activities are presented in Table (13). The proportion of income derived from different activities is more appropriate to obtain than absolute income. In order to determine which one of the activities is more important to the household the farmers were asked the relative contribution of different activities in the source of household income, Moreover, the validity of the responses for income were checked against the total area, number of animal, the number of people from the household working outside and finally the number of people having off-farm agricultural activities. The income generated from farm activities was 41% of the total household income. The income generated from non-agricultural activities was 53% of household income. The share of women in household income is nearly neglected. Therefore, it is likely that the job opportunities are better for males than females.

Table (13)
Income Generated From Different Activities
as a percentage of Total Household Income

Source	Male	Female	Total
Farm Income	37	2	39
Livestock	1	1	2
Agric. Off-Farm	6	0	6
Non-Agric. Activities	51	2	53

Source : From villages surveyed in the study.

Job opportunities for female in these rural areas are restricted to the villages and the related agricultural tasks. Most of cases the head of the household is unwilling to report that females make a share in household income, due to cultural reason in the rural areas. Males however, have better conditions, first they are more eligible or qualified through their levels of education and second they have the choice of working within or outside the village.

The farmers were also asked about the relative importance of field crops in the farm income. On the average, wheat is the most important source in the farm income. 51% relative importance of wheat followed by 17% of lentil. And 16% of fruit trees, 6% of animal rearing and it ranged from 2-4% for vegetables, barley, vetch, chickpea and other field crops.

4.4.1 FACTORS AFFECTING LABOR INPUT IN FARM

Labor input was closely correlated with area cropped. Therefore, the data were analyzed to determine factors

affecting male and female labor input from household, hired labor from village, hired labor from off-village, total hired labor, total labor input on farm and the relative importance of female to male. Moreover, the household labor input was measured in a manpower unit. By taking into consideration that the female labor input in hours is one half of men. Children labor input in hours is one third of men.

The participation of men, women, and hired labor was highly correlated with the cropped dunums. Therefore, a stepwise regression was used at 5% level of significance to consider the importance of variables. The full model regression and correlated matrix was done to show and to check the sign and value of parameters.

The labor input measured in hours for different labor groups was taken as a dependent variable. The socio-economic variables were taken as independent variables such as dunum cropped, household size, surplus of female, education level. To avoid multicollinearity between the variables. If two variables were highly correlated to each other, one of them was taken and the other was removed from the model. Therefore, the 19 variables remained in the model.

4.4.2 RESULTS OF THE REGRESSION MODEL

A stepwise regression was used to consider the importance of variables affecting labor input. For the household men labor input the regression results were presented in Equation

(4). It showed that the cropped area and household size have a positive impact on household men labor input, but as increased number of student in the household had a negative impact on household labor input in farm.

Hours input by men from the household = -273 + 0.24 Dunum Cropped + 26.3 Household Size - 14.1 Number of Student in Household + 135 Villages Location in Zone 2. + 87 Village Location in Zone 3.....(4)

Table (14) shows that area planted in dunum was a statistically significant factor for most of the different labor categories of labor. An increase in area cropped increased the need for labor. Also the labor input hours in zone 2 (Al-Shajara and Sareh) were greater than in zone 1 (Ramtha and Nu'aima) because of three-year crop rotation (Wheat- Legumes- Summer crops). Moreover, labor input in zone 2 is greater than in zone 3, due to larger size of holdings in zone 2 (Samma, Kufer Asad and Zahar). As a matter of fact, the main characteristics of zone 3 play a dominant role of labor input. Of those characteristics are steep mountains, slope of land, nearest to city, severe fragmentation of land, families with more student and absent of household members devoted fewer hours to agriculture.

An increase in the farmers experience in farming demands fewer hours in farming for different labor categories due to efficiency in the utilization of household and hired labor. If a farmer was in a good or fair health they devoted more hours in farm from women and off-farm labor. For household

Table (14)

Socio-economic Factors Affecting Labor Input in the Farm for the Study Sample

	AGE.	EDU.	EXPR.	DUNM.	HOUSE.	STUDT.	ABSEC.	DAYS.	COOP.	HELTH.	ZONE2.	ZONE3.	R^2	F.test
F MEN.				0.4	26.3	-14.1					135	87	0.4	18.2
F WOMEN.	-3.1				14.0	-8.9	10.9	-1.6		47.5		64	0.2	5.0
F LABOR.	-11.8			0.5	66.4	-33.7		-0.5			334	237	0.3	7.7
IN HIRED.	-5.0			0.5							154		0.5	37.1
OFF HIRED.	39.1		-15.5	0.3	-35.0					248.0			0.2	4.9
LOCAL HIRED.	26.6		-19.1	0.9		-41.7					370		0.3	9.1
MIG HIRED.	4.6		-6.8	0.3	13.7	-25.2					347		0.5	16.0
T.HIRED.	31.1		-26.9	1.2		-55.5					703		0.5	21.0
T.LABOR.	21.6		-26.1	1.5	61.6	-98.0		-0.8		281.0	802		0.5	13.7
T.MALE.			-10.9	1.4	56.3	-64.4	-29.0	-0.4	139.0		778	175	0.8	37.0
T.FEMALE.	7.9		-4.2			-11.5				95.8			0.1	2.8
F/M RATIO.		-3.3								14.0		20	0.2	9.5
M.FAMILY.				0.4	34.0	-18.4		-0.2		101.0			0.3	12.4
M.IN HIRED.	-6.5			0.7							199		0.5	37.1
M.OFF HIRED.	15.9		-6.8	0.1	-18.8					105.8		-114	0.2	4.8
M.LOCAL HIRED.			-7.0	0.8		-28.5		-0.5			359		0.5	21.1
M.T.HIRD.			-14.8	1.2	26.8	-67.3		-0.5			737		0.7	42.9
M.T.LABOR.			-15.6	1.7		-85.7		-0.7			960	227	0.7	35.1

* Between 0.1 To 0.05, otherwise >= 0.05 Level of Significance

F MEN. = Men from the Household Input
F WOMEN. = Women from the Household Input
F LABOR. = Household Labor Input
IN HIRED. = In-Village Hired Labor Input
OFF HIRED. = Off-Village Hired Labor Input
LOCAL HIRED. = Local Hired Labor Input
MIG HIRED. = Migrant Labor Input
T.HIRED. = Total Hired Labor Input
T.LABOR. = Total Labor Input
T.MALE. = Total Male Labor Input
T.FEMALE. = Total Female Labor Input
F/M RATIO. = Female to Male Ratio
M.FAMILY. = Manpower Family Labor Input
M.IN HIRED. = Manpower In-Village Hired Labor Input
M.OFF HIRED. = Manpower Off-Village Hired Labor Input
M.LOCAL HIRED = Manpower Local Hired Labor Input
M.T.HIRD. = Manpower Total Hired Labor Input
M.T.LABOR. = Manpower Labor Input

AGE. = Farmer Age in Years
EDU. = Education Level
EXPR. = Experiance in Farming
DUNM. = Dunum Cropped
HOUSE. = Household Size
STUDT. = Student in Household
ABSEC. = Absence from Household
DAYS. = Day's off Farm
COOP. = Member in Cooperatives
HELTH. = Farmer's Health
ZONE2. = Zone 350mm
ZONE3. = Zone 500mm

men labor the coefficient of determination R^2 = 0.45, this means that 45% of the total change of household men labor input was due to dunum cropped, household size, number of students in the household, and location of villages according to rainfall precipitation. In order to test the overall significance of the regression model, F-test was done and it is equal to 18.2. The F tabulated was 2.30. Since the calculated F value exceeds the tabulated F value at 5% level of significance and degree of freedom, the alternative hypothesis is accepted that the regression parameters are not equal to zero and that R^2 is statistically different from zero. The household size and an increased number of absence household members as well as the farmer health had a positive impact on household women labor , but age of head of household, increased number of students in household as well as increased days of work off-farm for the head of the household had a negative impact on women labor from the household. Also the women labor input in zone 3 was more than in zone 2 and in zone 1, because of cropping system and less dependence on mechanization to perform agricultural operations due to small holdings.

The cropped dunums and household size had a positive impact on household labor, but age of farmer, student number, day's worked off-farm had a negative impact on the household labor. Also the household labor input was more in zone 2 than in zone 3, and in zone 3 more than in zone 1, because of mechanization and adoption of new technology in zone 1 and

small holdings in zone 3.

The factor affecting hired labor from village was found to be dunums cropped and age of farmer. Zone 2 was more pronounced in hired labor from village than other two zones.

Cropped dunums, age of farmer, good health of farmer had a positive impact on off-village hired labor input, whereas household size and experience in farming had a negative impact.

Dunums cropped, age of farmer had a positive impact of Jordanian hired labor, whereas experience in farming , number of students in families had a negative impact on labor input. The factors affecting migrant labor were dunums cropped, household size, age of farmer had a positive impact on labor input, whereas experience in farming, number of students had a negative impact. Zone 2 is highly dependent on migrant labor because larger areas in this zone are planted with legumes, and household members are not sufficient to make manual harvesting of legumes (particularly lentil) in a short period of time to prevent loss of grain. The same above factors have the same impact on the total hired labor input on farm. Age of farmer, dunums cropped, household size, health of farmer had a positive impact on the total labor hours input on farm, whereas experience in farming, number of students in household, day's work off-farm had a negative impact. It was found also that zone 2 demands more labor hours input than other zones. The male labor input was positively influenced by dunums cropped, household size and

members in agricultural cooperatives and negatively influenced by experience in farming, number of students in household, number of absent members of household, days work off-farm. The male labor input in zone 2 was more than in zones 3 and zone 1, due to cropping system applied.

The female labor input is positively influenced by age and health of farmer and negatively influenced by experience in farming and number of students in the household.

The education level measured in years of education had a negative impact on the ratio of female labor input to male labor input, whereas health of farmer had a positive impact.

The factors influence the household labor input, in village hired labor , off-village hired labor, local labor, total hired labor as well as total labor input in farm measured in hours and converted to manpower units were presented in table (14). The man hours input is considered one unit, while women is one half unit and children is one third unit, due to physical and physiological reason for women and children.

4.5.0 FACTORS AFFECTING TECHNOLOGY ADOPTION

The same explanatory variables were taken with the same procedure of stepwise regression to determine the factors affecting technology adoption. Equation (5) shows the explained variable of fertilizer application is influenced by the risk coefficient of farmer, which means that when fertilizer application was more frequent when the farmer was

risk preferer. The household size and seeding after rainfall had a negative influence on fertilizer application, since the risk averse farmer does not apply fertilizer until enough rainfall was received.

Fertilizer application in Kg = - 0.174 Household size + 0.089 Farmer's Risk Index -2.1 Planting after Rainfall + 5.6 Villages Location in Zone 2. + 3.8 Villages location in zone 3.....(5)

Table (15) shows that the farmers in zone 2 applied more fertilizer than zone 3, because small areas were pronounced in zone 3, which do not encourage farmer's to maximize yields by applying fertilizer.

The farmer risk index, dunums cropped, membership in agricultural cooperatives were the main factors influencing the adoption of herbicide application, whereas household size and percentage of income generated from agricultural activities and seeding after rainfall had a negative impact on herbicide application. The highly income generated from agriculture was pronounced in zone 1. As a result of large holdings (337 average dunums planted with wheat compared to 18 dunums in zone 3.) with average rainfall 250mm, and the farmer in that zone usually practice seeding before rainfall (Afeer is the arabic term), herbicide application was not a pronounced practice for that zone.

Fertilizer and herbicide application together was taken as explained (dependent) variable. Table (15) shows that the dunums cropped, risk index of farmer had an influence on the

adoption of fertilizer and herbicide application, whereas number of male in household, and number of members absent from household as well as planting after rainfall had a negative influence on the adoption process of fertilizer and herbicide application.

As the number of males and absent members from the household increases, farmer dependence on non-agriculture income increases. This led the farmer to have less attention to farm production and adoption of technology to increase farm output.

Table (15)

Socio-economic Factors Affecting The Adoption of Fertilizer and Herbicide Application in the Sample

	DUNN.	HOUSE.	MALE.	ABSEC.	AGRIC.	RISK.	COOP.	WET.	ZONE2.	ZONE3.	R^2	F.test
Fertilizer		-0.174				0.089		-2.1	5.6	3.8	0.20	5.8
t-value		-1.73				2.18		-3	15.2	8.5		
Herbicde	3.93	-5.43			-0.02	0.15	0.14	-0.1			0.20	4.6
t-value	14.49	-3.68			-1.98	9.35	1.7	-2.4				
Fert+Herb	3.44		-0.25	-0.84		0.01		-0.2	0.3	0.2	0.23	4.7
t-value	11.3		-1.7	-3		5.6		-3.5	4.5	2.5		

DUNN. = Dunum Cropped
HOUSE. = Household Size
MALE. = Male in Household
ABSEC. = Absence from Household
AGRIC. = Percent of Agricultural Income
RISK. = Farmer's Risk Index
COOP. = Member in Cooperatives
WET. = Planting after Rainfall
ZONE2. = Zone 350mm
ZONE3. = Zone 500mm

4.6.0 THE LABOR INPUT IN AGRICULTURAL PRODUCTION

The farm labor force was the primary constraint affecting farm production. The household labor input and hired labor were important factors which determine the supply and demand for labor force in conjunction with the adoption and introduction of new agricultural technology. Labor force was disaggregated by sex and age and it is distinguished between household labor and hired labor from within or outside villages, and for migrant labor. Those who were 15 years old and over were considered as adults and were classified as men and women, while children included those between the age 8 to 14 years old. Since children who are less than 8 years old do not participate in any economic activity, they were not included in this analysis. The number of workers, number of work days as well as the number of hours per day for every crop and each task were collected to calculate the contribution of men, women and children of household labor as well as hired labor from within and outside villages and migrant labor. Also the requirement of labor for each specific agricultural practice was calculated to figure out which task needed more labor than others.

As a matter of fact, the number of hours spent in any physical work on the farm for economic production was used to measure the actual contribution. People who were not physically involved in any specific task were not considered as contributors (supervising any agricultural task, transporting food to field, and farm management were

eliminated). Where various categories of labor (men, women and children) were involved in a given task for a given period, we assumed that they worked for the same amount of time. Information on each crop grown in the farm was collected. In analyzing the data each crop was analyzed alone and then after that wheat and barley were combined into cereals crops. Lentil, vetch, chickpea and begia into legume crops. Cereals and legumes were combined together to get farm activities for field crops.

It should be pointed out that the field work was broken down into different tasks, from tillage operation to transportation of yield. This gives more accurate information in collecting data for agricultural process (Rassam,1984). Many past studies have failed to do so and much confusion exists regarding the impact of each component task.

Table (16) shows the contribution of men, women and children as a percentage of total hours for each agricultural activity in total farm labor input. From the table it was show that the manual harvesting requires 45% of total hours input on farm, whereas mechanical harvesting requires only 6.3% of labor input.

4.6.1 THE LABOR INPUT IN THE FARM ACTIVITIES

The distribution of the contributors in agricultural production is given in Table (17). The men household contribution was 16.9% of the total hours spent for all production practices, whereas women from household was 13.4%

Table (16)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Field Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	16	0	0	12	0	0	3	0	0	1	5.2
Seeding	7	2	6	15	0	0	5	0	0	0	4.8
Fertiliz	3	0	1	12	0	0	1	0	0	0	2.6
Weeding	13	16	38	12	0	0	6	1	0	12	13.5
Herbicide	2	0	0	1	0	0	1	0	0	0	0.6
Rodent	2	0	1	0	0	0	0	0	0	0	0.5
Mechanical	18	0	2	4	0	0	27	0	0	3	6.3
Manual	19	74	36	26	0	100	26	82	75	55	45.2
Threshing	0	0	0	5	0	0	10	2	2	7	3.8
Winnowing	2	3	5	0	100	0	5	4	8	0	2.3
Bagging	3	1	2	0	0	0	5	0	1	3	2.0
Transport	15	4	7	13	0	0	12	11	14	19	13.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table (17)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Field Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	52	0	0	40	0	0	3	0	0	5	100
Seeding	26	5	11	52	0	0	6	0	0	0	100
Fertiliz	16	0	5	77	0	0	1	0	0	0	100
Weeding	16	16	24	16	0	0	3	0	0	24	100
Herbicide	60	0	0	27	0	0	13	0	0	0	100
Rodent	79	2	20	0	0	0	0	0	0	0	100
Mechanical	49	0	3	11	0	0	27	0	0	11	100
Manual	7	22	7	10	0	0	4	8	10	32	100
Threshing	1	0	0	25	0	0	17	2	4	52	100
Winnowing	12	17	20	0	5	0	13	8	23	3	100
Bagging	24	6	10	4	0	0	16	1	2	36	100
Transport	19	4	5	17	0	0	6	4	6	38	100
% of Hours for Labor Group	16.9	13.5	8.6	17.3	0.1	0.1	6.3	4.6	6.1	26.5	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

for total hours input on farm. Also 8.6% was the contribution of the household male child and female child. By examining the labor input within household it was shown that the household labor input provides 39% of total labor input which means that the household provides much higher labor than that of local hired labor and much less than hired labor (migrant and local hired). Figure (7) shows the contribution of labor categories as a percentage of total hours spent in agricultural production for cereals, legumes and field crops. It would appear that the shortage of hired labor makes a serious problem to those farmers. The female household provides 13.5% of the total labor input. As a matter of fact, it is a household prestige that the male farmer would not let his wife and his daughter to work outside the household. Also some farmers were unwilling to report that their families work in the field.

It can be shown that the household labor input is more in legumes than in cereals due to non-mechanization of legumes production and manual harvesting is done by laborers. The farmers used household members to harvest crops when area planted of legumes is small and the expected return does not encourage the farmer to hire labor. On the contrary local hired labor was more in cereals than legumes due to highly mechanization of cereals crops, like harvesting, seeding and fertilization by drill, And the custom services for herbicide application.

Contribution of Labor Groups as a Percentage of Total Hours Inputs in Farm for the Sample

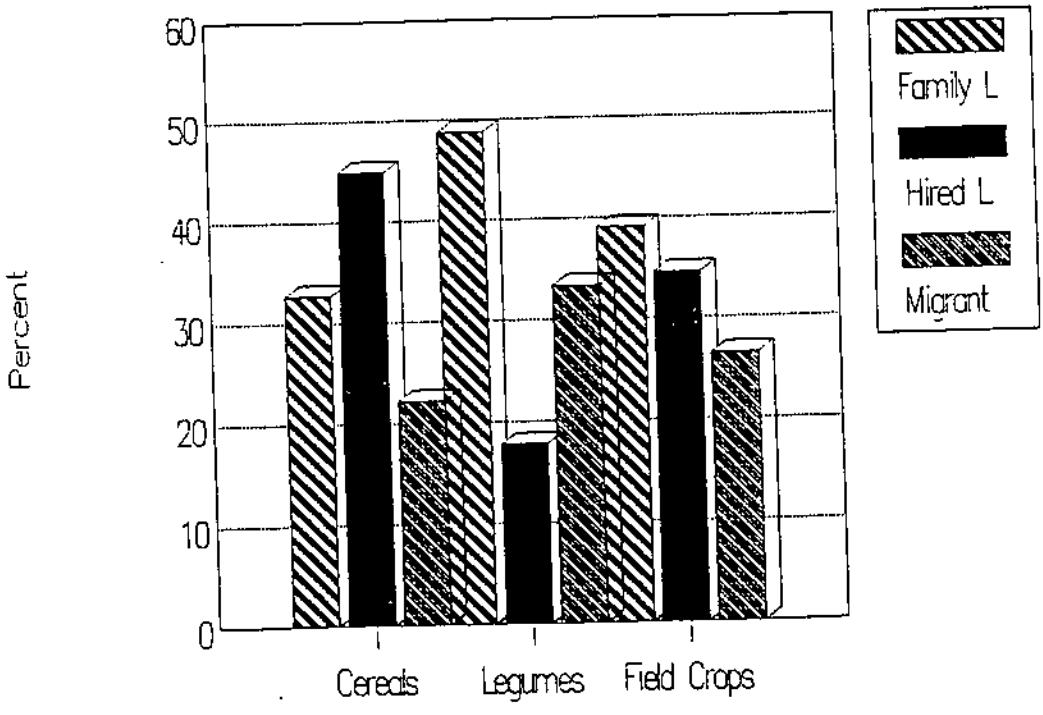


Fig (7)

Moreover, migrant labor was engaged more in legumes than cereals due to the same reason for household labor, but when large areas were planted with legumes and household members were not enough to harvest crops or when household members work off-farm, like public sector or army forces as well as the unwillingness of young people to be engaged in farming.

The contribution of hired labor was 61% of total labor input. One can notice that local hired labor was more than migrant labor. The hired male local labor was 34.5%. That was usually done in skilled operations, such as tillage operation, seeding mechanical harvesting. The hired women was 4.7% which usually was done in manual operations, such as weeding, manual harvesting and cleaning.

The contribution of migrant labor force was 26.5% of total labor input. These were done in unskilled labor practices such as manual harvesting, bagging and transportation of the yield. From Table (16) it can be noticed that the highest requirement of migrant labor was in manual harvesting, transportation, hand weeding and threshing.

The contributions of male and female were shown in Fig (8). One can notice that female labor input was one fifth of male labor input, and female input was twice in legumes than in cereals.

Finally, it can be concluded that the introduction of mechanical harvesting displaces women and children from agricultural operation and at the same time, the introduction

Contribution of Male and Female as a Percentage of Total Hours Input in Farm

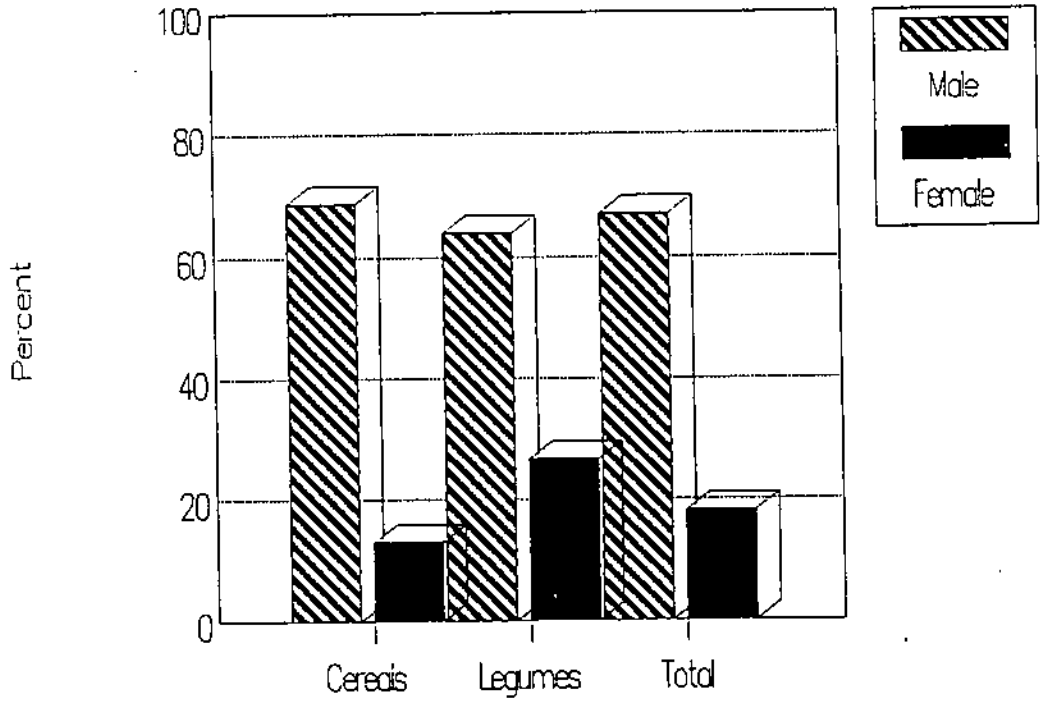


Fig (8)

of fertilizer had slightly increased the women household input as well as increased the requirement for hired labor. But the adoption of herbicide had a negative impact on women and child labor and at the same time increased the requirement for hired labor.

4.6.2 THE CONTRIBUTION OF LABOR FORCE IN CEREAL CROPS

The contribution of labor force in cereals crops for different activities were presented in Table (18). It was shown that the highest number of hours was spent on harvesting operations that made up about 45% of total hours spent on farm for cereals. The second highest number of hours was spent on hand weeding and transportation of the yield. It was also shown that 36% of household labor input was taken for harvesting of the crop. Table (19) shows that about 20% of total labor input for cereals was done by man from household and 32.8% provided by household members. About 67% of hours was hired. Local hired labor provided about 45% of total labor input.

4.6.2.1 THE TILLAGE OPERATIONS

Farmers who own tractors prepare their own fields and sometimes do tillage operations for relatives. 17 farmers in the sample own tractors, 10 of which were in zone 1. 86% of the sample had custom services, either from within or outside villages. Land preparation was on average performed by two cultivations for cereals. Primary tillage is performed from

Table (18)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Cereals Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	19	0	0	13	0	0	3	0	0	2	6.8
Seeding	8	6	8	19	0	0	5	0	0	0	6.6
Fertiliz	3	0	2	17	0	0	1	0	0	0	4.0
Weeding	12	42	41	10	0	0	4	1	0	12	13.0
Herbicide	3	0	0	1	0	0	1	0	0	0	0.9
Rodent	2	0	1	0	0	0	0	0	0	0	0.5
Mechanical	26	0	4	6	0	0	32	0	0	5	10.2
Manual.H	10	36	28	16	0	100	25	83	75	45	35.1
Threshing	0	0	0	4	0	0	7	2	2	7	3.3
Winnowing	1	6	4	0	100	0	6	4	8	0	2.6
Bagging	3	2	3	1	0	0	4	0	1	4	2.3
Transport	13	8	8	12	0	0	12	11	14	24	14.4
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table (19)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Cereals Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	53	0	0	37	0	0	4	0	0	6	100
Seeding	24	5	10	55	0	0	7	0	0	0	100
Fertiliz	15	0	5	79	0	0	1	0	0	0	100
Weeding	17	18	26	15	0	0	2	0	0	21	100
Herbicide	60	0	0	27	0	0	13	0	0	0	100
Rodent	79	1	20	0	0	0	0	0	0	0	100
Mechanical	49	0	3	11	0	0	27	0	0	11	100
Manual.H	6	6	7	9	0	0	6	17	21	29	100
Threshing	1	0	0	23	0	0	17	4	7	49	100
Winnowing	8	12	14	0	4	0	18	11	32	2	100
Bagging	21	5	10	5	0	0	15	1	3	40	100
Transport	17	3	4	16	0	0	7	6	9	37	100
% of Hours for Labor Group	19.1	5.5	8.2	18.9	0.1	0.1	8.5	7.4	9.9	22.2	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women, Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

April until August. The main purpose is to break down the soil surface in order to increase infiltration and store more moisture in the soil profile (Jaradat,1988).

Secondary tillage refers to field operation after primary tillage to prepare the soil for seedbed. The moldboard is the most popular for primary tillage and disk harrow for the secondary tillage. Small portion of farmers used chisel plows, duck foot, and other modern implements. From the sample about 60% of tillage operations were performed by moldboard plows and 20% were done by disk plows, and 10% done by conventional animals to perform tillage operations. were the remaining 10% used modern implements.

For animal tillage the main source of power is mule, and donkey. Only one farmer used bullock for tillage operations. Of those used animal tillage, about 80% of farmers owned their animal and the remaining percent hired this service. The main reason for using this kind of tillage is the slope of land which is not suitable for mechanization, and some time the land is suitable for mechanical tillage but farmers prefer to use animal tillage. They felt that the animal tillage conserves more soil moisture than mechanical tillage. This phenomenon is pronounced in zone 3. Figure (9) shows the tractor in front of field and a farmer used animal tillage to prevent loss of soil moisture. Particularly this practice was used for summer crops.

Animal Tillage Practices of Land Suitable for Tractorization

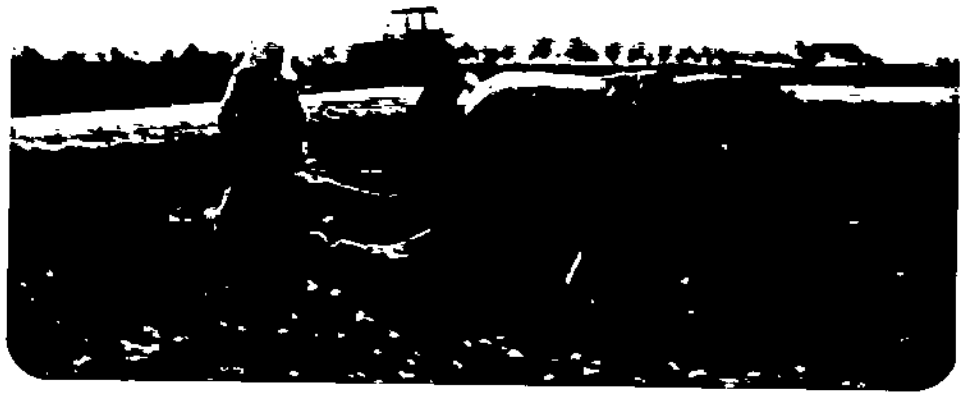


FIG (9)

From the study it was found that about 55% of hours input was done by farmer himself for a such operation.

Tillage operation is a men's task. Table (20) shows that 19% of men household labor input were devoted to tillage operation for wheat, whereas 13% of hours input by men from village were devoted to tillage operations. Also it was shown that tillage operations require 7.2% of total input hours for wheat. Table (21) shows that 54% of total hours input in tillage operation were done by men from household, whereas it was 35% of hired men from village, 4% hired men from outside and 2% migrant labor. Those migrants are permanent workers and trained by farmers to do these tasks.

Moreover were shown that 20% of hours input in wheat production were done by men from household, whereas it was 35% of from household members, and 40% from local hired labor. The migrant labor provided 22.9% of total labor input in wheat production in the surveyed villages.

For barley Table (22) shows that 2.9% of total input hours was devoted to tillage operations, and 39% of hours were done by hired men from village devoted to this operation. Table (23) shows that 83% of total hours for tillage were done by hired labor from village. Appendix (B) shows the comparison between zones for wheat and barley for all kinds of agricultural activities. It can be shown that 17.5% of total hours input in zone 1 were devoted to tillage, whereas it was 6% and 3% for zone 2 and zone 3 respectively. This high percentage for zone 1 was due to large areas

Table (20)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Wheat Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	19	0	0	13	0	0	4	0	0	2	7.2
Seeding	8	6	8	18	0	0	6	0	0	0	6.9
Fertiliz	3	0	2	17	0	0	1	0	0	0	4.4
Weeding	12	43	42	11	0	0	4	1	0	12	14.3
Herbicide	3	0	0	1	0	0	1	0	0	0	1.0
Rodent	2	0	1	0	0	0	0	0	0	0	0.6
Mechanical	26	0	4	6	0	0	38	0	0	5	11.1
Manual	10	35	28	17	0	100	15	83	70	45	31.7
Threshing	0	0	0	4	0	0	7	2	2	7	3.4
Winnowing	1	6	4	0	100	0	6	4	11	0	2.5
Bagging	2	2	2	1	0	0	5	0	0	4	2.3
Transport	13	8	8	12	0	0	13	11	16	24	14.7
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table (21)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Wheat Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	54	0	0	35	0	0	4	0	0	6	100
Seeding	24	5	10	54	0	0	7	0	0	0	100
Fertiliz	15	0	5	79	0	0	1	0	0	0	100
Weeding	17	18	26	15	0	0	2	0	0	21	100
Herbicide	62	0	0	28	0	0	11	0	0	0	100
Rodent	78	1	20	0	0	0	0	0	0	0	100
Mechanical	49	0	3	11	0	0	27	0	0	10	100
Manual	7	6	8	11	0	0	4	16	15	34	100
Threshing	0	0	0	24	0	0	17	3	5	51	100
Winnowing	9	14	16	0	4	0	17	9	28	2	100
Bagging	22	5	9	6	0	0	16	0	0	42	100
Transport	18	3	5	17	0	0	7	4	7	39	100
% of Hours for Labor Group	20.5	5.8	9.0	20.1	0.1	0.1	7.8	6.0	6.5	23.9	100

MH = Men from Household
WH = Women from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Table (22)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Barley Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	12	0	0	39	0	0	0	0	0	0	2.9
Seeding	18	0	22	45	0	0	0	0	0	0	3.7
Fertiliz	0	0	0	0	0	0	0	0	0	0	0.0
Weeding	0	0	0	0	0	0	0	0	0	0	0.0
Herbicide	0	0	0	0	0	0	2	0	0	0	0.3
Rodent	3	0	0	0	0	0	0	0	0	0	0.1
Mechanical	6	10	0	1	0	0	0	0	0	5	0.7
Manual	20	77	0	0	0	0	80	82	82	40	71.8
Threshing	1	5	0	1	0	0	2	2	2	12	2.6
Winnowing	0	0	0	0	0	0	5	4	5	0	3.8
Bagging	9	8	78	1	0	0	2	1	2	11	2.6
Transport	30	0	0	13	0	0	9	11	9	32	11.6
Total	100	100	100	100	0	0	100	100	100	100	100.0

Table (23)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Barley Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	17	0	0	83	0	0	0	0	0	0	100
Seeding	20	0	2	78	0	0	0	0	0	0	100
Fertiliz	0	0	0	0	0	0	0	0	0	0	0
Weeding	0	0	0	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	100	0	0	0	100
Rodent	100	0	0	0	0	0	0	0	0	0	100
Mechanical	36	24	0	8	0	0	0	0	0	32	100
Manual	1	2	0	0	0	0	18	26	51	2	100
Threshing	2	3	0	2	0	0	12	17	44	20	100
Winnowing	0	0	0	0	0	0	22	22	56	0	100
Bagging	15	5	10	3	0	0	10	10	30	18	100
Transport	10	0	0	7	0	0	12	22	37	12	100
% of Hours for Labor Group	4.1	1.6	0.3	6.3	0.0	0.0	15.8	22.5	45.1	4.2	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

cropped in zone 1 and high level of mechanization for other activities, whereas zone 3 was less mechanized and large number of hours input were needed to perform other activities. Therefore, tillage operations appear to be a small portion, whereas the inverse is time for barley due to manual harvesting of barley in zone 1, where the farmers own sheep or goats make manual harvesting in order to feed straw to the herd.

4.6.2.2 THE SEEDING OPERATION

There are two common methods in the sample for seeding the grain crops, namely broadcasting and drilling.

Broadcasting is done mostly by hand and the seed is covered by a tillage implement. Small portion of farmers use a grain drill. Those farmers own large holdings and are members in cooperatives.

Seeding of wheat and barley is men's task. About 85% of seeding hours for wheat was done by men (Table 21), whereas it was 98% for barley (Table 23). The seeding operation was mostly performed by broadcasting. Only 8% of farmers in the sample used drill. From the survey 75% of farmers used Hourani variety, 15% used other varieties, and only 6% used local variety. 40% of farmers used their own stock from the previous year, and 60% bought the seed from the cooperatives. The average quantity of seed per dunum is 10 Kg, ranging from 5 Kg to 20 Kg per dunum for wheat. 7 Kg per dunum is the average in zone 1 and 10 Kg for zone 2 and 17 Kg in zone 3,

respectively.

This variation is according to rainfall received, and the increase in the quantity of seed per dunum is to avoid the competition of weed with the wheat. For barley the average is 8 Kg of grain per dunum. Table (20) shows that seeding requires 6.9% of total labor input for wheat, whereas it is 15.6%, 9.7% and 2.3% for zone 1, zone 2 and zone 3 respectively. This variation is due to previous explanation for tillage.

4.6.2.3 THE FERTILIZER OPERATION

Phosphate, nitrogen, mixed fertilizer and manure are used by the farmers in the sample. Usually the chemical fertilizer is broadcasted and incorporated prior to sowing of wheat. In the sample 61% of the farmers had a fertilizer application. 52% of those used a mixed fertilizer with an average of 10 Kg per dunum. 25% used nitrogen fertilizer with an average of 8 Kg per dunum, 10% used phosphate with an average of 6 Kg per dunum. Moreover, 13% used nitrogen and phosphate individually with an average of 5 Kg per dunum of each. In the most cases phosphate or mixed fertilizer and seeding were spread at the same time. Since seeding requires skilled labor, farmers tend to hire people who have experience in seeding, or the broadcasting is done by the head of the household. Hired labor is used in fertilization for helping the farmer to carry the seeds and fertilizer in the field in the case of those operations done by farmers.

From pervious tables, it was shown that 4.4% of total labor input in wheat production was devoted to fertilization. Only 3% of household male labor was done in fertilization, whereas about 80% of hours spent in fertilization was provided by in village hired men. From the sample none of the farmers applied fertilizer to barley. Farmers reported the reason to be a limited response to fertilizer due to low rainfall.

For the comparison between zones, Table (2) in Appendix (B) shows that 92% of hours input for fertilization in zone 1 was done by hired labor, whereas it was 52% in zone 2 (Table 4) and 42% in zone 3 (Table 6), respectively.

About 13% of total hours for wheat production were taken for fertilizer application in zone 1, whereas it was 5.4% for zone 2 and 0.4% for zone 3, respectively.

6.4.2.4 THE HAND WEEDING OPERATION

The third most intensive labor task in wheat production is hand weeding. 14.3% of total hours in wheat production was spent in hand weeding. Women and children from household play the most important role in hand weeding. 44% of total hours spent in hand weeding was provided by women and children from the household. Women from household provided 5.8% of total hours in wheat production, 43% of those hours was done for hand weeding (Table 20). This task requires much patience (selecting the weed from wheat plants). This is why it is considered as a female's job. The contribution

of children was the highest because this task does not require skilled labor.

For the comparison between zones Appendix (B) shows that the percentage of total hours input for wheat was 17.3% for zone 3, 11.9% for zone 2 and 9% for zone 1, respectively. The highest figure in zone 3 was due to higher rainfall received and more weed grown. Two things were achieved in weeding: First reducing competition to the wheat plants because weed damages and reduces the yield of wheat from 5 to 30 percent as farmers reported. Second, weeding supports feed for animals. Migrant labor also contributed to hand weeding, and about 20% of weeds hours were done by migrant.

4.6.2.5 THE HERBICIDE APPLICATION

Chemical weed control in rainfed agriculture in Jordan is relatively new, most farmers use cultural practices for weed control by hand weeding or tillage operations. An estimated 18% of wheat farmers sprayed herbicide, mainly 2,4-D (Arabiat, 1982). The number of farmers using herbicide application is increasing, The explanation of this increase is due to the increase in cost of hand weeding. Arabiat (1982) showed that the cost of herbicide application was 0.52 J.D./D, whereas hand weeding cost was 2.0 J.D./D.

From the sample 42% of wheat farmers applied herbicide. The main source of herbicide application is JCO and custom services. Since the household labor of hand weeding is not paid in cash immediately, the custom services for herbicide

application which paid in cash, may be viewed as a constraint to the adoption of herbicide application. Herbicide application is a men's task. About 60% of hours needed to perform this operation was done by the household. This high percent is due to large farmers who own sprayer machines for their own work and for custom services. Also 38% of hours was hired, 11% of hours was hired from cooperatives (Table 21). Appendix (B) shows that 69% of hours for herbicide application in zone 1 was done by household, whereas it was 45% for zone 2, and 8% for zone 3, respectively. For Zone 1 which is characterized by large holdings,the previous explanation still applies.

4.6.2.6 THE RODENT CONTROL OPERATION

Also rodent control is a men's task. 100% of labor input (Table 21) was done by household labor. Of those 20% of hours input was provided by male children. This operation is done by walking throughout the field in order to cover by hand or legs the rat's holes first. In the second day if the hole reappears, poison was used. This operation was done 2 to 3 times every 10 to 15 days. Farmers reported that this was not serious problem when frost occurred at the beginning of the year. Therefore, not all farmers do rodent control. Farmers do such practices according to the density of animal's burrows in the field.

4.6.2.7 THE HARVESTING OPERATION

Farmers who own combines to harvest their own fields and do custom services for other farmers made up 6% of the total

sample. Other farmers received custom services of combines from the private sector.

Harvesting of wheat made up of 43% of total hours for wheat production. From this percent it was shown the importance of harvesting task in wheat production. Harvesting of cereals begins in the first week of June and continues until the end of July. The input of household labor was about 52% of hours input in mechanical harvesting. This large proportion of hours input by household is due to the fact that large holders have their own combines. Therefore, they provide high proportion of hours which are required to harvest their holdings. The mechanical harvesting made up 11% of labor input, whereas manual harvesting was 31.7% for wheat production. Table (20) Shows that 35% of women input for wheat was devoted to manual harvesting. Hired labor from village is pronounced in this operation based on a household agreement. The farmer agrees with head of poor families or landless farmers to harvest the crops manually with known percent from the grain yield and straw. The migrant labor is also engaged in manual harvesting. About 34% of hours input in this task was performed by migrant labor.

The manual harvesting is pronounced in zone 3. This is because the land is not suitable for mechanical harvesting. Sloppy land, size of cropped dunums were the main reasons. The manual harvesting in zone 1 and zone 2 is due to the fact that the farmers who own livestock harvest manually rather than with machines in order to benefit the from straw

to feeding their animals.

In general large holding farmers hire landless families in the case of manual harvesting, or they have the alternative to hire migrant labor.

Threshing was done by mechanical threshers, and it is migrant task, because it needs physical power. About 50% of hours provided for threshing was done by migrant labor, and other 50% was done by local hired labor from within and outside the villages. Very small percent of farmers perform winnowing task, and it is done by household members or by local hired men.

Some farmers hire women from a neighboring refugee camps to clean wheat from straw and seed of weeds. In Sareh village which adjusting to Husun refugee camp, Farmers rent their lands for one year in a follow period in the crop rotation wheat-legumes-summer crops in cash leases to palestinian families. In order to plant the land with summer crops, farmers report that the vegetables require experience and laborers who are available in palestianian families.

4.6.2.8 THE POST-HARVESTING OPERATION

The post harvesting task consists of activities starting with bagging to transportation. The percentage time for all post-harvesting task is 17% for wheat and 14% for barley, respectively. Those tasks are considered as men's task, because physical work was needed to throw the bags into the trucks. Since this operation did not require a skilled labor,

a high percent of migrant labor was engaged in this operation.

Transportation includes 1) the bags of grain from the field to the storage facility; 2) the straw and ; 3) the plants to the threshing floor in the case of hand harvesting.

4.6.3.0 THE CONTRIBUTION OF LABOR FORCE IN LEGUMES CROP

More than 60% of farmers in the sample planted legumes as a part of crop rotation. legume crops consist of lentil, vetch, chickpea and begia. While lentils are planted in three zones, vetch were planted in zone 1 and zone 3. Chickpea and begia were planted mainly in zone 3. Lentil and vetch were planted around mid December. One cultivation was normally performed during planting period. Deep ploughing was performed in late summer.

The contribution of different agricultural activities in legumes production is presented in Table (24). It was shown that manual harvesting requires 60% of total hours input in legumes production followed by hand weeding. Also it was shown that 84% of women work was provided to manual harvesting, whereas 28% of hours input by children involved in hand weeding.

Table (25) shows the contribution of labor force by men, women and children in legumes production. It shows that 33.4% of hours input in legumes production was provided by migrant labor. whereas household provided about 52% of total

Table [24]
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Legume Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	13	0	0	11	0	0	0	0	0	0	3.5
Seeding	6	1	3	5	0	0	2	0	0	0	2.2
Fertiliz	1	0	0	1	0	0	0	0	0	0	0.3
Weeding	15	9	28	16	0	0	19	43	0	12	13.9
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodant	3	0	1	0	0	0	0	0	0	0	0.6
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual.H	38	84	53	44	0	100	27	57	100	65	60.2
Threshing	0	0	0	8	0	0	29	0	0	8	4.4
Winnowing	2	2	5	0	100	0	0	0	0	0	1.5
Bagging	4	1	2	0	0	0	10	0	0	2	1.7
Transport	18	4	8	15	0	0	13	0	0	13	11.2
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table [25]
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Legume Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	57	0	0	42	0	0	0	0	0	1	100
Seeding	42	13	13	30	0	0	2	0	0	0	100
Fertiliz	52	7	5	33	0	0	3	0	0	0	100
Weeding	17	16	21	16	0	0	3	0	0	26	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodant	81	2	18	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual.H	10	37	9	10	0	0	1	0	0	34	100
Threshing	1	0	0	25	0	0	16	0	0	57	100
Winnowing	20	31	34	0	9	0	0	0	0	6	100
Bagging	32	9	12	1	0	0	15	0	0	31	100
Transport	25	10	7	18	0	0	3	0	0	36	100
% of Hours for Labor Group	15.4	26.4	10.4	13.4	0.1	0.1	2.4	0.1	0.0	31.4	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

hours.

Also 37% and 34% of hours input in manual harvesting were done by women from household and migrant labor, respectively. The contribution of labor force in each agricultural operation. Also the contribution of each activity form the total hours input for lentil, vetch, chickpea and begia in three different zones are presented in appendix (C). It shows that 30.7%, 61.6%, and 69.5% of total hours for legumes production were done in manual harvesting for zone 1, zone 2 and zone 3, respectively.

Also it was shown that the household provided 83.5%, 42.3% and 60% of total hours spent in lentil production for zone 1, zone 2 and zone 3, respectively. The same results were obtained for vetch, chickpea and begia.

For the simplicity lentil planted in the sample is presented in the analysis. In the same fashion this could be done for vetch, chickpea and begia.

4.6.3.1 THE TILLAGE OPERATIONS

The contribution of labor in tillage operations of legumes is similar to cereals. One cultivation is normally performed during mid-December by using disk harrow to cover seeds. 20% of farmers planting legumes had two cultivations by using moldboard plow first followed by disk harrow.

4.6.3.2 THE SEEDING AND FERTILIZATION

Lentils are planted at mid-December. About 81% of farmers used their own stocks, and others bought their seeds

from the market. 71% of farmers planted lentil by mid-December, 14% planted lentil at the first week of January, and others at late of November. Five farmers in the sample used drill for lentil seeding. One of those farmers reported that the small cropped areas of lentil and cereals and the cash payment to the cooperatives did not encourage him to use drill again.

The mixed fertilizer and phosphate fertilizer was broadcasted at the same time with seeds and this operation is similar to those of cereals.

About 23% of legumes farmers applied fertilizer. Some other farmers reported that fertilizer does not have any impact on the yield. One farmer in the sample reported that he used herbicide for lentil crops, about 44% of legumes farmers hired labor to perform those operations, and others were dependent on themselves and on their household members to perform those operations. From Table (26) it was shown that 2.25 of total hours for lentil was involved in seeding and fertilization, also a very small portion of hours input from labor groups was devoted for seeding and fertilization.

Male and female children help the farmers by carrying seeds through the fields. Rodent can cause damage to yield. This damage was estimated to be 5-10% of yield.

4.6.3.3 THE HAND WEEDING OPERATION

As it can be seen from Table (26), hand weeding for lentil crop requires on the average about 14 of total hours

spent in growing lentil. Table (27) shows that household labor contribution was 50% of total time spent to this activity. The hand weeding of lentil was split between household labor, migrant labor and in-village hired labor. It is concluded that hired labor was important in terms of hours spent in weeding activities.

4.6.3.4 THE HARVESTING OPERATION

The mechanical harvesting of legumes were done by only two farmers in the sample. One of those used his own combine and used it to harvest chickpea, and the other used self-propelled one axle mower. This farmer employed permanent migrant laborers and trained them for harvesting operations. Therefore, labor input in mechanical harvesting of legumes was divided into both household and migrant labor.

Table (27) shows that the average time devoted to hand harvesting was 61.3% of the total time spent for lentil crop. Lentils are harvested in the second half of May. Farmers reported that lentil should be harvested in a short period of time to prevent losses. So they were forced to hire labor in order to perform the operation in a appropriate time. Because this operation does not need a skilled labor, the contribution of migrant labor was 36% of total time spent in this task. Farmers reported that they didn't face any problem to hire those workers. But some farmers faced a problem to manage the labor in the field. The average number of those workers in the field was about 10 workers. One worker can

Table (26)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Lentils Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	10	0	0	9	0	0	0	0	0	0	2.7
Seeding	5	1	3	5	0	0	2	0	0	0	1.9
Fertiliz	1	0	0	1	0	0	0	0	0	0	0.3
Weeding	16	7	32	16	0	0	19	43	0	12	14.1
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	3	0	1	0	0	0	0	0	0	0	0.5
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual	39	87	48	46	0	100	28	57	100	65	61.3
Threshing	0	0	0	8	0	0	28	0	0	8	4.5
Winnowing	3	2	6	0	100	0	0	0	0	0	1.7
Bagging	4	1	2	0	0	0	10	0	0	1	1.6
Transport	19	3	7	15	0	0	13	0	0	13	10.8
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table (27)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Legume Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	48	0	0	51	0	0	0	0	0	1	100
Seeding	37	8	16	36	0	0	3	0	0	0	100
Fertiliz	53	0	5	37	0	0	4	0	0	0	100
Weeding	15	14	21	17	0	0	4	0	0	29	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	79	2	19	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual	8	37	7	11	0	0	1	0	0	36	100
Threshing	0	0	0	27	0	0	17	0	0	56	100
Winnowing	20	31	34	0	9	0	0	0	0	6	100
Bagging	32	9	13	1	0	0	16	0	0	28	100
Transport	23	7	6	20	0	0	3	0	0	41	100
% of Hours for Labor Group	13.2	26.3	9.3	14.6	0.2	0.1	2.7	0.2	0.0	33.4	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

harvest by hand about one half dunum or less slightly. Also the women from the household were considered high contributors. 37% of hours input in manual harvesting and about 87% of women input were used in lentil production. The farmers who were unwilling to pay in cash for labor, they used household members to harvest the crops.

4.6.3.5 THE POST-HARVESTING OPERATION

The post-harvesting operation begins with activities from threshing to transportation of the yield. Table (26) shows that the post-harvesting task requires 18.6% of the total input hours in lentil production.

Threshing usually was done by using mechanical threshers. This operation was done in all cases by hired labor. 56% of hours provided by migrant labor and 44% was done by local hired labor. Winnowing seems to be men's task, but cleaning seems to be women's task (Table 27). Bagging seems to be men's task with some exception of those women who work jointly with their husbands. Transportation is more likely to be men's task. This is of course, reflecting the high percentage of men contribution, which amounted to 89% of total hours of transportation done by man.

Concluding from the section on agricultural production, one can notice that every body who lives in rural areas including young and old people has a role in agricultural production. But every one is allocated a definite time for contribution in a different part of production cycle.

Table (18) and Table (24) shows the requirements of

different agricultural tasks from the total hours input in cereals and legumes respectively. It can be shown that the manual harvesting of legumes is twice the requirement of cereal harvesting. It was also shown that the impact of new technology in term of hours input was 10% and 35% of total input hours for mechanical and manual harvesting respectively in cereal production.

When the farmers use mechanical harvesting then manual harvesting, threshing and winnowing will not made. Also when the farmer uses herbicide application he will not be involved in hand weeding, which forms 13% of hours spent in cereal production.

The contribution of labor groups in cereals and legumes production as a percentage of total hours are presented in (Fig 10). It was shown that the women from household provide twice hours than man from household in legumes production, whereas it is opposite in cereals. Moreover, cereals is more dependent on local hired labor than legumes, also labor from outside villages is more engaged in cereal than legumes.

Migrant labors are more engaged in legumes than in cereals. Therefore, men's and women's contribution in agricultural production tend to be complementary, whereas men's task are mainly the ones using machines or any task which needs physical strength.

Women's tasks are mainly the ones that need a lot of patience like weeding and manual harvesting. Therefore to minimize the negative effects of mechanization it should be

Comparison in Contribution of Labor Groups as a Percentage of Total Hours Spent for Cereals and Legumes in the Sample

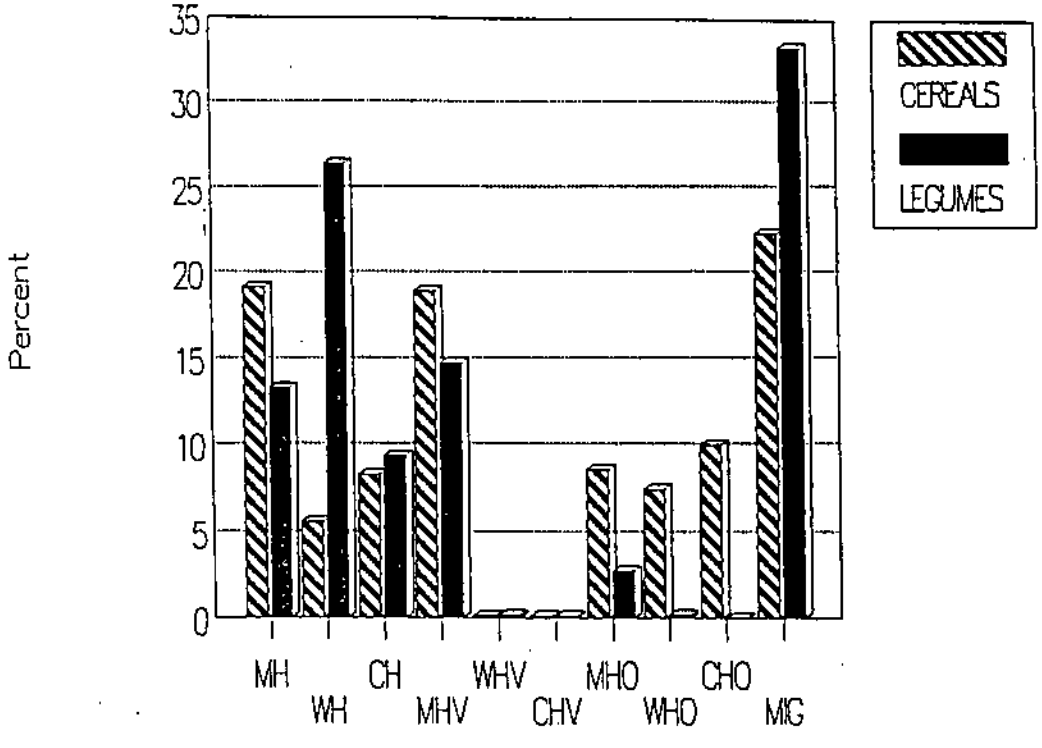


FIG (10)

aware that women's input and local hired labor input in manual harvesting of wheat and lentil crops are very important and contribute about 60% of total hours spent to perform this activity. Hence any mechanization will likely to eliminate 60% of hours spent by women and local hired labor . A major important point is that women's and local labor contribution in agricultural production is more likely to diminish as well as their earning opportunities if other alternative are not offered to them.

Therefore, the approach of appropriate technology is recommended by oriented to the most immediate and enormous problems of food, employment and self reliance were the capital intensive technologies should be used when they are only effective mean of exploiting the country's physical resources.

4.7.0 CALENDAR FOR LABOR GROUPS IN FIELD CROPS

Changing availability and allocation of household labor as well as hired labor on the labor market play a dominant role in agricultural production. Rainfed agricultural labor market is characterized by highly seasonal demand as well as relatively low labor productivity. Small holding size and labor replacing technologies caused many agricultural laborers to leave rural areas and migrate to cities. Therefore, agricultural work is increasingly carried out by women and the elderly aged, who are unable to find other employment opportunities.

Advanced technologies and labor saving technologies are usually of interest for small and large holding farmers. Such technologies are made available to farmers by custom services. Therefore, agricultural work is highly dependent on hired labor. The question remains concerning the impact of technologies on employment calendar of families and hired labor, due to the fact that the unskilled labor seems to be becoming less available, which leads to changing the cropping system. For instance the high costs and the problem associated with manual harvesting in legumes, discouraged farmers to grow crops. Therefore, it is important to build up employment calendar for household labor and hired labor.

To capture time allocated by each labor group, farmers were asked about the time of performing the agricultural tasks and who have done those tasks, numbers of hours as well as number of days and number of worker were reported for each task and for each labor group. The calendar for labor groups in field crops in the sample are presented in Table (28). It is shown that the peak season for agricultural labor starts from March until the end of June. The highest hours input by men household and off-village hired men is in June, whereas women household,children, from village hired labor and migrant is in May. November and December are characterized by increasing the input hours by hired labor, which is needed for the land preparation, seeding and fertilization. For the comparison between zones in the calendar of labor input the tables (1 to 9) were presented in appendix (E). It shows

that the peak season for zone 1 was earlier than in zone 2 and zone 3, respectively.

The calendar for labor groups in wheat production is presented in Table (29). It shows that labor input by men from household scattered all the year round, whereas hours input by women extended from February to June. 38% and 45% of hours input from men and women from household respectively were done in June. Table (30) shows the labor input calendar for labor group in lentil production in the sample. It is shown that the peak season of labor groups is May, whereas more than 55% of hours input from household was done in this month. More than 95% of migrant labor hours was done in April to June. For the household labor input more than 80% of hours was done in March to June. For the comparison between zones in labor calendar for wheat and lentil production is presented in appendix (E). It Shows that there is a difference between zones, that zone 3 was more pronounced in hand weeding due to higher rainfall received. Therefore, more labor input in March was needed for wheat and lentil.

4.8.0 CALENDAR FOR AGRICULTURAL OPERATIONS

The proper timing of performing agricultural operations is an important means of improving yield through the efficiency of using labor. Table (31) shows the time schedule for agricultural operations and percentage of hours spent to perform those operations of field crops. It was

Table (28)

Percentage of Total Hours Spent by Labor Group for the Year Round for Fields Crops in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	HIGR
Jan.	4	1	0	1	0	0	1	0	0	0
Feb.	2	5	3	1	0	0	1	0	0	0
Mar.	11	18	22	14	0	0	7	0	0	5
Apr.	12	13	13	13	0	100	14	1	0	13
May.	14	33	32	17	0	0	14	1	0	58
Jun.	20	25	20	13	100	0	38	41	72	19
July	9	0	2	7	0	0	11	18	20	5
Aug.	3	0	0	7	0	0	4	12	8	1
Sept.	2	0	0	2	0	0	0	0	0	0
Oct.	7	0	3	10	0	0	4	27	0	0
Nov.	10	4	3	10	0	0	2	0	0	1
Dec.	4	2	2	6	0	0	4	0	0	0
Total	100	100	100	100	100	100	100	100	100	100

Table (29)

Percentage of Total Hours Spent by Labor Group for the Year Round for Wheat Crops in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	HIGR
Jan.	0	0	1	1	0	0	1	0	0	0
Feb.	2	8	4	0	0	0	0	0	0	0
Mar.	14	23	29	7	0	0	1	0	0	0
Apr.	13	13	9	13	0	0	4	0	0	5
May.	4	2	2	3	0	0	3	0	0	6
Jun.	38	45	38	26	0	0	65	82	88	75
July	13	0	3	7	0	0	10	8	0	14
Aug.	1	0	0	4	0	0	9	10	12	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	2	0	5	22	0	0	3	0	0	0
Nov.	9	8	6	15	0	0	2	0	0	0
Dec.	3	2	1	2	0	0	3	0	0	0
Total	100	100	100	100	0	0	100	100	100	100

Table (30)

Percentage of Total Hours Spent by Labor Group for the Year Round for Lentils Crops in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	XIGR
Jan.	1	0	0	0	0	0	0	0	0	0
Feb.	0	2	1	0	0	0	0	0	0	0
Mar.	11	13	15	17	0	0	17	0	0	4
Apr.	10	12	12	1	0	100	2	43	100	11
May.	53	56	59	55	0	0	65	57	0	76
Jun.	11	14	9	7	100	0	12	0	0	8
July	2	0	1	9	0	0	0	0	0	1
Aug.	5	0	0	3	0	0	0	0	0	0
Sept.	0	0	0	1	0	0	0	0	0	0
Oct.	0	0	0	0	0	0	0	0	0	0
Nov.	4	0	1	1	0	0	0	0	0	0
Dec.	4	2	3	5	0	0	3	0	0	0
Total	100	100	100	100	100	100	100	100	100	100

Table (31)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Fields Crops in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	4	2	5	10	3	4	9	14	4	8	20	17
Seeding	14	4	0	0	0	0	0	0	0	4	33	46
Fertilizin	8	14	16	0	0	0	0	0	0	5	25	33
Weeding	0	12	64	22	3	0	0	0	0	0	0	0
Herbicide	0	7	57	35	1	1	0	0	0	0	0	0
Rodant.C.	0	3	60	37	0	0	1	0	0	0	0	0
Mechanic.H	0	0	0	0	11	87	2	0	0	0	0	0
Manual.H.	0	0	0	10	71	11	3	3	0	2	0	0
Threshing.	0	0	0	0	10	72	16	2	0	0	0	0
Winnowing	0	0	0	0	0	26	48	26	0	0	0	0
Bagging	0	0	0	0	35	58	7	0	0	0	0	0
Transport	0	0	0	0	37	57	6	0	0	0	0	0
Task %	3	2	9	7	15	25	6	5	1	3	11	13

shown that 25% of total hours in field crops was done in June , 15% in May and 12% was done in December. Tillage operations are performed all year round and are concentrated in April for primary tillages when wheat-fallow rotation is practiced. About 14% of hours for tillage were done in August. It was 20% and 17% for December and November respectively. Timing of tillage is very important in rainfed areas in order to break down the soil surface to increase the infiltration and store more moisture in the soil profile. While seeding of field crops is extended from late October to the early of January, about 33% and 41% of hours of seeding was done in November and December respectively. Sowing date is the actual time seeds are placed in the soil, which is one of the most important factors affecting crops yield under rainfed areas. Farmers in rainfed areas learned by trial and error that the seeding of grain before sufficient rain is received is very risky. Because seeds may germinate in the absence of sufficient moisture and dry out. Fertilizer application extended from November to March, whereas it was mainly done in November and December. Hand weeding and herbicide application were done in March to April, whereas about 60% of hours in weeding and herbicide application was done in March.

Mechanical harvesting of field crops are mainly done in June in which 87% of hours input was done in this month. The manual harvesting extends from April to June, but it is mainly done in May (71% of hours).

The post-harvesting task extended from May to July, in which 72% of hours for threshing was done in June. 58% and 57% for bagging and transportation were done in June respectively.

For the between zone in the timing for agricultural operation were presented in Appendix (D), Tables (1 to 3). It shows as increase the rainfall received by zone the late of sowing date and fertilizer application.

4.8.1 TIME SCHEDULE FOR WHEAT PRODUCTION

Tillage operations for wheat production extended from April to January. Deep tillage occurs in April was and done by those practice wheat- fallow rotations. The highest number of hours input was done in November and December respectively.

The seeding of wheat start from October until the begging of January. Table (32) shows that the highest hours input was done in November until March. The phosphate fertilizer is relatively immobile in the soil. Therefore, it is in general applied prior to planting of wheat. In February and March half of nitrogen fertilizer is applied, and the second half is broadcasted and incorporated with soil at sowing date.

Weeding, herbicide application and rodent control were done in March to April. 90% of hours in mechanical harvesting was done in June, but the manual harvesting starts from the late of May until the end of June.

The post-harvesting tasks were done at mid of June until July. For the comparison between zones in timing of wheat, production practices were presented in Appendix (D). Tables (4 to 6) show the wheat production activities approximately happened at the same time in all zones.

4.8.2 TIME SCHEDULE FOR LENTIL PRODUCTION

The timing of tillage operation of lentil is similar to wheat. Table (33) shows the time schedule for agricultural operations for lentil in the sample. It shows that 29% of tillage hours performed in December at a time of sowing date by using disk harrow. The sowing date extended from November until January. But in general most of farmers were seeding lentil after the mid of December.

Small portion of farmers added fertilizer to lentil and perform the application at seeding date or added nitrogenous fertilizer in February to the early of March.

Hand weeding and rodent controls were mainly done in March, in which more than 60% of hours was performed in this month. The manual harvesting of lentil was performed in May. About 86% of manual hours was performed at this month. Post-harvesting task naturally happens in May and July.

For the comparison between zones in timing of lentil, production practices were presented in Appendix (D). In Tables (7 to 9). One can notice that there is a difference in seeding date between zones, the reason is that the rainfall

Table (32)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Wheat Crops in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	3	0	0	10	3	3	6	19	3	9	28	16
Seeding	3	0	0	0	0	0	0	0	0	7	53	38
Fertilizin	8	16	10	0	0	0	0	0	0	6	32	27
Weeding	0	20	64	16	0	0	0	0	0	0	0	0
Herbicide	0	5	59	35	1	0	0	0	0	0	0	0
Rodant.C.	0	4	56	40	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	8	90	2	0	0	0	0	0
Manual,H.	0	0	0	0	28	72	0	0	0	0	0	0
Threshing.	0	0	0	0	0	81	19	0	0	0	0	0
Winnowing	0	0	0	0	0	0	20	80	0	0	0	0
Bagging	0	0	0	0	2	91	7	0	0	0	0	0
Transport	0	0	0	0	2	91	7	0	0	0	0	0
Task %	2	3	8	6	3	37	5	5	1	4	17	11

Table (33)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Lentils Crops in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	6	0	0	4	2	4	8	16	7	8	15	29
Seeding	24	0	0	0	0	0	0	0	0	0	16	59
Fertilizin	5	15	15	0	0	0	0	0	0	0	5	59
Weeding	0	7	66	27	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0	0
Rodant.C.	0	5	61	34	0	0	0	0	0	0	0	0
Mechanic,H	0	0	0	0	0	0	0	0	0	0	0	0
Manual,H.	0	0	0	10	86	4	0	0	0	0	0	0
Threshing.	0	0	0	0	20	67	13	0	0	0	0	0
Winnowing	0	0	0	0	0	43	57	0	0	0	0	0
Bagging	0	0	0	1	82	16	1	0	0	0	0	0
Transport	0	0	0	1	82	16	1	0	0	0	0	0
Task %	4	1	8	6	33	14	5	4	2	2	6	16

received by zone is a determinant factor of seeding date, as well as farm size.

Calendar of hours spent in wheat and lentil production are presented in Fig (11). It shows that the peak season of wheat was in June at harvesting time, whereas the peak season for lentil was May. The second highest hours input for wheat is November at a seeding date and covering seed by tillage implements. This is done in December for lentil. The farmers practice wheat-lentil- fallow crop rotation. Seeding wheat first and after that broadcasting lentil.

4.9.0 LABOR REQUIREMENTS PER ONE DUNUM OF FILED CROPS

The main issues in the planning process is to determine the input-output coefficients. Therefore , to provide the planner for the requirements of labor force in term of hours for field crops, farmers were asked to determine the total number of worker and number of days as well as number of hours spent to perform specific agricultural tasks. To determine the requirement of labor per one dunum, total number of hours provided by each labor group for each agricultural task in the sample was taken and divided by the total number of dunums for that task, i.e. number of fertilized dunums does not necessarily equal the cropped dunums. By other means, the total hours input in each task was divided by the corresponding dunums. Harvested dunums was divided by mechanized and manual harvesting. The "

Calendar of Agricultural Activity as a Percentage of Total Hours Spent on Wheat and Lentil Production in the Sample

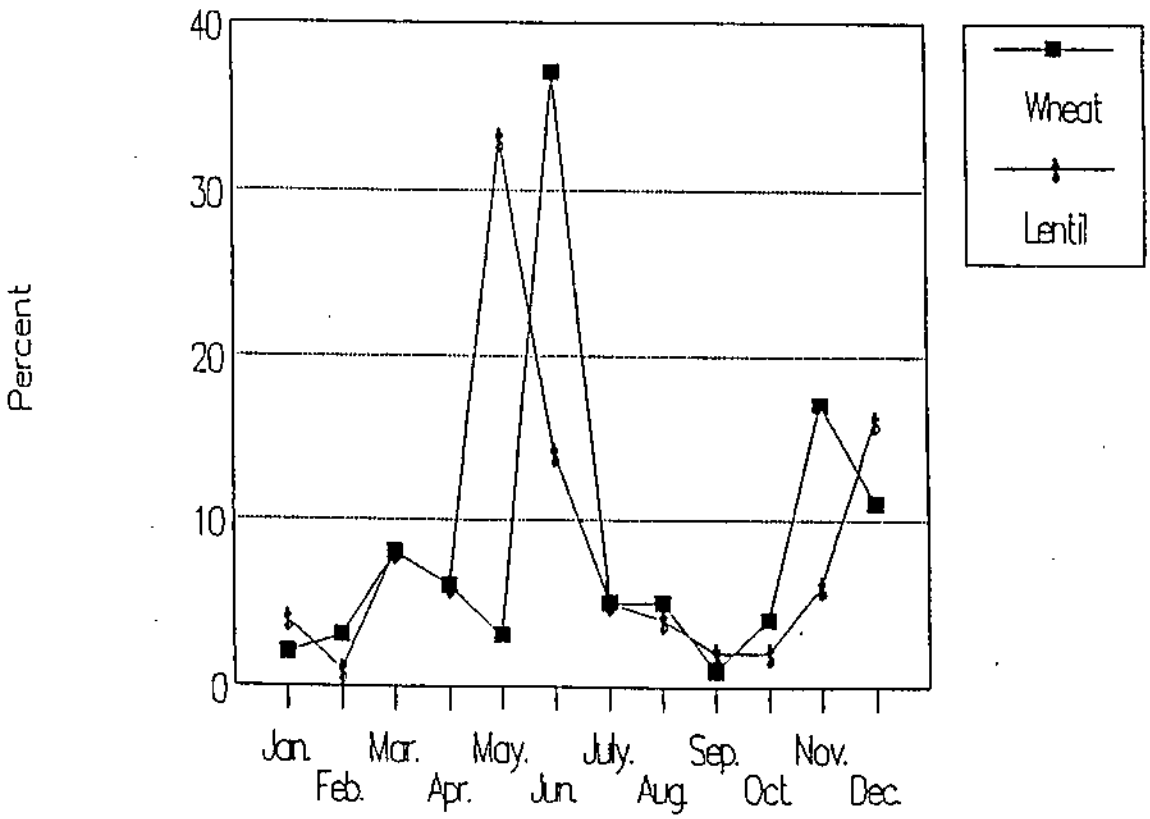


FIG (11)

dunum", one tenth of a hectare (0.1 ha), was chosen as the unit of land areas in the calculation, because it is the one most used by local farmers (Nordblom,1987).

There was a difference in the requirements per one dunum of labor from one crop to another. Also there were differences in manual and mechanical labor. The importance here is the hours input by labor groups, because the capacity of the machine is known for different agricultural tasks.

The requirements of hand labor is different according to methods of production and differences in the productivity of hand labor from one area to another.

For studies here, estimates of labor force is dependent on the age composition of agricultural rural communities. Therefore, not all household members can provide adult-equivalent labor, particularly in field work. Depending on the issues at hand , it may be worth to mentioning to convert labor input into an adult-equivalent measure (Norton, 1988). Therefore the manpower input equation is calculated as mentioned at the beginning of this chapter.

Rahahela (1989) estimated the production costs of cereals and legumes in Irbid per one dunum. the results of the study indicated that one dunum of modern wheat requires 1.18 hours, whereas the conventional method of wheat requires 10.3 hours. Another finding of the study was that one dunum of lentil requires 13.11 hours of manpower unit. Al-Kadi *et. al.* (1975) studied the production costs of field crops in Jordan. It was found out that the requirement per one dunum

of wheat for labor varies according to the method used. For mechanical tillage and combine harvester, the requirements per one dunum ranged from 0.3 to 1.33 hours, and it ranged from 11.76 to 1.12 hours for animal tillage and manual harvesting. Haddad (1986) indicated that one dunum of lentil requires 13 hours of work for hand pulling under normal conditions, whereas it requires 0.29 hours for grain combine harvester.

Labor requirement data are reported for six crops, namely wheat (Table 34), barley (Table 35), lentil (Table 36), chickpea (Table 37), vetch (Table 38) and begia (Table 39). Also for the comparison between zones the labor requirements for different field crops are presented in Tables (1 to 12) in Appendix (F). Tables are presented in a standard format which follows the production sequence. First labor requirements for mechanical tillage operation, seeding labor was reported next, fertilization labor third and so on. Twelve tasks were presented in the tables. But not all tasks were done by an individual farmer. Farmers have the choice to fertilize or not to fertilize, to use hand weeding or herbicide application, mechanical harvesting versus manual harvesting. Therefore, to determine labor requirement for one dunum of wheat for example, the method of production should be specified first before calculating the labor requirement per one dunum.

2.16 hours measured in manpower were needed to produce one dunum of wheat by using modern techniques (fertilizer and

Table (34)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Wheat Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.16	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.02	0.30	0.30
Seeding	0.07	0.02	0.03	0.16	0.00	0.00	0.02	0.00	0.00	0.00	0.30	0.27
Fertiliz	0.05	0.00	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.34
Weeding	0.32	0.32	0.47	0.27	0.00	0.00	0.04	0.01	0.00	0.38	1.81	1.32
Herbicide	0.04	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.06	0.06
Rodant	0.35	0.01	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.38
Mechanical	0.26	0.00	0.02	0.06	0.00	0.00	0.14	0.00	0.00	0.06	0.53	0.52
Manual	0.57	0.54	0.69	0.91	0.00	0.03	0.31	1.34	1.24	2.92	8.55	6.23
Threshing	0.01	0.00	0.00	0.35	0.00	0.00	0.24	0.04	0.07	0.73	1.43	1.36
Winnowing	0.19	0.29	0.33	0.00	0.09	0.00	0.36	0.20	0.59	0.05	2.08	1.16
Bagging	0.03	0.01	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.05	0.12	0.10
Transport	0.11	0.02	0.03	0.11	0.00	0.00	0.04	0.03	0.05	0.25	0.65	0.57
Total	2.15	1.20	1.69	2.27	0.09	0.03	1.20	1.61	1.94	4.46	16.63	12.63

Table (35)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Barley Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.04	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25
Seeding	0.06	0.00	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31
Fertiliz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.08	0.08
Rodant	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11
Mechanical	0.10	0.40	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.53	1.67	1.47
Manual	0.11	0.16	0.00	0.00	0.00	0.00	1.65	2.40	4.80	0.22	9.35	4.70
Threshing	0.01	0.02	0.00	0.01	0.00	0.00	0.06	0.09	0.22	0.10	0.49	0.29
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	1.71	1.71	4.29	0.00	7.71	3.86
Bagging	0.03	0.01	0.02	0.01	0.00	0.00	0.02	0.02	0.06	0.04	0.22	0.14
Transport	0.10	0.00	0.00	0.07	0.00	0.00	0.12	0.21	0.36	0.11	0.99	0.63
Total	1.07	0.59	0.03	0.67	0.00	0.00	3.65	4.44	9.73	1.00	21.18	11.84

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Table (36)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Lentils Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.12	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25
Seeding	0.07	0.01	0.03	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.19	0.16
Fertiliz	0.25	0.00	0.02	0.17	0.00	0.00	0.02	0.00	0.00	0.00	0.46	0.44
Weeding	0.78	0.73	1.11	0.89	0.00	0.00	0.19	0.03	0.00	1.51	5.24	4.08
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.64	0.02	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.70
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual	0.82	3.62	0.70	1.06	0.00	0.02	0.12	0.01	0.00	3.46	9.73	7.50
Threshing	0.00	0.00	0.00	0.13	0.00	0.00	0.08	0.00	0.00	0.26	0.47	0.47
Winnowing	0.35	0.53	0.59	0.00	0.16	0.00	0.00	0.00	0.00	0.09	1.72	0.96
Bagging	0.05	0.01	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.15	0.13
Transport	0.24	0.07	0.06	0.20	0.00	0.00	0.03	0.00	0.00	0.42	1.03	0.95
Total	3.32	5.00	2.70	2.65	0.16	0.02	0.47	0.04	0.00	5.80	20.06	15.65

Table (37)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Chickpea Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.87	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.99
Seeding	0.32	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.42
Fertiliz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	1.21	0.99	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	2.43	1.93
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.14	2.14
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual.H	1.33	1.75	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.60	5.89	3.46
Threshing	0.00	0.00	0.00	0.07	0.00	0.00	0.25	0.00	0.00	0.61	0.93	0.93
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bagging	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.54	0.41
Transport	0.50	0.75	0.50	0.20	0.00	0.00	0.00	0.00	0.00	0.60	2.53	1.81
Total	6.48	3.80	2.82	0.62	0.00	0.00	0.25	0.00	0.00	2.01	15.97	12.10

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Table (38)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Vetch Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	1.01	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	1.31	1.31
Seeding	0.30	0.11	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.39
Fertiliz	0.50	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.87
Weeding	0.69	1.16	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.83	1.56
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.47	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.51
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual	1.83	2.96	2.50	0.00	0.00	0.00	0.00	0.00	0.00	1.90	9.18	5.95
Threshing	0.08	0.00	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.39	0.56	0.56
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50
Bagging	0.09	0.02	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.16	0.30	0.28
Transport	0.65	0.36	0.18	0.04	0.00	0.00	0.00	0.00	0.00	0.19	1.42	1.11
Total	5.60	5.36	3.83	0.42	0.00	0.00	0.06	0.00	0.00	3.13	18.40	13.04

Table (39)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Begia Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.00	0.00	0.00	2.86	0.00	0.00	0.00	0.00	0.00	0.00	2.86	2.86
Seeding	0.86	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.14	1.50
Fertiliz	0.57	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43	1.00
Weeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	1.71
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual.H	4.57	6.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.43	8.00
Threshing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	1.29	1.29
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Bagging	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	1.71
Transport	2.29	3.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.71	4.00
Total	11.71	12.43	0.00	2.86	0.00	0.00	0.00	0.00	0.00	1.29	28.30	22.07

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

herbicide application including combine harvesting), whereas 11.68 hours were needed for one dunum of wheat by using conventional methods (table 34). Also 0.72 hour was required from men household in modern techniques, whereas it was 1.81 hours in conventional methods. Women from household provided zero and 1.21 hours in modern and conventional method, respectively.

Therefore, 12.63 hours of total manpower in table (35) does not reflect the reality, it should specify which tasks were chosen in the production process, and then calculating the labor requirement per one dunum.

Table (36) shows the requirement of one dunum of lentil production. Also the farmers have different alternatives to produce lentil (fertilization or not, weeding or not, rodent control or not). It shows that one dunum requires 5.0 hours of household women labor compared to 3,32 hours from men household.

One dunum of lentil requires 15.6 adult-equivalent hours if all agricultural tasks are done, and 11.57 hours if farmers do not perform hand weeding tasks. Women household provides 5.0 hour per one dunum of lentil, of which 4.35 hours were for hand weeding and pulling lentil. This figure shows that female is heavily engaged in non mechanized tasks. This could be done in the same manner for the other crops to determine labor requirement by tokening into consideration the kind of agricultural tasks performed for each crop.

4.10.0 COST OF PRODUCTION FOR DIFFERENT TECHNOLOGIES

Technological changes cannot be accomplished unless people are willing to change production methods. We know that all farmers do not employ the most modern technology at any point in time. This often results from the fact that the farmers frequently associate an increase in risk with a change in technology. Producer will not adopt a change in technology unless they expect that adoption will lead to a reduction in per-unit cost at the output which they expect to get. Singh (1975) found out that the total cost per acre shows a decreasing trend with increased level of farm mechanization. Also the physical productivity per acre of "HYV" was found to be higher on mechanized farm compared to farm dependent primary on traditional source of power.

A technological package is an idea to be applied but in most cases, technological packages are not adopted by farmers as a whole but in pieces or components or in cluster of components. There are many constraints that prevent the farmers to adopt such technological packages. Of those constraints, risk associated by adoption, for example seeding of wheat may be decided upon until the rainfall received and consequently determine the incoming technological components, such as fertilizer, herbicide and so on.

Enterprise budgets were constructed to achieve the cost of production. This method enables us to detect the cost of each components of technologies. Data were collected for each

crop grown in the farmer's field. The interviewed farmers were asked to answer the cost of each individual component of production method. The costs were calculated in two ways. The current market price for input and the opportunity cost of farm families labor. For those farmers who own machinery and implement, the opportunity costs of hiring custom services were taken. the reason for that is to avoid heterogeneity by ignoring the fixed cost and depreciation. The opportunity cost of land also was not accounted in the budgets calculation, due to the fact that there was a very little reliable information on land rents.

There is alternative methods of production for the same crops and also there is a difference in cost for each component between zones. Therefore classification the method of production according to level of technology is appropriate to obtain the cost of alternative methods. Moreover, classification according to rainfall received to show the practices pronounced for each zone were done.

Cost and return per one dunum of wheat planted in zone 3 is presented in Table (40). It is shown that there are different alternative methods of production and the cost of each alternative component of technological packages was shown.

The cost of production of the old traditional methods (animal tillage, weeding, manual harvesting) is 2.6 times the cost of advanced technological level. Table (40) shows that

Table (40)

Cost and Return of One Dunum of Wheat at Different Levels of Technology in Zone 3, in the Sample

(0.01 J.D)

		level.1		level. 2		level. 3		level. 4		level.5		level.6	
		AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD
	Yield/Kg	158	46	156	5	197	63	159	10	164	28	167	27
Return..	Grain/P	1801	541	1818	82	2341	771	1905	123	1968	332	1993	333
	Straw/P	475	130	472	72	643	266	0	0	0	0		
Cost...	Tillage1			0	0	107	17	100	0	100	0	110	20
	Tillage2			0	0	93	17	100	0	74	22	60	21
	Tillage3			0	0	20	23	38	22	22	27	20	24
	Animal.T1	388	22	375	25	0	0	0	0	0	0		
	Animal.T2	300	173	175	175	0	0	0	0	0	0		
	Animal.T3	100	173	0	0	0	0	0	0	0	0		
	Seeds	230	16	205	5	171	21	195	14	201	11	176	43
	Drill			0	0	21	25	0	0	0	0	56	5
	Labor.seeding	30	6	33	3	16	15	35	9	26	4	4	8
	Fertilization	37	40	25	25	66	42	0	0	75	21	85	18
	F.Labor	5	5	5	5	4	7	0	0	20	0	2	4
	Herbicide			0	0	20	24	15	30	30	24	52	7
	Hand weeding	165	98	125	125	74	97	40	69	42	52	0	0
	Rodant Control	3	4	0	0	3	7	5	9	4	5	4	5
	Combine.H	0	0	0	0	0	0	125	18	125	39	120	25
	Mower.H	0	1	300	0	307	42	0	0	0	0		
	Manual.H	400	0	0	0	0	0	0	0	0	0		
	M.Transport	113	38	63	13	134	39	19	6	19	4	18	7
	Man.Transport	113	38	53	13	159	41	14	2	19	4	16	7
	Threshing	113	41	150	0	155	40	0	0	0	0		
	G.Baggs	33	11	43	8	51	22	31	13	39	6	43	9
	S.baggs	55	18	40	0	52	19	0	0	0	0	0	0
	Sewing	19	7	20	0	26	10	15	7	17	2	16	4
	Total Return/D	2276		2290		2984		1905		1968		1993	
	Total Cost/D	2100		1610		1480		734		813		782	
	Net Return/D	176		680		1504		1172		1155		1211	

level.1 = animal tillage, hand weeding, manual harvesting
level.2 = animal tillage , hand weeding, mower harvesting
level.3 = mechanical tillage, mower harvesting
level.4 = mechanical tillage , combine harvester.
level.5 = mechanical tillage, fertilization, combine harvester.
level.6 = mechanical tillage, drill, fertilization, herbicide, combine harvester.
AVG = Average
STD = Standard Deviation
P = Paister (0.01 J.D.)

the animal tillage is still practiced in this zone due to land topography which makes it not suitable for mechanization. Hand weeding and manual harvesting is also practiced in this zone. Small areas of farm and rearing animals make farmers prefer such practices.

It has been shown that the most profitable technologies is to use mechanical tillage and mower harvester, which were reliable and practiced by the majority of farmers. The mower harvester enable farmers to benefit from straw, also the small size of mower harvester is suitable for sloppy land and fragmented farms.

Table (41) and Table (42) show the cost and return per one dunum of wheat at different levels of technologies for zone 2 and zone 3, respectively. It has been shown that the mechanical tillage and combine harvester were used at all levels of technology. For zone 2 the most profitable technology was to use combined packages, whereas in zone 1 using only mechanical tillage and combine harvester without applying fertilizer or herbicide was the most profitable technology. These results may indicate the additional returns by combined packages is less than additional cost (marginal cost more than marginal return). From the tables of the cost of production for wheat it has been found that an increase in the adoption of technological component implied a reduction in the cost of production, but not necessarily an increase in the net return, i.e. in the case of the use of old traditional practices, farmers get the straw , whereas in

Table (41)

Cost and Return of One Dunum of Wheat at Different Levels of Technology in Zone 2, in the Sample
(0.01 J.D)

		level.1		level. 2		level. 3		level. 4	
		AVG	STD	AVG	STD	AVG	STD	AVG	STD
	Yield/Eg	107	7	132	2	122	8	143	20
Return..	Grain/P	1232	93	1538	41	1448	94	1666	163
	Straw/P	0	0	0	0	0	0	0	0
Cost...	Tillage1	96	8	94	11	90	17	95	9
	Tillage2	66	21	61	24	70	17	83	20
	Tillage3	26	22	13	22	15	26	23	23
	Animal.T1	0	0	0	0	0	0	0	0
	Animal.T2	0	0	0	0	0	0	0	0
	Animal.T3	0	0	0	0	0	0	0	0
	Seeds	126	17	145	33	134	24	157	39
	Drill	0	0	0	0	0	0	58	4
	Labor.seeding	25	4	26	4	29	4	0	0
	Fertilization	0	0	73	28	73	28	73	8
	F.Labor	0	0	20	0	13	4	0	0
	Herbicide	0	0	0	0	50	0	45	9
	Hand weeding	0	0	0	0	0	0	0	0
	Rodant Control	1	2	3	4	4	2	3	4
	Combine.H	100	0	100	0	106	11	113	13
	Mower.H	0	0	0	0	0	0	0	0
	Manual.H	0	0	0	0	0	0	0	0
	M.Transport	17	4	16	4	16	4	20	7
	Man.Transport	18	4	17	5	16	4	23	11
	Threshing	0	0	0	0	0	0	0	0
	G.Baggs	25	0	28	8	26	4	29	4
	S.baggs	0	0	0	0	0	0	0	0
	Sewing	10	0	11	2	11	2	11	2
	Total Return/D	1232		1538		1448		1666	
	Total Cost/D	510		606		653		730	
	Net Return/D	722		932		795		937	

level.1 = mechanical tillage, combine
level.2 = mechanical tillage, fertilization, combine
level.3 = mechanical tillage, fertilization, herbicide, combine
level.4 = mechanical tillage , drill, fertilization,herbicide, combine
AVG = Average
STD = Standerd Deviation
P = Paister (0.01 J.D.)

Table (42)

Cost and Return of One Dunum of Wheat at Different Levels of Technology in Zone 3, in the Sample

(0.01 J.D)

		level. 1		level. 2		level. 3		level. 4		Level. 5	
		AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD
	Yield/Kg	115	4	92	8	86	6	85	8	100	4
Return..	Grain/P	1325	75	1055	76	1030	70	997	118	1133	85
	Straw/P	0	0	0	0	0	0	0	0	0	0
Cost...	Tillage1	70	0	93	13	90	10	80	14	90	14
	Tillage2	55	15	45	5	43	18	40	8	63	26
	Tillage3	0	0	10	17	0	0	13	19	17	24
	Animal.T1	0	0	0	0	0	0	0	0	0	0
	Animal.T2	0	0	0	0	0	0	0	0	0	0
	Animal.T3	0	0	0	0	0	0	0	0	0	0
	Seeds	110	10	115	13	108	18	89	29	107	19
	Drill	0	0	0	0	0	0	0	0	50	0
	Labor.seeding	19	6	25	4	20	0	25	4	3	5
	Fertilization	0	0	0	0	0	0	40	8	33	47
	F.Labor	0	0	0	0	0	0	7	5	0	0
	Herbicide	0	0	0	0	50	0	17	24	17	24
	Hand weeding	250	50	0	0	0	0	0	0	0	0
	Rodant Control	3	3	0	0	0	0	0	0	2	2
	Combine.H	100	0	106	11	113	13	117	12	97	5
	Mower.H	0	0	0	0	0	0	0	0	0	0
	Manual.H	0	0	0	0	0	0	0	0	0	0
	M.Transport	18	8	13	3	15	0	17	9	15	0
	Man.Transport	22	4	16	4	18	3	17	9	15	0
	Threshing	0	0	0	0	0	0	0	0	0	0
	G.Baggs	20	0	24	2	25	0	25	0	25	0
	S.baggs	0	0	0	0	0	0	0	0	0	0
	Sewing	10	0	10	0	10	0	10	0	10	0
	Total Return/D	1325		1055		1030		997		1133	
	Total Cost/D	675		456		490		495		543	
	Net Return/D	650		599		540		501		590	

level.1 = mechanical tillage, hand weeding, combine
level.2 = mechanical tillage, combine
level.3 = mechanical tillage, herbicide, combine
level.4 = mechanical tillage, fertilization, combine
level.5 = mechanical tillage, drill, fertilization, combine
AVG = Average
STD = Standard Deviation
P = Paister (0.01 J.D.)

modern practices the straw is free for animal rearers. Therefore small farmers prefer to use traditional methods as a source of additional income. Farmers who own livestock are unwilling to lose straw, which is use to feed animals and to pay in kind. Table (43) shows the cost of production per one dunum of lentil in different zones in Jordanian Dinar (J.D) (0.01 J.D.). One can show that the most profitable technique was mechanical tillage, drilling, fertilizer application. The minimum input cost was seeding the lentil and never see the field until the harvesting period.

Lentil technology indicated as increase the cost of technological components there is an increasing in total return and net return also increases.

Table (44) shows the cost and return for barley, chickpea, and vetch under different levels of technological alternatives of production. The low net returns of those crops show why farmers are unwilling to plant those crops and decreasing planting area year by year of those crops. The farmers plant those crops as a part of crop rotation and feeding of farm animals.

Table (43)

Cost and Return of One Dunum of Lentils at Different Levels of Technology at Different Zones

(0.01 J.D)

		level. 1 500mm		level. 2 500mm		level. 3 500mm		level. 4 350mm		level.5 350mm		level.6 250mm	
		AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD
	Yield/Eg	103	19	146	4	140	25	108	16	100	18	84	9
Return..	Grain/P	1863	338	2688	194	2512	457	1915	280	1744	253	1498	152
	Straw/P	617	85	995	119	730	168	648	147	570	147	500	89
Cost...	Tillage1	0	0	100	0	106	16	96	8	84	20	77	12
	Tillage2	0	0	70	17	81	32	66	12	46	23	36	20
	Tillage3	0	0	26	28	19	28	19	25	8	16	0	0
	Animal.T1	400	41	0	0	0	0	0	0	0	0	0	0
	Animal.T2	267	189	0	0	0	0	0	0	0	0	0	0
	Animal.T3	133	189	0	0	0	0	0	0	0	0	0	0
	Seeds	345	32	283	49	307	39	233	42	214	51	186	61
	Drill	0	0	58	4	0	0	0	0	0	0	0	0
	Labor.seeding	23	5	0	0	33	9	30	3	32	9	38	8
	Fertilization	0	0	63	16	11	31	52	10	0	0	10	20
	F.Labor	0	0	3	4	2	6	17	4	0	0	0	0
	Herbicide	0	0	0	0	0	0	0	0	0	0	0	0
	Hand weeding	253	5	175	179	177	131	205	121	48	62	40	58
	Rodant Control	3	5	8	8	6	11	10	11	0	0	4	4
	Combine.H	0	0	0	0	0	0	0	0	0	0	0	0
	Mower.H	0	0	0	0	0	0	0	0	0	0	0	0
	Manual.H	500	82	500	71	561	105	520	117	560	80	470	60
	M.Transport	78	16	90	39	117	56	95	33	93	44	70	19
	Man.Transport	113	19	96	34	133	46	105	24	101	44	75	16
	Threshing	123	21	124	33	168	63	160	58	158	58	109	27
	G.Baggs	28	5	44	12	34	7	29	5	31	10	25	0
	S.baggs	37	5	65	17	46	16	40	8	36	5	38	4
	Sewing	20	0	30	10	20	6	24	5	19	7	18	4
	Total Return/D	2480		3683		3242		2563		2314		1998	
	Total Cost/D	2325		1734		1821		1701		1431		1196	
	Net Return/D	155		1949		1421		863		883		802	

level.1 = animal tillage, hand weeding, manual harvesting
level.2 = mechanical tillage , drill, fertilization, manual harvesting
level.3 = mechanical tillage, hand weeding, manual harvesting
level.4 = mechanical tillage, fertilization, manual harvesting
level.5 = mechanical tillage, manual harvesting.
AVG = Average
STD = Standard Deviation
P = Paister (0.01 J.D.)

Table (44)

Cost and Return of One Dunum of Barley, Chickpea and Vetch at Different Levels of Technology in Different Zones

(0.01 J.D)

		Barley level .1 250mm		Barley level. 2 250mm		Chickpea level .1 All Zone		Vetch level. 3 500mm		Vetch level.4 500mm		Vetch level.4 250mm	
		AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD	AVG	STD
	Yield/Kg	121	15	116	12	89	7	121	10	133	15	111	9
Return..	Grain/P	967	125	931	95	1669	199	1100	100	994	111	875	83
	Straw/P	350	41	0	0	0	0	650	150	425	43	325	43
Cost...	Tillage1	70	24	92	12	100	14	0	0	113	22	71	2
	Tillage2	43	5	50	8	70	17	0	0	75	26	45	5
	Tillage3	0	0	13	19	0	0	0	0	15	26	10	17
	Animal.T1	0	0	0	0	0	0	400	0	0	0	0	0
	Animal.T2	0	0	0	0	0	0	400	0	0	0	0	0
	Animal.T3	0	0	0	0	0	0	200	200	0	0	0	0
	Seeds	56	18	67	9	340	105	190	10	181	32	105	9
	Drill	0	0	0	0	0	0	0	0	0	0	0	0
	Labor.seeding	27	9	23	2	30	12	23	3	30	9	26	15
	Fertilization	0	0	0	0	0	0	0	0	0	0	0	0
	F.Labor	0	0	0	0	0	0	0	0	0	0	0	0
	Herbicide			17	24	0	0	0	0	0	0	0	0
	Hand weeding	33	47	0	0	75	130	0	0	0	0	0	0
	Rodant Control	0	0	5	4	1	2	0	0	2	2	1	2
	Combine.H	0	0	100	0	0	0	0	0	0	0	0	0
	Mower.H	0	0	0	0	0	0	0	0	0	0	0	0
	Manual.H	433	125	0	0	313	74	400	100	413	114	550	50
	H.Transport	48	22	13	2	88	38	88	13	65	21	50	0
	Man.Transport	57	26	17	2	88	38	88	13	65	21	56	11
	Threshing	87	33	0	0	74	43	110	10	125	43	113	13
	G.Baggs	23	2	25	0	20	12	23	3	29	2	25	0
	S.baggs	33	5	0	0	0	0	40	0	40	0	38	4
	Sewing	17	5	10	0	8	4	20	0	20	0	20	0
	Total Return/D	1317		931		1669		1750		1419		1200	
	Total Cost/D	928		432		1205		1980		1172		1110	
	Net Return/D	389		499		464		-230		247		90	

level.1 = mechanical tillage, hand weeding, manual harvesting
level.2 = mechanical tillage, herbicide, combine harvesting
level.3 = animal tillage, manual harvesting
level.4 = mechanical tiliage , manual harvesting
AVG = Average
STD = Standard Deviation
P = Paister (0.01 J.D.)

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The objective of this study was to examine the impact of new technology on employment in the rainfed farming in Irbid. The specific objectives were to describe the current situation of technology in the study area and to find out the relative contribution of men, women and children of rural household and hired labor in agricultural production in order to test the hypothesis that the household labor is less than hired labor, to examine the socio-economic factors that explain labor input and adoption of technology, and to initialize a calendar for agricultural operations and for labor.

Farmers in Irbid governorate were interviewed concerning their contribution in the farming operations compared to hired and migrant labor. The data used to explain the impact of new technology on employment in the rainfed farming in Irbid, were obtained by personal interviews conducted in 1988/1989. A random sample of 120 farmers was selected. Primary and secondary data were used in this analysis. Cereals and legumes in three climatic zones were considered in this analysis. On the average, farmers in the survey were about 57 years of age (Ogleh,1988), (Arabiat,1982),(Rahahela,1989), have large families (11.5 persons). Also they have been farming most of their lives and

most of them can read and write.

The average age of the first marriage of male in the sample was 22.8 years, whereas it was 19.1 years of old for female. 11.2% of the sample was illiterate. They farm in an average size of nearly 279 dunums, about 87% of farmers planted wheat in the sample and 55% planted lentil. 75% of farmers in zone 1 practiced the wheat-fallow crop rotation, whereas in Zone 2 and zone 3 they are 72% and 76% of farmers practiced three year crop rotation of wheat-legumes-summer crops, respectively.

About 60% of farmers in the survey was a full time farmer. The income generated from the farm activities was 47% of household income.

Multiple regression Models were developed and used in this analysis to determine the factors affecting household and hired labor input, and adoption of technology. The results of the study indicated that the cropped areas, household size and health of farmers had a positive impact on labor input on farm, whereas numbers of student in the household, experience in farming and numbers of days off-farm had a negative impact on farm labor. Also the results indicated that the farm labor input in zone 2 was more than that of zone 3 and zone 1, respectively. Dunums cropped, risk preference, and members in agricultural cooperatives were statistically significant factors affecting the increase in the adoption of technology, whereas household size, number of males in household, absence from household and planting after

rainfall seemed to have negative impact on adoption of technology.

It can be concluded that the agricultural production in the rainfed areas of Irbid governorate is dependent on hired labor. The contribution of men, women and children is summarized in the following points. (Table 45)

1. Specialization of agricultural operations by household members, and by hired labor differ among crops and techniques used in accomplishing tasks. One can notice that tillage operation, fertilizer application and weed chemicals are usually done by men. But hand weeding and manual harvesting are mostly done by females.
2. female contribution is less than 20% of total hours input in agricultural production (Table 45),
3. Family contribution is less than 40% of total hours input in agricultural production,
4. The average input of women from household input is less than 35% from the total hours input by household labor and less than 15% of the total labor input in agricultural production,
5. Women provide 27% of all labor group for legume crops and 13% for cereals, compared to 62% and 69% provided by men respectively. legumes crops involve more non-mechanized operations in which women's contribution exceed those of men.
6. Hired labor is equally divided by within and outside villages in total agricultural production, whereas hired women from village is seldom.

7. Migrant labor provides 26.5% of total hours, whereas it is 32% in legumes compared to 22% in cereals
8. Local hired men's are mainly the ones using machines and their contribution is about 25% of hours input.
9. The local hired labor is more in cereals than in legumes, but migrant hired labor is more in legumes than cereals,
10. The migrant labor is mainly engaged in operations that need unskilled labor and physical work is recommended,
11. Considering total agricultural production, household labor provides 39% of the total worked hours, while the rest is provided by hired labor . It appears that in the village surveyed, the shortage of hired labor creates a problem for farmers.

Table (45) shows the contribution of men, women and children of household labor and hired labor as a percentage of time spent in farm agricultural production. It is shown that the household provides 49% of hours for lentil compared to 35% for wheat. Also migrant labor provides 33% of hours for lentil compared to 24% for wheat.

Time calendar for agricultural operations was also done. It shows that 33% and 45% of seeding hours were done in November and December, respectively. About 87% of mechanical hours was done in June, whereas 71% of manual harvesting was done in May.

Requirements of labor per one dunum of field crops has been calculated. Production practices have been divided to individual components to determine labor requirements

Table (45)

CONTRIBUTION OF MEN, WOMEN AND CHILDREN

AS A PERCENTAGE OF THE TOTAL TIME SPENT FOR

AGRICULTURAL PRODUCTION

Contribution	Wheat	Lentil	Cereals	legumes	Total
A. HOUSEHOLD					
MEN	20.5	13.2	19.1	15.4	16.9
WOMEN	5.8	26.3	5.5	26.4	13.5
CHILDREN	9.0	9.3	8.2	10.4	8.6
Sub-Total	35.3	48.8	32.8	52.2	39.0
B. HIRED IN VILLAGE					
MEN	20.1	14.6	18.9	13.4	17.3
WOMEN	0.1	0.2	0.1	0.1	0.1
CHILDREN	0.1	0.1	0.1	0.1	0.1
Sub-Total	20.3	14.9	19.1	13.6	17.5
C. HIRED OFF VILLAGE					
MEN	7.8	2.7	8.5	2.4	6.3
WOMEN	6.0	0.2	7.4	0.1	4.6
CHILDREN	6.5	0.0	9.9	0.0	6.1
Sub-Total	20.3	2.9	25.8	2.5	17.0
D. MIGRANT LABOR	23.9	33.4	22.2	31.4	26.5
E. GRAND TOTAL					
MEN	72.3	63.9	68.7	62.6	67.0
WOMEN	11.9	26.7	13.0	26.6	18.2
CHILDREN	1.1	9.4	18.2	13.0	14.8

Source: From surveyed villages of the Study.

according to production techniques, for instance 2.16 hours measured in manpower were needed to produce one dunum of wheat using a modern technique, whereas 11.68 hours were needed for one dunum by using conventional methods of production.

The cost of individual components of alternative agricultural technology has been obtained by personal

interviews. For wheat production it has been found that there is an increase in the adoption of advanced technological components, and there was a reduction in production cost but not necessarily an increase in the net return. For lentil an increase in the cost of technological alternatives implied an increase in the net return.

5.1 RECOMMENDATIONS AND FUTURE RESEARCH

Future research is needed in different regions of Jordan to determine the contribution of hired labor, migrant labor and household labor in agricultural production including cereals, legumes, summer crops, fruit trees and animal production activities

More research should be done concerning the costs of production and net returns to identify variations of land holdings and sizes by climatic zones.

Another kind of research should be geared toward the impact of technology on employment, output and income distribution in the long run, by decomposing the total change in employment between farm employing old production technology and farm employing new production technology, also the determination of employment elasticities and marginal rate of substitution between employment and farm technology is needed.

The input coefficient of labor in the field crops and schedule of agricultural operations have been achieved from this study. Therefore, optimal farm organization for

technology and labor can be done easily taken into consideration the farm size and climatic zones.

From this study the following recommendations can be drawn:

1. Labor is moving from agricultural sectors, leaving the agricultural tasks to be done by older aged and women or done by migrant labor. Therefore, great effort should be done to encourage young people to be engaged in the agricultural sector by improving the productivity of labor and increasing the marginal productivity of agricultural sector to be compete other sector for labor.
2. The Socio-economic change in agricultural sector shows that the farmers accepting technology as a substitute of farm laborers. The new technology seem to be more acceptable by farmers rather than migrant labor. The mechanization should be only take place if it is to fulfill specialized functions and facilitating the agricultural operation that cannot be carried out by existing labor .
3. The local hired labor and women's are the most labor groups well be worse-off technology. Therefore, there is a strong reasons for introduction appropriate technology which, cheap, simple to adopt and not dependent of the availability of migrant labor and foreign exchange. Also should be specifically to meet the social and economic requirements of the society.

4. Land reform or limiting holding size are recommended now a day's. Small holdings prevent farmers from using labor efficiently and also discourage many farmers from depending on farming as full-time jobs.
5. The main reason for continuations of using draft animals and manual harvesting in some agricultural operation is that the sloppy land which is inaccessible to tractors and combines. Therefore, appropriate technology for sloppy land is needed be to developed taking into consideration household labor, cropping system and negative effects associated with the adoption of such technologies.
6. More attention should be done to help farmers to make optimal farm organization by using suitable technological components satisfying the farm conditions of family labor and resource availability.
7. Labor shortage in the agricultural sector has become critical issues. This shortage is leading to an increase in the cost of agricultural operations, particularly for those operations which are performed manually like lentil harvesting. Both high cost and scarcity of labor used for harvesting are the main reasons for decreasing area planted of lentil. Therefore, developing and improving mechanical harvesters for lentils are needed taking into account the existing farm labor, especially women. In order to be utilized by farmers, the straw plays an important role in lentil production. Farmers consider the income from straw to be equivalent to that from grain. Therefore, appropriate

mechanical harvesters of lentil are recommended to be developed.

This research does not suggest that the Jordan should avoid intensive and labor saving technologies, but the labor saving technologies should be used only when they are the only effective means of exploiting a country's natural resources. A policy of " Walking on two legs", which emphasizes small scale labor intensive methods of production within the frame work of a long-term trend towards large scale intensive technologies.

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Appendix (A)

Table (1)

Number of Interviewed Farmers for Each Crops

Village	Rainfall	No.Farmer	Wheat	Barley	Lentil	Vetch	Chickpea	Begia
Nu'aima	200-300	17	14	2	3	0	2	0
Ramtha	200-300	18	10	6	5	4	0	0
Shajara	300-400	17	17	0	16	0	0	0
Sareh	300-400	17	17	1	14	0	1	0
Zahar	400-500	17	17	1	11	2	1	1
Samma	400-500	17	17	2	8	4	2	6
Rufer-Ased	400-500	17	15	0	8	4	7	3
Total		120	107	12	65	14	13	10

Source: Villages Surveyed in the Study

Table (2)

The Correlation Matrix between The Significant Explanatory Variables

	AGE	EDUC	EXPER	DOPERTD	FAMILY	STUDANT	ABSENCE	DAYWORK	COOPER	FHELTH	ZONE2	ZONE3
AGE	1.00000											
EDUC	-.49407	1.00000										
EXPER	.73750	-.51099	1.00000									
DOPERTD	-.16878	.17843	-.06810	1.00000								
FAMILY	-.07526	.07704	.01085	-.16846	1.00000							
STUDANT	-.40047	.26478	-.37886	-.06346	.54731	1.00000						
ABSENCE	.40166	-.07476	.28849	.08318	.05986	-.21311	1.00000					
DAYWORK	-.41612	.42903	-.33953	.10789	.14450	.16136	-.11526	1.00000				
COOPER	.01834	.10228	.07697	.20421	.02824	-.09699	.13195	.07023	1.00000			
FHELTH	-.32570	.31025	-.21860	.22183	.20003	.22138	-.15329	.19719	.19177	1.00000		
ZONE2	.37850	.08235	.34308	.05344	-.07772	-.06595	.17115	-.15319	.15864	.14752	1.00000	
ZONE3	-.13615	-.15414	-.21900	-.34965	-.05603	-.01118	-.19301	.04693	-.19298	-.11362	-.54777	1.00000

Appendix (A)

Table (3)

Full Model regression Results Between Source Of Labor Input And Explanatory variables

	AGE	EDU	EXPR	DUMM	FAMLY	MALE	SFEMLE	STUDT	ABSEC	DAYS	AGRIC	RISK	COOP	HELTH	WETPLNT	ZON2	ZON3	CONSTAT	R^2	F.test
F MEN	-4.62	2.90	3.22	0.39	29.98	-5.70	-3.66	-15.70	-4.46	-0.18	0.79	2.48	32.03	22.02	-24.49	125.90	126.60	124.5	0.48	5.51
t-value	-1.39	0.45	1.32	7.19	0.52	-0.05	-0.06	-1.66	-0.37	-1.17	0.94	1.02	0.61	0.47	-0.48	1.83	2.22			
F WOMEN	-4.50	-4.68	-0.49	0.02	-4.40	39.67	22.62	-10.74	11.81	-0.17	-0.34	1.62	11.30	35.76	-7.68	58.98	89.79	146.9	0.28	2.29
t-value	-2.28	-1.21	-0.43	0.57	-0.13	0.59	0.66	-1.91	1.65	-1.95	-0.68	1.13	0.36	1.27	-0.26	1.44	2.64			
F LABOR	-13.22	3.32	3.23	0.42	26.30	68.89	37.09	-34.25	14.72	-0.61	0.45	4.90	57.97	107.60	-106.2	251.25	289.15	99.0	0.36	3.38
t-value	-2.06	0.27	0.68	3.96	0.24	0.31	0.33	-1.87	0.63	-2.07	0.28	1.04	0.57	1.17	-1.08	1.89	2.17			
IN HIRED	-8.06	5.96	-0.65	0.57	51.55	-58.37	-31.62	-21.25	-10.04	-0.36	0.61	4.17	36.61	-66.21	-83.91	224.25	153.56	276.2	0.56	7.58
t-value	-2.05	0.78	-0.23	8.63	0.76	-0.43	-0.46	-1.90	-0.70	-2.00	0.62	1.45	0.59	-1.19	-1.40	2.76	2.27			
OFF HIRED	36.96	-31.33	-22.94	0.26	-46.52	40.34	20.41	-22.23	-32.92	0.21	3.35	-3.92	-25.35	292.54	317.00	137.90	-251.5	-1092	0.23	1.82
t-value	3.03	-1.32	-2.55	1.26	-0.22	0.10	0.06	-0.64	-0.74	0.38	1.09	-0.44	-0.13	1.69	1.70	0.55	-1.20			
LOCAL HIRED	28.89	-25.37	-23.60	0.82	5.03	-18.02	-11.20	-43.48	-42.97	-0.14	3.96	0.24	11.25	226.32	233.12	362.17	-97.97	-815.5	0.33	2.94
t-value	2.31	-1.05	-2.58	3.97	0.02	-0.04	-0.05	-1.23	-0.95	-0.26	1.27	0.03	0.06	1.28	1.23	1.41	-0.46			
MIG HIRED	6.52	8.91	-7.81	0.34	26.66	-25.28	-3.71	-23.88	-12.10	0.02	-0.27	-0.87	42.88	-29.00	-61.70	330.97	39.40	-180.6	0.48	5.61
t-value	1.68	1.18	-2.74	5.26	0.40	-1.90	-0.06	-2.16	-0.86	0.10	-0.28	-0.31	0.70	-0.53	-1.04	4.14	0.59			
T.HIRED	35.41	-16.46	-31.41	1.16	31.69	-43.31	-14.91	-67.37	-55.07	-0.13	3.69	-0.63	54.14	197.29	171.36	693.14	-58.56	-996.1	0.51	6.20
t-value	3.04	-0.73	-3.66	5.98	0.16	-1.08	-0.07	-2.03	-1.30	-0.24	1.26	-0.07	0.29	1.19	0.96	2.88	-0.29			
T.LABOR	22.19	-13.14	-28.17	1.58	57.99	25.57	22.17	-101.6	-40.35	-0.73	4.14	4.27	112.11	304.90	65.17	944.40	230.59	-897.1	0.51	6.31
t-value	1.59	-0.48	-2.75	6.83	0.24	0.05	0.09	-2.56	-0.80	-1.15	1.18	0.42	0.51	1.54	0.31	3.29	0.96			
T.MALE	-3.93	15.80	-7.41	1.38	101.83	-81.67	-34.43	-68.75	-35.35	-0.60	1.33	5.42	123.16	-46.10	-135.5	751.63	268.59	5.9	0.77	19.61
t-value	-0.63	1.29	-1.60	13.15	0.94	-0.38	-0.31	-3.84	-1.55	-2.11	0.84	1.18	1.24	-0.52	-1.41	5.80	2.49			
T.FEMALE	5.11	-13.09	-6.71	0.07	-18.12	48.93	27.13	-16.45	7.89	-0.09	0.60	0.18	-8.11	92.98	96.48	112.67	13.67	-114.3	0.16	1.16
t-value	1.34	-1.76	-2.39	1.21	-0.28	0.37	0.41	-1.52	0.57	-0.50	0.62	0.07	-0.14	1.72	1.66	1.43	0.21			
F/M RATIO	0.19	-3.58	-0.61	-0.00	-6.66	14.78	7.72	0.31	2.72	-0.04	-0.18	0.01	11.05	11.88	-3.50	-4.59	14.48	41.2	0.28	2.27
t-value	0.33	-3.15	-1.41	-0.47	-0.66	0.74	0.76	0.19	1.28	-1.51	-1.23	0.03	1.20	1.43	-0.39	-0.38	1.44			
M.FAMILY	-8.10	2.09	3.12	0.41	27.93	24.58	13.08	-23.42	3.65	-0.34	0.62	3.53	42.07	54.83	-50.54	175.30	193.34	-28.1	0.42	4.38
t-value	-1.88	0.25	0.99	5.70	0.38	0.17	0.17	-1.91	0.23	-1.74	0.58	1.12	0.62	0.90	-0.77	1.97	2.61			
M.IN HIRED	-10.51	7.87	-0.78	0.74	66.70	-75.60	-40.96	-27.38	-12.60	-0.47	0.81	5.46	46.40	-85.09	-108.6	289.35	199.43	356.5	0.56	7.58
t-value	-2.05	0.79	-0.21	8.63	0.76	-0.43	-0.46	-1.88	-0.68	-2.00	0.63	1.46	0.60	-1.17	-1.39	2.74	2.27			
M.OFF HIRED	14.60	-12.57	-9.72	0.14	-20.76	19.12	10.09	-13.59	-17.23	0.02	1.32	-1.75	-4.15	117.22	139.71	103.64	-126.2	-352.8	0.25	1.97
t-value	2.66	-1.18	-2.41	1.54	-0.22	0.10	0.10	-0.87	-0.87	0.09	0.96	-0.44	-0.05	1.50	1.66	0.92	-1.34			
M.LOCAL HIRED	4.09	-4.70	-10.49	0.88	45.93	-56.52	-30.87	-40.97	-29.83	-0.44	2.12	3.70	44.25	32.13	31.11	392.99	73.25	3.7	0.50	6.04
t-value	0.56	-0.33	-1.96	7.22	0.37	-0.23	-0.24	-1.98	-1.32	-1.34	1.16	0.69	0.39	0.31	0.28	2.62	0.59			
M.T.HIERD	10.61	4.20	-18.30	1.21	72.59	-81.81	-34.59	-64.85	-41.94	-0.43	1.86	2.83	87.13	3.09	-30.63	723.96	112.66	-176.9	0.71	14.93
t-value	1.56	0.32	-3.67	10.76	0.62	-0.35	-0.29	-1.36	-1.71	-1.38	1.09	0.57	0.81	0.03	-0.30	5.20	0.97			
M.T.LABOR	2.51	6.29	-15.18	1.63	100.52	-57.22	-21.50	-88.28	-38.28	-0.77	2.47	6.36	129.21	57.93	-81.17	899.27	306.00	-205.0	0.70	14.08
t-value	0.28	0.37	-2.34	11.08	0.66	-0.19	-0.14	-3.52	-1.20	-1.91	1.11	0.99	0.93	0.46	-0.60	4.95	2.02			

Appendix (B)

Table (1)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Wheat Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	31	0	0	13	0	0	17	0	0	10	17.5
Seeding	6	5	0	35	0	0	20	0	0	0	15.6
Fertiliz	3	0	2	36	0	0	0	0	0	0	13.2
Weeding	7	93	66	0	0	0	0	0	0	0	9.0
Herbicide	6	0	0	2	0	0	1	0	0	0	2.9
Rodent	1	0	2	0	0	0	0	0	0	0	0.6
Mechanical	37	0	10	9	0	0	61	0	0	20	23.8
Manual	0	0	0	0	0	0	0	0	0	0	0.0
Threshing	0	0	0	0	0	0	0	0	0	0	0.0
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	1	0	3	1	0	0	0	0	0	13	3.0
Transport	7	2	17	5	0	0	0	0	0	57	14.4
Total	100	100	100	100	0	0	100	100	0	100	100.0

Table (2)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Wheat Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	59	0	0	24	0	0	8	0	0	9	100
Seeding	13	1	0	76	0	0	10	0	0	0	100
Fertiliz	8	0	1	92	0	0	0	0	0	0	100
Weeding	24	29	46	0	0	0	0	0	0	0	100
Herbicide	69	0	0	28	0	0	3	0	0	0	100
Rodent	76	0	24	0	0	0	0	0	0	0	100
Mechanical	51	0	3	13	0	0	19	0	0	13	100
Manual	0	0	0	0	0	0	0	0	0	0	0
Threshing	0	0	0	0	0	0	0	0	0	0	0
Winnowing	0	0	0	0	0	0	0	0	0	0	0
Bagging	13	0	7	11	0	0	0	0	0	69	100
Transport	17	0	7	11	0	0	0	0	0	64	100
% of Hours for Labor Group	33.1	2.8	6.3	34.0	0.0	0.0	7.6	0.0	0.0	16.1	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (B)

Table (3)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Wheat Crop in Zone 2, in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	12	0	1	20	0	0	0	0	0	4	6.0
Seeding	14	28	31	14	0	0	3	0	0	0	9.7
Fertiliz	6	2	11	18	0	0	1	0	0	0	5.4
Weeding	12	69	43	19	0	0	0	0	0	0	11.9
Herbicide	2	0	0	2	0	0	2	0	0	0	1.2
Rodent	2	0	1	0	0	0	0	0	0	0	0.5
Mechanical	46	0	11	3	0	0	32	0	0	0	18.2
Manual	0	0	0	0	0	0	19	57	38	0	15.9
Threshing	0	0	0	0	0	0	2	4	5	0	1.6
Winnowing	0	0	0	0	0	0	13	11	23	0	7.2
Bagging	1	1	2	1	0	0	5	0	0	21	2.3
Transport	5	0	0	22	0	0	23	28	34	75	20.1
Total	100	100	100	100	0	0	100	100	100	100	100.0

Table (4)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Wheat Crop in Zone 2, in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	48	0	1	48	0	0	0	0	0	2	100
Seeding	36	11	26	21	0	0	5	0	0	0	100
Fertiliz	28	2	17	49	0	0	4	0	0	0	100
Weeding	24	23	30	23	0	0	0	0	0	0	100
Herbicide	45	0	0	21	0	0	34	0	0	0	100
Rodent	79	0	21	0	0	0	0	0	0	0	100
Mechanical	62	0	5	2	0	0	30	0	0	0	100
Manual	0	0	0	0	0	0	21	41	38	0	100
Threshing	0	0	0	0	0	0	20	30	50	0	100
Winnowing	0	0	0	0	0	0	31	17	51	0	100
Bagging	11	2	6	7	0	0	41	0	0	34	100
Transport	7	0	0	16	0	0	20	16	27	14	100
% of Hours for Labor Group	24.6	4.0	8.4	14.4	0.0	0.0	17.4	11.6	16.0	3.6	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (B)

Table (5)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Wheat Crop in Zone 3. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	11	0	0	10	0	0	0	0	0	0	3.2
Seeding	6	2	4	5	0	0	1	0	0	0	2.3
Fertiliz	1	0	0	1	0	0	0	0	0	0	0.4
Weeding	18	30	35	18	0	0	13	1	0	15	17.3
Herbicide	0	0	0	0	0	0	0	0	0	0	0.1
Rodent	3	0	1	0	0	0	0	0	0	0	0.6
Mechanical	3	0	0	4	0	0	30	0	0	2	3.3
Manual.H	27	46	44	37	0	100	19	99	100	56	50.5
Threshing	0	0	0	9	0	0	20	0	0	9	5.5
Winnowing	3	8	7	0	100	0	0	0	0	0	2.0
Bagging	4	2	2	0	0	0	7	0	0	2	1.9
Transport	22	11	8	16	0	0	9	0	0	16	13.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table (6)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Wheat Crop in Zone 3. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	47	0	0	52	0	0	0	0	0	1	100
Seeding	37	8	16	37	0	0	3	0	0	0	100
Fertiliz	53	0	5	38	0	0	4	0	0	0	100
Weeding	14	14	21	17	0	0	4	0	0	30	100
Herbicide	8	0	0	83	0	0	8	0	0	0	100
Rodent	79	2	19	0	0	0	0	0	0	0	100
Mechanical	14	0	0	21	0	0	43	0	0	21	100
Manual.H	7	7	9	12	0	0	2	13	12	38	100
Threshing	0	0	0	27	0	0	17	0	0	56	100
Winnowing	20	31	34	0	9	0	0	0	0	6	100
Bagging	32	9	13	2	0	0	16	0	0	28	100
Transport	23	6	6	20	0	0	3	0	0	41	100
% of Hours for Labor Group	13.8	7.8	10.3	16.3	0.2	0.2	4.6	6.6	6.1	34.2	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (B)

Table (7)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Barley Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	11	0	0	45	0	0	0	0	0	0	4.1
Seeding	22	0	0	52	0	0	0	0	0	0	5.2
Fertiliz	0	0	0	0	0	0	0	0	0	0	0.0
Weeding	0	0	0	0	0	0	0	0	0	0	0.0
Herbicide	0	0	0	0	0	0	3	0	0	0	0.5
Rodent	5	0	0	0	0	0	0	0	0	0	0.2
Mechanical	8	10	0	1	0	0	0	0	0	7	1.0
Manual.H	27	77	0	0	0	0	84	86	86	51	73.9
Threshing	2	5	0	1	0	0	1	0	0	15	1.1
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	12	8	100	2	0	0	0	0	0	14	1.9
Transport	12	0	0	0	0	0	12	14	14	14	12.0
Total	100	100	100	100	0	0	100	100	100	100	100.0

Table (8)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Barley Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	12	0	0	87	0	0	0	0	0	0	100
Seeding	19	0	0	81	0	0	0	0	0	0	100
Fertiliz	0	0	0	0	0	0	0	0	0	0	0
Weeding	0	0	0	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	100	0	0	0	100
Rodent	100	0	0	0	0	0	0	0	0	0	100
Mechanical	36	24	0	8	0	0	0	0	0	32	100
Manual.H	2	3	0	0	0	0	19	27	47	3	100
Threshing	7	11	0	5	0	0	11	0	0	65	100
Winnowing	0	0	0	0	0	0	0	0	0	0	100
Bagging	29	10	19	6	0	0	0	0	0	35	100
Transport	5	0	0	0	0	0	16	27	47	6	100
% of Hours for Labor Group	4.5	2.4	0.4	8.1	0.0	0.0	16.4	23.0	40.3	4.9	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Table (9)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Barley Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	13	100	0	0	0	0	0	0	0	0	0.4
Seeding	7	0	100	0	0	0	0	0	0	0	0.4
Fertiliz	0	0	0	0	0	0	0	0	0	0	0.0
Weeding	0	0	0	0	0	0	0	0	0	0	0.0
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	0	0	0	0	0	0	0	0	0	0	0.0
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual.H	0	0	0	0	0	0	70	73	75	0	67.4
Threshing	0	0	0	0	0	0	5	6	6	0	5.5
Winnowing	0	0	0	0	0	0	18	12	12	0	11.7
Bagging	0	0	0	0	0	0	5	4	4	0	3.9
Transport	80	0	0	100	0	0	2	5	3	100	10.7
Total	100	100	100	100	0	0	100	100	100	100	100.0

Table (10)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Barley Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	100	0	0	0	0	0	0	0	0	0	100
Seeding	50	0	50	0	0	0	0	0	0	0	100
Fertiliz	0	0	0	0	0	0	0	0	0	0	0
Weeding	0	0	0	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	0	0	0	0	0	0	0	0	0	0	0
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual.H	0	0	0	0	0	0	15	23	62	0	100
Threshing	0	0	0	0	0	0	13	25	63	0	100
Winnowing	0	0	0	0	0	0	22	22	56	0	100
Bagging	0	0	0	0	0	0	20	20	60	0	100
Transport	24	0	0	24	0	0	3	10	13	26	100
% of Hours for Labor Group	3.2	0.0	0.2	2.6	0.0	0.0	14.8	21.3	55.1	2.8	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (C)

Table (1)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Lentil Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	2	0	0	27	0	0	0	0	0	0	2.8
Seeding	7	3	0	0	0	0	0	0	0	0	2.5
Fertiliz	0	0	0	0	0	0	0	0	0	0	0.0
Weeding	20	24	34	0	0	0	0	0	0	0	21.8
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodant	7	0	0	0	0	0	0	0	0	0	1.9
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual.H	40	43	35	47	0	0	0	0	0	46	30.7
Threshing	0	0	0	1	0	0	100	0	0	24	3.1
Winnowing	14	26	26	0	0	0	0	0	0	0	19.0
Bagging	6	5	5	0	0	0	0	0	0	10	5.1
Transport	3	0	0	25	0	0	0	0	0	20	4.2
Total	100	100	100	100	0	0	100	0	0	100	100.0

Table (2)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Lentil Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	22	0	0	78	0	0	0	0	0	0	100
Seeding	69	31	0	0	0	0	0	0	0	0	100
Fertiliz	0	0	0	0	0	0	0	0	0	0	0
Weeding	23	33	45	0	0	0	0	0	0	0	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodant	94	0	6	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual.H	32	42	32	12	0	0	0	0	0	11	100
Threshing	0	0	0	3	0	0	41	0	0	56	100
Winnowing	19	42	39	0	0	0	0	0	0	0	100
Bagging	29	31	25	0	0	0	0	0	0	15	100
Transport	18	0	0	47	0	0	0	0	0	35	100
% of Hours for Labor Group	24.6	30.3	28.6	7.9	0.0	0.0	1.3	0.0	0.0	7.3	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (C)

Table (3)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Lentil Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	6	0	0	8	0	0	0	0	0	0	1.6
Seeding	6	0	7	7	0	0	2	0	0	0	2.0
Fertiliz	2	0	0	1	0	0	0	0	0	0	0.3
Weeding	22	5	45	18	0	0	21	43	0	14	15.1
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	2	0	1	0	0	0	0	0	0	0	0.2
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual	23	94	37	38	0	0	30	57	0	64	61.6
Threshing	0	0	0	11	0	0	25	0	0	7	5.3
Winnowing	2	0	2	0	100	0	0	0	0	0	0.7
Bagging	5	0	2	0	0	0	8	0	0	1	1.3
Transport	32	1	5	17	0	0	14	0	0	13	11.7
Total	100	100	100	100	100	0	100	100	0	100	100.0

Table (4)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for lentils Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	33	0	0	64	0	0	0	0	0	3	100
Seeding	30	2	20	45	0	0	3	0	0	0	100
Fertiliz	50	0	6	44	0	0	0	0	0	0	100
Weeding	14	9	19	16	0	0	5	1	0	37	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	78	0	22	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual	3	41	4	9	0	0	2	0	0	41	100
Threshing	1	0	0	29	0	0	16	0	0	54	100
Winnowing	24	3	22	0	32	0	0	0	0	19	100
Bagging	36	3	11	0	0	0	20	0	0	31	100
Transport	25	2	3	21	0	0	4	0	0	46	100
% of Hours for Labor Group	9.2	26.8	6.3	13.9	0.2	0.0	3.4	0.2	0.0	39.9	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (C)

Table (5)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Lentil Crop in Zone 3. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	17	0	0	11	0	0	0	0	0	0	6.2
Seeding	3	1	0	1	0	0	10	0	0	0	1.4
Fertiliz	1	0	0	0	0	0	8	0	0	0	0.2
Weeding	6	11	10	15	0	0	0	0	0	0	8.2
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	3	0	2	0	0	0	0	0	0	0	1.1
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual	61	75	72	64	0	100	0	0	100	78	69.5
Threshing	0	0	0	2	0	0	38	0	0	9	2.3
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	1	0	1	0	0	0	45	0	0	3	1.5
Transport	7	11	14	6	0	0	0	0	0	11	9.6
Total	100	100	100	100	0	100	100	0	100	100	100.0

Table (6)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Lentil Crop in Zone 3. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	65	0	0	35	0	0	0	0	0	0	100
Seeding	56	24	3	11	0	0	5	0	0	0	100
Fertiliz	74	0	0	0	0	0	26	0	0	0	100
Weeding	16	32	17	35	0	0	0	0	0	0	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	71	5	24	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual	21	25	14	17	0	1	0	0	0	21	100
Threshing	0	0	0	18	0	0	12	0	0	70	100
Winnowing	0	0	0	0	0	0	0	0	0	0	100
Bagging	23	8	6	6	0	0	23	0	0	36	100
Transport	18	28	20	13	0	0	0	0	0	22	100
% of Hours for Labor Group	23.5	23.4	13.5	19.0	0.0	0.7	0.7	0.0	0.1	19.1	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (C)

Table (7)

Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Vetch Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	27	0	0	73	0	0	0	0	0	0	11.6
Seeding	8	4	0	10	0	0	0	0	0	0	4.0
Fertiliz	0	1	0	0	0	0	0	0	0	0	0.3
Weeding	7	16	17	0	0	0	0	0	0	0	10.0
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodant	4	0	2	0	0	0	0	0	0	0	1.9
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual	32	67	72	0	0	0	0	0	0	67	53.8
Threshing	2	0	0	8	0	0	63	0	0	15	3.5
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	2	1	1	0	0	0	38	0	0	9	2.7
Transport	17	12	8	8	0	0	0	0	0	10	12.3
Total	100	100	100	100	0	0	100	0	0	100	100.0

Table (8)

Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Vetch Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	77	0	0	23	0	0	0	0	0	0	100
Seeding	66	25	0	9	0	0	0	0	0	0	100
Fertiliz	40	60	0	0	0	0	0	0	0	0	100
Weeding	24	41	35	0	0	0	0	0	0	0	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodant	76	0	24	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual	20	32	27	0	0	0	0	0	0	21	100
Threshing	14	0	0	9	0	0	7	0	0	70	100
Winnowing	0	0	0	0	0	0	0	0	0	100	100
Bagging	29	6	6	0	0	0	6	0	0	54	100
Transport	46	26	13	2	0	0	0	0	0	13	100
% of Hours for Labor Group	33.2	25.9	20.3	3.6	0.0	0.0	0.4	0.0	0.0	16.6	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Table (9)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Chickpea Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	20	0	0	23	0	0	0	0	0	0	7.8
Seeding	7	5	0	0	0	0	0	0	0	0	4.1
Fertiliz	0	0	0	0	0	0	0	0	0	0	0.0
Weeding	25	25	0	36	0	0	0	0	0	0	17.1
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	4	0	0	0	0	0	0	0	0	0	1.5
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual.H	31	48	81	0	0	0	0	0	0	40	45.9
Threshing	0	0	0	5	0	0	100	0	0	14	2.5
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	1	1	1	0	0	0	0	0	0	5	1.5
Transport	11	21	18	36	0	0	0	0	0	40	19.8
Total	100	100	100	100	0	0	100	0	0	100	100.0

Table (10)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Chickpea Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	87	0	0	12	0	0	0	0	0	0	100
Seeding	62	38	0	0	0	0	0	0	0	0	100
Fertiliz	0	0	0	0	0	0	0	0	0	0	0
Weeding	50	41	0	9	0	0	0	0	0	0	100
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	100	0	0	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	0
Manual.H	23	30	38	0	0	0	0	0	0	10	100
Threshing	0	0	0	8	0	0	27	0	0	65	100
Winnowing	0	0	0	0	0	0	0	0	0	0	0
Bagging	20	20	20	0	0	0	0	0	0	40	100
Transport	20	29	20	8	0	0	0	0	0	24	100
% of Hours for Labor Group	33.8	28.3	21.4	4.3	0.0	0.0	0.7	0.0	0.0	11.5	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Table (11)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Production for Begia Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	% per Task
Tillage	0	0	0	100	0	0	0	0	0	0	10.1
Seeding	7	10	0	0	0	0	0	0	0	0	7.6
Fertiliz	5	7	0	0	0	0	0	0	0	0	5.1
Weeding	0	0	0	0	0	0	0	0	0	0	0.0
Herbicide	0	0	0	0	0	0	0	0	0	0	0.0
Rodent	15	0	0	0	0	0	0	0	0	0	6.1
Mechanical	0	0	0	0	0	0	0	0	0	0	0.0
Manual.H	39	55	0	0	0	0	0	0	0	0	40.4
Threshing	0	0	0	0	0	0	0	0	0	100	4.5
Winnowing	0	0	0	0	0	0	0	0	0	0	0.0
Bagging	15	0	0	0	0	0	0	0	0	0	6.1
Transport	20	28	0	0	0	0	0	0	0	0	20.2
Total	100	100	0	100	0	0	0	0	0	100	100.0

Table (12)
Contribution of Men, Women and Children as a Percentage of Total Hours Spent in Each Operation for Begia Crop in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total
Tillage	0	0	0	100	0	0	0	0	0	0	100
Seeding	40	60	0	0	0	0	0	0	0	0	100
Fertiliz	40	60	0	0	0	0	0	0	0	0	100
Weeding	0	0	0	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0
Rodent	100	0	0	0	0	0	0	0	0	0	100
Mechanical	0	0	0	0	0	0	0	0	0	0	100
Manual.H	40	60	0	0	0	0	0	0	0	0	100
Threshing	0	0	0	0	0	0	0	0	0	100	100
Winnowing	0	0	0	0	0	0	0	0	0	100	100
Bagging	100	0	0	0	0	0	0	0	0	0	100
Transport	40	60	0	0	0	0	0	0	0	0	100
% of Hours for Labor Group	41.4	43.9	0.0	10.1	0.0	0.0	0.0	0.0	0.0	4.5	100

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MIGR = Migrant Labor

Source : Villages Surveyed in Study.

Appendix (D)

Table (1)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Fields Crops in Zone 1, in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	0	0	7	20	8	1	3	10	3	9	26	11
Seeding	15	2	0	0	0	0	0	0	0	17	57	9
Fertilizin	8	0	8	0	0	0	0	0	0	38	31	15
Weeding	0	9	91	0	0	0	0	0	0	0	0	0
Herbicide	0	5	37	47	5	5	0	0	0	0	0	0
Rodant.C.	0	0	38	56	0	0	6	0	0	0	0	0
Mechanic.H	0	0	0	0	21	66	10	3	0	0	0	0
Manual.H.	0	0	0	32	50	0	14	5	0	0	0	0
Threshing.	0	0	0	0	25	44	25	6	0	0	0	0
Winnowing	0	0	0	0	0	40	20	40	0	0	0	0
Bagging	0	0	0	2	27	56	10	5	0	0	0	0
Transport	0	0	0	2	23	62	9	4	0	0	0	0
Task %	2	1	9	13	14	23	6	5	1	6	15	5

Table (2)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Fields Crops in Zone 2, in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	4	3	14	21	6	5	6	2	1	5	19	15
Seeding	6	0	0	0	0	0	0	0	0	7	37	50
Fertilizin	11	0	0	0	0	0	0	0	0	8	55	26
Weeding	0	6	39	56	0	0	0	0	0	0	0	0
Herbicide	0	17	56	28	0	0	0	0	0	0	0	0
Rodant.C.	0	20	60	20	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	3	94	3	0	0	0	0	0
Manual.H.	0	0	0	3	77	5	0	8	0	8	0	0
Threshing.	0	0	0	0	13	53	34	0	0	0	0	0
Winnowing	0	0	0	0	0	22	56	22	0	0	0	0
Bagging	0	0	0	0	46	48	6	0	0	0	0	0
Transport	0	0	0	0	48	48	5	0	0	0	0	0
Task %	3	2	9	10	17	20	6	1	0	4	15	13

Appendix (D)

Table (3)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Fields Crops in Zone 3. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	5	1	0	2	0	4	11	22	7	9	20	20
Seeding	18	2	0	0	0	0	0	0	0	0	26	54
Fertilizin	6	22	24	0	0	0	0	0	0	0	8	39
Weeding	0	13	67	15	4	0	0	0	0	0	0	0
Herbicide	0	0	65	35	0	0	0	0	0	0	0	0
Rodant.C.	0	0	63	37	0	0	0	0	0	0	0	0
Mechanic,H	0	0	0	0	12	88	0	0	0	0	0	0
Manual,H.	0	0	0	10	71	15	3	0	0	0	0	0
Threshing.	0	0	0	0	8	79	10	2	0	0	0	0
Winnowing	0	0	0	0	0	0	0	0	0	0	0	0
Bagging	0	0	0	0	32	62	7	0	0	0	0	0
Transport	0	0	0	0	34	60	6	0	0	0	0	0
Task %	4	3	9	4	14	28	6	6	2	2	9	14

Table (4)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Wheat Crops in Zone 3. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	0	0	0	28	4	0	0	6	4	16	34	6
Seeding	0	0	0	0	0	0	0	0	0	33	63	4
Fertilizin	8	0	0	0	0	0	0	0	0	42	33	17
Weeding	0	0	100	0	0	0	0	0	0	0	0	0
Herbicide	0	7	36	50	7	0	0	0	0	0	0	0
Rodant.C.	0	0	20	80	0	0	0	0	0	0	0	0
Mechanic,H	0	0	0	0	16	72	12	0	0	0	0	0
Manual,H.	0	0	0	0	0	0	0	0	0	0	0	0
Threshing.	0	0	0	0	0	0	0	0	0	0	0	0
Winnowing	0	0	0	0	0	0	100	0	0	0	0	0
Bagging	0	0	0	0	0	95	5	0	0	0	0	0
Transport	0	0	0	0	0	96	4	0	0	0	0	0
Task %	1	1	6	14	4	34	3	2	1	12	20	3

Appendix (D)

Table (5)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Wheat Crops in Zone 2. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	1	0	6	18	7	3	7	0	1	7	36	12
Seeding	0	0	0	0	0	0	0	0	0	13	68	19
Fertilizin	6	0	0	0	0	0	0	0	0	10	65	19
Weeding	0	50	0	50	0	0	0	0	0	0	0	0
Herbicide	0	12	59	29	0	0	0	0	0	0	0	0
Rodant.C.	0	20	60	20	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	0	97	3	0	0	0	0	0
Manual.H.	0	0	0	0	0	100	0	0	0	0	0	0
Threshing.	0	0	0	0	0	100	0	0	0	0	0	0
Winnowing	0	0	0	0	0	0	0	100	0	0	0	0
Bagging	0	0	0	0	8	88	4	0	0	0	0	0
Transport	0	0	0	0	7	90	3	0	0	0	0	0
Task %	1	2	7	8	4	35	3	1	0	5	27	8

Table (6)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Wheat Crops in Zone 1. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	1	0	6	18	7	3	7	0	1	7	36	12
Seeding	0	0	0	0	0	0	0	0	0	13	68	19
Fertilizin	6	0	0	0	0	0	0	0	0	10	65	19
Weeding	0	0	60	40	0	0	0	0	0	0	0	0
Herbicide	0	12	59	29	0	0	0	0	0	0	0	0
Rodant.C.	0	20	60	20	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	0	97	3	0	0	0	0	0
Manual.H.	0	0	0	0	0	100	0	0	0	0	0	0
Threshing.	0	0	0	0	0	100	0	0	0	0	0	0
Winnowing	0	0	0	0	0	0	0	100	0	0	0	0
Bagging	0	0	0	0	8	88	4	0	0	0	0	0
Transport	0	0	0	0	7	90	3	0	0	0	0	0
Task %	1	1	8	8	4	35	3	1	0	5	26	8

Appendix (D)

Table (7)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Lentils Crops in Zone 1. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	0	0	0	6	0	0	18	24	0	18	12	24
Seeding	11	0	0	0	0	0	0	0	0	0	11	78
Fertilizin	0	0	0	0	0	0	0	0	0	0	0	0
Weeding	0	0	100	0	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0	0
Rodant.C.	0	0	0	100	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	0	0	0	0	0	0	0	0
Manual.H.	0	0	0	50	50	0	0	0	0	0	0	0
Threshing.	0	0	0	0	50	50	0	0	0	0	0	0
Winnowing	0	0	0	0	0	100	0	0	0	0	0	0
Bagging	0	0	0	13	75	13	0	0	0	0	0	0
Transport	0	0	0	13	75	13	0	0	0	0	0	0
Task %	1	0	7	16	29	12	4	6	0	4	4	16

Table (8)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Lentils Crops in Zone 2. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	9	0	0	12	2	2	7	2	0	7	21	37
Seeding	14	0	0	0	0	0	0	0	0	0	14	71
Fertilizin	17	0	0	0	0	0	0	0	0	0	17	67
Weeding	0	0	44	56	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0	0
Rodant.C.	0	0	20	80	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	0	0	0	0	0	0	0	0
Manual.H.	0	0	0	3	97	0	0	0	0	0	0	0
Threshing.	0	0	0	0	13	53	33	0	0	0	0	0
Winnowing	0	0	0	0	0	33	67	0	0	0	0	0
Bagging	0	0	0	0	91	4	4	0	0	0	0	0
Transport	0	0	0	0	93	3	3	0	0	0	0	0
Task %	4	0	4	9	39	10	9	0	0	1	6	18

Appendix (D)

Table (9)

Time Schedule for Agricultural Operation and Percentage of Hours to Perform those Operation for Lentils Crops in Zone 3. in the Sample

Operation	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Tillage	5	2	0	0	0	5	8	21	11	8	13	26
Seeding	31	0	0	0	0	0	0	0	0	0	15	54
Fertilizin	0	22	22	0	0	0	0	0	0	0	0	56
Weeding	0	12	76	12	0	0	0	0	0	0	0	0
Herbicide	0	0	0	0	0	0	0	0	0	0	0	0
Rodant.C.	0	0	70	30	0	0	0	0	0	0	0	0
Mechanic.H	0	0	0	0	0	0	0	0	0	0	0	0
Manual.H.	0	0	0	11	82	7	0	0	0	0	0	0
Threshing.	0	0	0	0	21	79	0	0	0	0	0	0
Winnowing	0	0	0	0	0	0	0	0	0	0	0	0
Bagging	0	0	0	0	78	22	0	0	0	0	0	0
Transport	0	0	0	0	75	25	0	0	0	0	0	0
Task %	5	2	9	3	30	17	2	6	3	2	5	15

Appendix (E)

Table (1)

Percentage of Total Hours Spent by Labor Group for the Year Round for Fields Crops in Zone 1. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	1	0	1	0	0	0	1	0	0	0
Feb.	0	4	5	0	0	0	0	0	0	0
Mar.	24	51	63	2	0	0	1	0	0	4
Apr.	22	15	1	18	0	0	19	0	0	22
May.	4	9	2	5	0	0	2	0	0	9
Jun.	23	17	22	10	0	0	32	0	0	43
July	3	0	6	2	0	0	27	100	100	13
Aug.	1	0	0	4	0	0	0	0	0	4
Sept.	0	0	0	5	0	0	0	0	0	0
Oct.	4	0	0	33	0	0	9	0	0	0
Nov.	18	2	0	17	0	0	9	0	0	6
Dec.	1	1	0	3	0	0	0	0	0	0
Total	100	100	100	100	0	0	100	100	100	100

Table (2)

Percentage of Total Hours Spent by Labor Group for the Year Round for Fields Crops in Zone 2. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	1	0	1	1	0	0	0	0	0	0
Feb.	2	0	3	2	0	0	2	0	0	0
Mar.	8	8	15	20	0	0	9	0	0	6
Apr.	17	44	29	17	0	0	14	1	0	14
May.	21	33	27	24	0	0	16	1	0	69
Jun.	17	1	2	7	100	0	39	48	85	9
July	8	0	4	8	0	0	7	3	6	1
Aug.	0	0	0	2	0	0	6	14	10	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	11	0	9	5	0	0	3	32	0	0
Nov.	10	12	7	9	0	0	1	0	0	0
Dec.	5	2	4	5	0	0	3	0	0	0
Total	100	100	100	100	100	0	100	100	100	100

Appendix (E)

Table (3)

Percentage of Total Hours Spent by Labor Group for the Year Round for Fields Crops in Zone 3. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	HIGH
Jan.	8	1	0	2	0	0	3	0	0	0
Feb.	3	5	2	0	0	0	0	0	0	0
Mar.	9	16	20	12	0	0	3	0	0	0
Apr.	5	8	6	1	0	100	2	0	100	0
May.	14	36	40	12	0	0	14	0	0	43
Jun.	21	30	30	25	0	0	46	0	0	42
July	12	0	0	9	0	0	15	0	0	14
Aug.	6	0	0	17	0	0	1	0	0	1
Sept.	5	0	0	3	0	0	0	0	0	0
Oct.	6	0	0	3	0	0	0	0	0	0
Nov.	8	2	2	6	0	0	0	0	0	0
Dec.	4	2	0	11	0	0	16	0	0	0
Total	100	100	100	100	0	100	100	0	100	100

Table (4)

Percentage of Total Hours Spent by Labor Group for the Year Round for Wheat Crops in Zone 1. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	HIGH
Jan.	0	0	2	0	0	0	3	0	0	0
Feb.	0	0	0	0	0	0	0	0	0	0
Mar.	25	93	66	1	0	0	0	0	0	0
Apr.	19	0	2	11	0	0	18	0	0	10
May.	1	0	0	3	0	0	1	0	0	2
Jun.	41	2	20	10	0	0	60	0	0	68
July	5	0	10	3	0	0	0	100	0	20
Aug.	0	0	0	1	0	0	0	0	0	0
Sept.	0	0	0	1	0	0	0	0	0	0
Oct.	3	0	0	56	0	0	17	0	0	0
Nov.	6	5	0	15	0	0	0	0	0	0
Dec.	0	0	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100	100	100

Appendix (E)

Table (5)

Percentage of Total Hours Spent by Labor Group for the Year Round for Wheat Crops in Zone 2. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	0	0	1	1	0	0	0	0	0	0
Feb.	1	0	10	0	0	0	1	0	0	0
Mar.	3	0	1	5	0	0	1	0	0	0
Apr.	21	68	33	32	0	0	1	0	0	0
May.	1	0	0	1	0	0	2	0	0	20
Jun.	39	1	4	13	0	0	69	89	88	80
July	13	0	9	15	0	0	10	0	0	0
Aug.	0	0	0	0	0	0	13	11	12	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	5	0	20	0	0	0	0	0	0	0
Nov.	12	29	17	33	0	0	2	0	0	0
Dec.	4	2	5	1	0	0	2	0	0	0
Total	100	100	100	100	0	0	100	100	100	100

Table (6)

Percentage of Total Hours Spent by Labor Group for the Year Round for Wheat Crops in Zone 3. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	0	0	0	3	0	0	4	0	0	0
Feb.	5	10	3	0	0	0	0	0	0	0
Mar.	16	22	34	14	0	0	4	0	0	0
Apr.	4	5	2	3	0	0	3	0	0	0
May.	7	2	4	5	0	0	7	0	0	4
Jun.	36	56	54	51	0	0	51	0	0	83
July	18	0	0	5	0	0	19	0	0	13
Aug.	3	0	0	11	0	0	0	0	0	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	0	0	0	1	0	0	0	0	0	0
Nov.	9	5	3	3	0	0	0	0	0	0
Dec.	3	2	0	3	0	0	11	0	0	0
Total	100	100	100	100	0	0	100	0	0	100

Appendix (E)

Table (7)

Percentage of Total Hours Spent by Labor Group for the Year Round for Lentils Crops in Zone 1. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	3	0	0	0	0	0	0	0	0	0
Feb.	0	0	0	0	0	0	0	0	0	0
Mar.	23	29	52	0	0	0	0	0	0	40
Apr.	42	30	1	33	0	0	0	0	0	1
May.	10	6	7	49	0	0	32	0	0	53
Jun.	17	32	40	2	0	0	68	0	0	6
July	0	0	0	8	0	0	0	0	0	0
Aug.	0	0	0	8	0	0	0	0	0	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	0	0	0	0	0	0	0	0	0	0
Nov.	3	2	0	0	0	0	0	0	0	0
Dec.	2	1	0	1	0	0	0	0	0	0
Total	100	100	100	100	0	0	100	0	0	100

Table (8)

Percentage of Total Hours Spent by Labor Group for the Year Round for Lentils Crops in Zone 2. in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	1	0	0	0	0	0	0	0	0	0
Feb.	0	0	0	0	0	0	0	0	0	0
Mar.	9	9	15	14	0	0	19	0	0	4
Apr.	9	19	23	0	0	0	2	43	0	13
May.	67	68	51	60	0	0	67	57	0	75
Jun.	1	1	1	6	100	0	10	0	0	7
July	4	0	2	11	0	0	0	0	0	1
Aug.	0	0	0	0	0	0	0	0	0	0
Sept.	0	0	0	0	0	0	0	0	0	0
Oct.	0	0	0	0	0	0	0	0	0	0
Nov.	4	0	2	2	0	0	0	0	0	0
Dec.	4	2	5	7	0	0	1	0	0	0
Total	100	100	100	100	100	0	100	100	0	100

Appendix (E)

Table (9)

Percentage of Total Hours Spent by Labor Group for the Year Round for Lentils Crops in Zone 3, in the Sample

Month	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR
Jan.	1	0	0	1	0	0	0	0	0	0
Feb.	1	3	1	0	0	0	0	0	0	0
Mar.	11	12	10	29	0	0	0	0	0	0
Apr.	6	6	3	0	0	100	0	0	100	0
May.	40	62	73	40	0	0	50	0	0	84
Jun.	22	15	12	8	0	0	33	0	0	16
July	0	0	0	5	0	0	0	0	0	0
Aug.	12	0	0	13	0	0	0	0	0	0
Sept.	0	0	0	3	0	0	0	0	0	0
Oct.	0	0	0	0	0	0	0	0	0	0
Nov.	4	0	0	0	0	0	0	0	0	0
Dec.	3	1	0	1	0	0	18	0	0	0
Total	100	100	100	100	0	100	100	0	100	100

Appendix (F)

Table (1)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Field Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.15	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.01	0.29	0.29
Seeding	0.07	0.01	0.03	0.14	0.00	0.00	0.02	0.00	0.00	0.00	0.28	0.25
Fertiliz	0.06	0.00	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.35
Weeding	0.40	0.39	0.59	0.39	0.00	0.00	0.07	0.01	0.00	0.59	2.45	1.84
Herbicide	0.04	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.06	0.06
Rodent	0.40	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.43
Mechanical	0.26	0.00	0.02	0.06	0.00	0.00	0.14	0.00	0.00	0.06	0.54	0.52
Manual	0.65	2.02	0.64	0.90	0.00	0.02	0.33	0.78	0.93	2.96	9.20	6.73
Threshing	0.00	0.00	0.00	0.18	0.00	0.00	0.12	0.01	0.03	0.37	0.72	0.69
Winnowing	0.24	0.36	0.41	0.00	0.11	0.00	0.27	0.16	0.47	0.07	2.09	1.16
Bagging	0.03	0.01	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.05	0.13	0.11
Transport	0.14	0.03	0.04	0.13	0.00	0.00	0.04	0.03	0.05	0.29	0.75	0.66
Total	2.45	2.85	1.85	2.22	0.11	0.02	1.03	1.00	1.48	4.40	17.36	13.08

Table (2)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Cereals Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.16	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.02	0.30	0.30
Seeding	0.07	0.01	0.03	0.17	0.00	0.00	0.02	0.00	0.00	0.00	0.30	0.27
Fertiliz	0.05	0.00	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.34
Weeding	0.32	0.32	0.47	0.27	0.00	0.00	0.04	0.01	0.00	0.38	1.81	1.32
Herbicide	0.04	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.06	0.06
Rodent	0.33	0.01	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.35
Mechanical	0.26	0.00	0.02	0.06	0.00	0.00	0.14	0.00	0.00	0.06	0.54	0.52
Manual.H	0.49	0.48	0.58	0.76	0.00	0.02	0.53	1.52	1.83	2.48	8.68	5.98
Threshing	0.01	0.00	0.00	0.29	0.00	0.00	0.21	0.05	0.09	0.62	1.27	1.18
Winnowing	0.18	0.28	0.31	0.00	0.08	0.00	0.41	0.25	0.72	0.05	2.29	1.26
Bagging	0.03	0.01	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.05	0.12	0.11
Transport	0.11	0.02	0.03	0.11	0.00	0.00	0.05	0.04	0.06	0.25	0.66	0.57
Total	2.04	1.13	1.55	2.07	0.08	0.02	1.45	1.86	2.71	3.90	16.81	12.27

MH = Men from Household
WH = Womenn from Household
CH = children from Household

MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor

MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Appendix (F)

Table (3)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Legume Crops in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.19	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33
Seeding	0.09	0.03	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.18
Fertiliz	0.26	0.03	0.02	0.17	0.00	0.00	0.02	0.00	0.00	0.00	0.50	0.47
Weeding	0.81	0.79	1.01	0.76	0.00	0.00	0.16	0.02	0.00	1.25	4.79	3.68
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
Rodent	0.66	0.01	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.71
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
Manual.H	0.92	3.50	0.88	0.94	0.00	0.02	0.10	0.01	0.00	3.23	9.53	7.22
Threshing	0.01	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00	0.28	0.48	0.48
Winnowing	0.35	0.53	0.59	0.00	0.16	0.00	0.00	0.00	0.00	0.09	1.72	0.96
Bagging	0.05	0.02	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.05	0.16	0.14
Transport	0.28	0.11	0.08	0.19	0.00	0.00	0.03	0.00	0.00	0.41	1.10	0.99
Total	3.60	5.02	2.78	2.39	0.16	0.02	0.42	0.03	0.00	5.32	19.88	15.17

Table (4)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Wheat Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.19	0.00	0.00	0.08	0.00	0.00	0.02	0.00	0.00	0.03	0.33	0.33
Seeding	0.04	0.00	0.00	0.24	0.00	0.00	0.03	0.00	0.00	0.00	0.32	0.32
Fertiliz	0.03	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.36
Weeding	1.22	1.47	2.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	2.65
Herbicide	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07
Rodent	0.29	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.32
Mechanical	0.24	0.00	0.01	0.06	0.00	0.00	0.09	0.00	0.00	0.06	0.46	0.45
Manual	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Threshing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bagging	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.08	0.08
Transport	0.05	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.18	0.28	0.26
Total	2.12	1.47	2.45	0.78	0.00	0.00	0.15	0.00	0.00	0.33	7.29	4.84

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Appendix (F)

Table (5)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Wheat Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.01	0.27	0.27
Seeding	0.16	0.05	0.12	0.10	0.00	0.00	0.02	0.00	0.00	0.00	0.45	0.34
Fertiliz	0.09	0.00	0.05	0.15	0.00	0.00	0.01	0.00	0.00	0.00	0.31	0.27
Weeding	1.22	1.18	1.55	1.18	0.00	0.00	0.00	0.00	0.00	0.00	5.13	3.45
Herbicide	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.05	0.05
Rodent	0.15	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.16
Mechanical	0.56	0.00	0.05	0.02	0.00	0.00	0.27	0.00	0.00	0.00	0.89	0.86
Manual	0.00	0.00	0.00	0.00	0.00	0.00	1.60	3.20	2.93	0.00	7.73	4.08
Threshing	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.24	0.40	0.00	0.80	0.40
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.30	0.90	0.00	1.75	0.97
Bagging	0.01	0.00	0.01	0.01	0.00	0.00	0.05	0.00	0.00	0.04	0.12	0.12
Transport	0.08	0.00	0.00	0.20	0.00	0.00	0.25	0.21	0.34	0.17	1.26	0.91
Total	2.43	1.23	1.82	1.80	0.00	0.00	2.93	3.95	4.58	0.22	18.96	11.89

Table (6)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Wheat Crop in Zone 3. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.12	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.26
Seeding	0.07	0.01	0.03	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.19	0.16
Fertiliz	0.25	0.00	0.02	0.17	0.00	0.00	0.02	0.00	0.00	0.00	0.46	0.44
Weeding	0.20	0.19	0.29	0.23	0.00	0.00	0.05	0.01	0.00	0.43	1.40	1.10
Herbicide	0.02	0.00	0.00	0.23	0.00	0.00	0.02	0.00	0.00	0.00	0.28	0.28
Rodent	0.64	0.02	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.70
Mechanical	0.06	0.00	0.00	0.09	0.00	0.00	0.18	0.00	0.00	0.09	0.42	0.42
Manual.H	0.63	0.61	0.77	1.02	0.00	0.03	0.15	1.12	1.04	3.27	8.65	6.49
Threshing	0.01	0.00	0.00	0.42	0.00	0.00	0.26	0.00	0.00	0.88	1.56	1.56
Winnowing	0.55	0.83	0.93	0.00	0.25	0.00	0.00	0.00	0.00	0.15	2.71	1.52
Bagging	0.05	0.01	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.15	0.13
Transport	0.24	0.07	0.06	0.21	0.00	0.00	0.03	0.00	0.00	0.43	1.04	0.96
Total	2.84	1.74	2.29	2.57	0.25	0.03	0.75	1.13	1.04	5.29	17.93	14.02

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Appendix (F)

Table (7)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Barley Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.03	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25
Seeding	0.06	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31
Fertiliz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.08	0.08
Rodant	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11
Mechanical	0.60	0.40	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.53	1.67	1.47
Manual.H	0.12	0.17	0.00	0.00	0.00	0.00	1.30	1.86	3.26	0.23	6.95	3.65
Threshing	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.11	0.16	0.16
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
Bagging	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.09
Transport	0.03	0.00	0.00	0.00	0.00	0.00	0.12	0.19	0.34	0.04	0.72	0.39
Total	1.00	0.60	0.02	0.62	0.00	0.00	1.52	2.06	3.60	0.95	20.37	6.51

Table (8)

Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Barley Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.29
Seeding	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.19
Fertiliz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual.H	0.00	0.00	0.00	0.00	0.00	0.00	1.78	2.67	7.11	0.00	11.56	5.24
Threshing	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.91	2.29	0.00	3.66	1.60
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	1.71	1.71	4.29	0.00	7.71	3.86
Bagging	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.51	1.54	0.00	2.57	1.23
Transport	1.71	0.00	0.00	1.71	0.00	0.00	0.23	0.69	0.91	1.83	7.09	6.10
Total	2.14	0.00	0.14	1.71	0.00	0.00	4.69	6.50	16.14	1.83	33.16	18.51

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Appendix (F)

Table (9)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Lentil Crop in Zone 1. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.09	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.42
Seeding	0.27	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.33
Fertiliz.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	2.46	3.57	4.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.94	5.72
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.89	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.91
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual.H	2.46	3.23	2.49	0.92	0.00	0.00	0.00	0.00	0.00	0.83	7.69	6.58
Threshing	0.00	0.00	0.00	0.01	0.00	0.00	0.19	0.00	0.00	0.27	0.47	0.47
Winnowing	0.54	1.20	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.87	1.48
Bagging	0.22	0.24	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.77	0.51
Transport	0.11	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.22	0.63	0.63
Total	7.05	8.36	8.79	1.56	0.00	0.00	0.19	0.00	0.00	1.43	25.13	17.05

Table (10)
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Lentil Crop in Zone 2. in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.10	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.01	0.30	0.30
Seeding	0.12	0.01	0.08	0.19	0.00	0.00	0.01	0.00	0.00	0.00	0.41	0.35
Fertiliz	0.24	0.00	0.03	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.46
Weeding	0.64	0.41	0.89	0.77	0.00	0.00	0.22	0.03	0.00	1.74	4.71	3.86
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.37	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.40
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Manual	0.34	4.08	0.38	0.86	0.00	0.00	0.17	0.02	0.00	4.12	9.96	7.65
Threshing	0.01	0.00	0.00	0.40	0.00	0.00	0.22	0.00	0.00	0.75	1.38	1.38
Winnowing	0.21	0.03	0.19	0.00	0.27	0.00	0.00	0.00	0.00	0.16	0.87	0.58
Bagging	0.09	0.01	0.03	0.00	0.00	0.00	0.05	0.00	0.00	0.08	0.25	0.23
Transport	0.58	0.04	0.07	0.48	0.00	0.00	0.10	0.00	0.00	1.07	2.33	2.27
Total	2.70	4.57	1.78	3.11	0.27	0.00	0.76	0.05	0.00	7.93	21.17	17.49

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.

Appendix (F)

Table (11):
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Lentil Crop in Zone 3, in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.13	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.21
Seeding	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04
Fertiliz	0.27	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.37	0.37
Weeding	1.22	2.38	1.26	2.60	0.00	0.00	0.00	0.00	0.00	0.00	7.45	5.38
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.90	0.06	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	1.03
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual	1.95	2.38	1.32	1.64	0.00	0.09	0.00	0.00	0.01	2.01	9.41	7.22
Threshing	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.05	0.08	0.08
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Bagging	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.05	0.04
Transport	0.06	0.09	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.07	0.32	0.23
Total	4.57	4.93	2.95	4.37	0.00	0.09	0.12	0.00	0.01	2.15	20.19	14.59

Table (12):
Requirements of One Dunum for Different Labor Groups for Each Agricultural Task Measured in Hours for Vetch Crop in Zone 1, in the Sample

Task\Labor	MH	WH	CH	MHV	WHV	CHV	MHO	WHO	CHO	MIGR	Total	MANPWR
Tillage	0.33	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50
Seeding	0.23	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.28
Fertiliz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weeding	0.36	0.72	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16	1.04
Herbicide	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rodent	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20
Mechanical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manual	0.80	1.13	1.47	0.00	0.00	0.00	0.00	0.00	0.00	2.93	6.33	4.74
Threshing	0.12	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.33	0.52	0.52
Winnowing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bagging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.17
Transport	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.77	0.77
Total	2.57	1.85	2.55	0.27	0.00	0.00	0.02	0.00	0.00	3.67	10.93	8.22

MH = Men from Household
WH = Womenn from Household
CH = children from Household
MHV = Men Hired from Village
WHV = Women Hired from Village
CHV = Children Hired from Village
MIGR = Migrant Labor
MHO = Men Hired from Outside
WHO = Women Hired from Outside
CHO = Children Hired from Outside
MANPWR = Man Power

Source : Villages Surveyed in Study.